Hart Mountain National Antelope Refuge

Comprehensive Management Plan

(Volume I of II)

Final Environmental Impact Statement

Prepared by

U.S. Fish and Wildlife Service

DEPARTMENT OF THE INTERIOR

FINAL ENVIRONMENTAL IMPACT STATEMENT

for the

HART MOUNTAIN NATIONAL ANTELOPE REFUGE

COMPREHENSIVE MANAGEMENT PLAN

PREPARED BY:
U.S. FISH AND WILDLIFE SERVICE
REGION 1
PORTLAND, OREGON

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Final Environmental Impact Statement
for the
COMPREHENSIVE MANAGEMENT PLAN
HART MOUNTAIN NATIONAL ANTELOPE REFUGE
Lake County, Oregon

Submitted by:
U.S. Department of the Interior
Fish and Wildlife Service

This Final Environmental Impact Statement (FEIS) is prepared in compliance with the National Environmental Policy Act (NEPA) and U.S. Fish and Wildlife Service (Service) NEPA procedures.

Deteriorated habitat conditions are the major limitation to maintaining healthy wildlife populations on the Refuge, and thus are the major limitation to accomplishing the primary purpose for which the Refuge was established. This FEIS focuses on issues of: (1) impacts to wildlife, (2) impacts to habitat, (3) impacts to the livestock grazing program, (4) impacts to recreation opportunities, (5) possibilities for wilderness or Research Natural Areas, and (6) impacts to the local economy.

This FEIS describes and evaluates five alternative comprehensive management plans for the Refuge. The five alternatives are: (A) Baseline Management (No Action Alternative), which proposes management similar to that during the period 1971-1990; (B) Featured Species Management, which focuses management on several game species on the Refuge; (C) Habitat Restoration, which emphasizes restoration of Refuge habitats; (D) Native Community Restoration (Proposed Action), which expands on efforts proposed in Alternative C, and emphasizes restoration of natural processes; and (E) Custodial Maintenance, which emphasizes the total exclusion of human intervention. Alternative D is the Service's Preferred Alternative.

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INTRODUCTION

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Chapter 1
INTRODUCTION

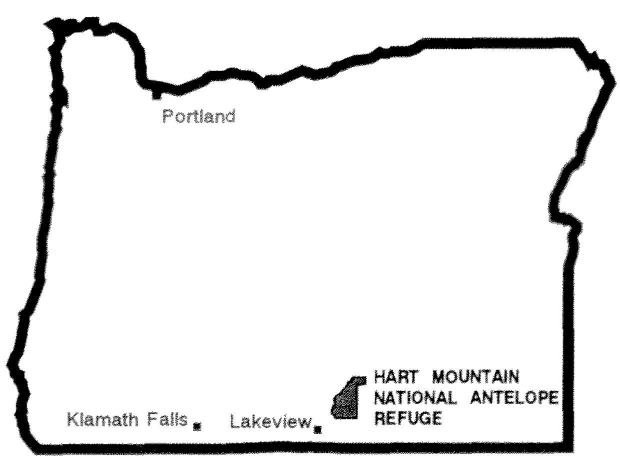
SECTION ONE - PURPOSE AND NEED

INTRODUCTION

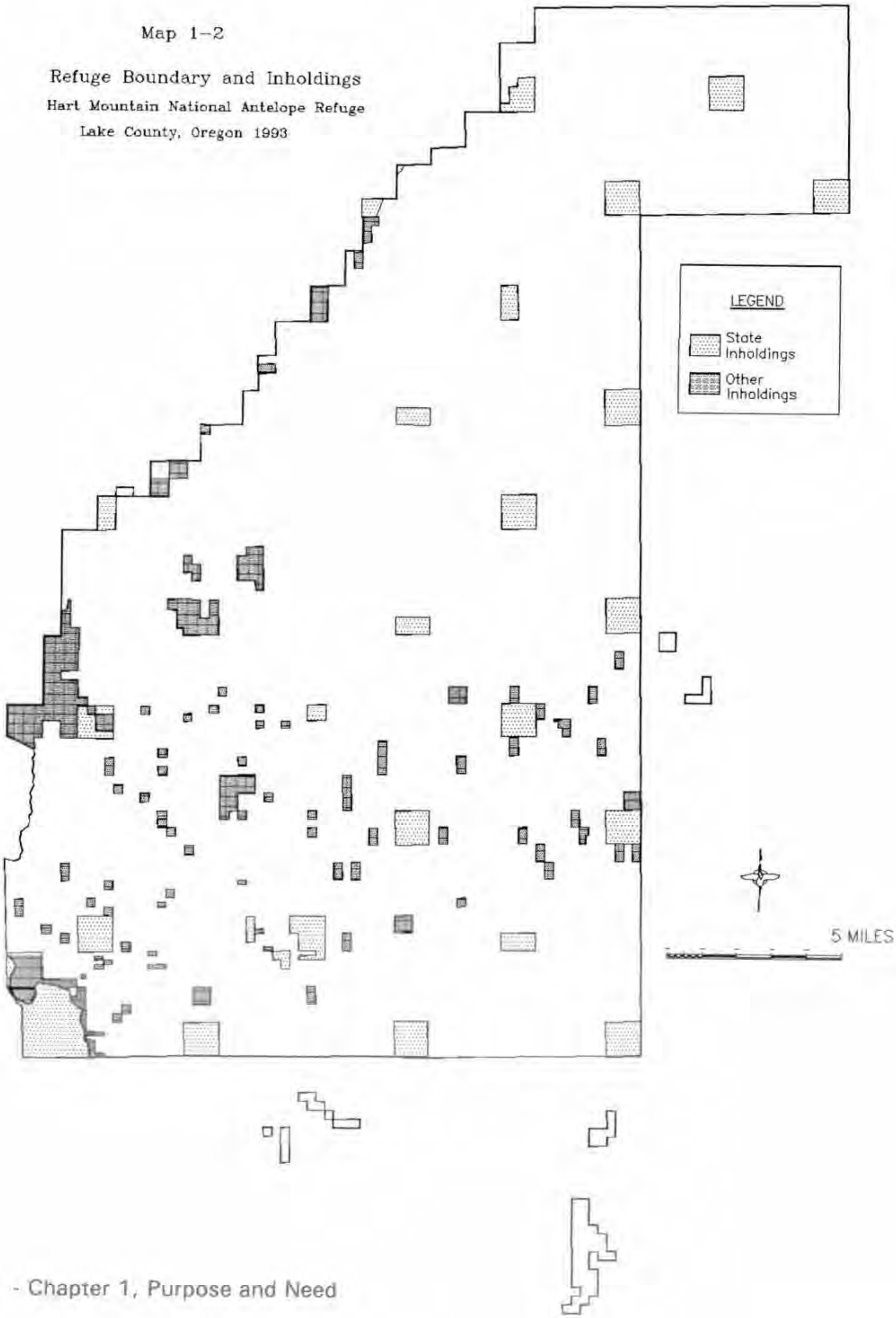
The U.S. Fish and Wildlife Service (Service) began the process of developing a comprehensive management plan for Hart Mountain National Antelope Refuge (NAR) in 1989. This Final Environmental Impact Statement (FEIS) identifies and provides an evaluation of five alternatives for managing Hart Mountain NAR for the next 15 years.

Hart Mountain NAR (Map 1-1) was established in 1936, with the help and support of some local residents (Gabrielson 1943:93), as a range and breeding ground for pronghorn and other wildlife. Hart Mountain NAR is located in east-central Lake County, Oregon, and is situated within the northwestern Great Basin. The total area encompassed within the executive borders of the Refuge equals 275,173 acres. Including Refuge lands outside these borders brings the total to 277,893 acres. Within the executive borders of the Refuge, 11,998 acres remain as state inholdings, 14,600 acres remain as private and county inholdings, and the remaining 251,295 acres are Refuge lands (Map 1-2).

This chapter describes the purpose and need for a new comprehensive management plan and the need for preparing an Environmental Impact Statement (EIS) in conjunction with the management plan; provides an overview of the planning process; identifies the goals and long-range objectives of the Refuge; and identifies and describes the major issues and concerns regarding implementation of a comprehensive management plan.



Map 1-1. Map of Oregon.


Map 1-2
Refuge Boundary and Inholdings
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
LEGEND
State Inholdings
Other Inholdings
5 MILES

PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed comprehensive management plan is to provide Hart Mountain NAR managers with a sound, workable strategy for managing wildlife, other natural resources, and public use of the Refuge for the next 15 years. Restoring wildlife habitat, which will be necessary in order to accomplish the purpose of the Refuge outlined in Executive Order 7523, will be the primary focus of this planning period.

A comprehensive management plan is needed because the 1970 Hart Mountain NAR Resource Management Plan (1970 Plan) does not provide adequate guidance in addressing current management issues. A comprehensive management plan reflecting state-of-the-art information and technology is needed. Also, public use of the Refuge is increasing, which necessitates a strategy for providing quality wildlife/wildland-oriented recreation opportunities balanced with protection of the Refuge environment. Public use was not addressed in the 1970 Plan.

NEED FOR PREPARING AN EIS

Preparation of an EIS as part of the comprehensive management planning process was necessary because of the highly controversial nature surrounding the development of the plan (CEQ 1986:§1508.27). The primary purposes of this FEIS are to 1) provide documentation that the Service identified and evaluated environmental impacts of a reasonable range of alternatives, 2) provide decision-makers with an environmental disclosure sufficiently detailed to help them decide among a reasonable range of alternative strategies for managing Hart Mountain NAR, and to 3) inform the public of environmental impacts of the alternatives being considered for implementation. This FEIS discloses the analysis of environmental consequences associated with implementing each of the alternative management strategies.

OVERVIEW OF THE PLANNING PROCESS

In preparing this FEIS, the Service followed the planning process required by the National Environmental Policy Act (NEPA). Chapter 2 describes the development of alternatives in greater detail. Upon completion of the Final EIS, the responsible official of the Service will select an alternative for implementation. The decision to be made is "which of the 5 alternative management strategies outlined in the Final EIS will provide the best framework for directing and guiding management of Hart Mountain NAR for the next 15 years?"

OTHER AGENCIES

The Service administers approximately 334 acres of Bureau of Land Management (BLM) lands east of County Road 3-12 north of Hart Lake, under provisions of a Memorandum of Understanding (MOU) between Hart Mountain NAR and the Lakeview District Resource Area, BLM. Also in accordance with the MOU, the BLM administers 1,120 acres of Service lands west of County Road 3-12. These Service lands are managed under the Warner Wetlands Area of Critical Environmental Concern (ACEC) Management Plan (USBLM 1990), and therefore are not covered under this FEIS.

Another MOU between the Service and BLM exists for the Shirk Ranch area, Jacobs Reservoir, and other Service lands to the south and east of the Refuge-proper. Under the MOU, the Service administers livestock grazing on 2,210 acres of BLM land in connection with the management of the Shirk Ranch. Also under the agreement, BLM administers livestock grazing on 1,440 acres of Service Lands in connection with the Beatty Butte Allotment; lands included are the Jacobs Reservoir parcel and the remaining parcels of Service lands to the south and east of the Refuge-proper. MOUs will be revisited and updated when necessary.

The Service works closely with the Oregon Department of Fish and Wildlife (ODFW) in surveying big game populations on the Refuge. ODFW also plans to periodically survey fish and stream-habitat of Rock and Guano creeks.

SECTION TWO - REFUGE GOALS AND LONG-RANGE OBJECTIVES

Refuge goals identify the broad direction for managing Hart Mountain NAR. Long-range objectives describe in greater detail desired conditions of Hart Mountain NAR. They reflect conditions depicted by the Refuge goals. Long-range objectives are divided into habitat objectives, wildlife population objectives, public use objectives, and cultural and historic resource objectives.

The scope of Refuge goals and long-range objectives is defined by the Service mission, National Wildlife Refuge System (NWRS) goals, and by the purpose stated in authorities that established the Refuge. Long-range objectives were further refined by incorporating specific wildlife needs where necessary, by reviewing other laws and regulations directing management of Hart Mountain NAR (Appendix A), and by considering available techniques, technology, and budget.

BASIS FOR HART MOUNTAIN NAR GOALS

Hart Mountain NAR, like all other units of the NWRS, must be managed within the scope of the Service mission, NWRS goals, and the purpose for which the Refuge was established. Refuge management also is governed by pertinent laws, regulations, and Service policy.

The goals of the NWRS (Part 2 of the Refuge Manual, USFWS 1982) are:

(1) to preserve, restore, and enhance in their natural ecosystems (when practicable) all species of animals and plants that are endangered or threatened with becoming endangered;

(2) to perpetuate the migratory bird resource;

(3) to preserve a natural diversity and abundance of fauna and flora on refuge lands; and

(4) to provide an understanding and appreciation of fish and wildlife ecology and man's role in his environment and to provide refuge visitors with high quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife to the extent these activities are compatible with the purposes for which the refuge was established.

Goals of the NWRS broadly define the purpose of the system, whereas the acquisition authorities (e.g., executive orders) used to obtain individual refuges more clearly define each refuge's purpose. Executive Order 7523 established Hart Mountain NAR "... as a range and breeding ground for antelope and other species of wildlife..." in 1936. The Shirk Ranch, which was acquired under the Migratory Bird Conservation Act (16 U.S.C. 715-715r), was added to Hart Mountain NAR in 1940 "... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds..." The purposes of lands acquired under the Refuge Recreation Act of 1962 are for "... (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..."

HART MOUNTAIN NAR GOALS

Based on the goals of the NWRS and authorities establishing Hart Mountain NAR, five goals were developed for the Refuge:

(1) Manage for healthy and balanced populations of pronghorn and other species of native wildlife in their natural[a] habitat, to the extent that populations can be influenced on Refuge lands.

(2) Manage for the conservation and recovery of threatened and endangered species of plants and animals in their natural[a] ecosystems.

(3) Restore and maintain, on Refuge lands, the structure, species composition, and processes of native[a] ecological communities and ecosystems of the northern Great Basin Region.

(4) Provide opportunities for wildlife/wildlands-dependent recreation and education oriented to the Great Basin ecosystem while maintaining the rugged, remote and undeveloped character of the Refuge.

(5) Provide high quality nesting and brood-rearing habitat for waterfowl and other migratory birds at the Shirk Ranch area.

BASIS OF LONG-RANGE OBJECTIVES

Long-range objectives describe in greater detail desired conditions that are broadly defined by Refuge goals. They provide numeric and qualitative targets to guide management, and benchmarks upon which to periodically assess progress being made in reaching Refuge goals. The Service identified three primary limitations to reaching Refuge goals:

- Shrub and juniper cover are excessively high throughout Refuge uplands, and periodic fires are lacking in these habitats.

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[a] largely natural (or largely native).

- Stream channels are eroded, and riparian vegetation on streambanks is deficient along the majority of Refuge streams.

- Resources are insufficient to manage the increasing number of Refuge visitors, and facilities are inadequately designed.

Because these problems reflect the underlying limitations to reaching Refuge goals, they provide the foundation of long-range objectives. By resolving core habitat problems through achieving long-range objectives, healthy and balanced populations of all native wildlife species of the Refuge would be maintained, to the extent that populations can be influenced on Refuge lands. In some areas on the Refuge, reduced soil productivity, exotic plant species, diminished seed-sources of native vegetation also could hinder the attainment of Refuge goals. These problems will have to be addressed in order to reach long-range objectives.

The central theme of long-range habitat objectives is to replicate, to the extent possible, the structure, species composition, and processes of native ecological communities of the Refuge. As observed by Dr. D. Dobkin, High Desert Ecological Research Institute, "[native] wildlife species evolved in concert with a dynamically shifting array of successional stages resulting from fires that created a constantly shifting mosaic of successional stages across the landscape" (USFWS 1993a). Replicating the range of habitat conditions under which wildlife species of the Hart Mountain area adapted would provide the greatest assurance of (1) maintaining populations of all native wildlife species; and (2) maintaining healthy population levels of each species in balance with populations of all other native species. As pointed out by Krueger et al. (1991), however, exact replication of habitat conditions cannot be expected, given the introduction of non-native plant species. Natural fluctuations of animal populations would be expected. In short, by providing a healthy environment, wildlife populations will respond accordingly.

Wildlife populations increase and decrease depending on the quality, type, and amount of available habitat, on and off the Refuge. In other words, wildlife is a product of habitat. Similarly, habitat is a product of the processes (i.e., forces) that shape habitat. As such, the replication of conditions under which native wildlife communities evolved (i.e., habitat conditions) requires that native processes be replicated (to the extent possible). This is reflected in the long-range objectives.

Long-range public use objectives were developed as standards that must be maintained in order to sustain the rugged, remote and undeveloped character of the Refuge while providing wildlife/wildlands-oriented recreation opportunities. The cultural and historic resource objective was formulated using NWRS policy, legislative mandates, and executive orders (Appendix A) as guidelines.

CAUSES OF CORE HABITAT PROBLEMS

Deteriorated upland habitats primarily are a consequence of heavy livestock grazing prior to Refuge establishment and fire suppression. Heavy livestock grazing contributed to high shrub cover by reducing grass and forb cover. Once shrubs became more abundant, less space, water and nutrients remained available for grass and forb establishment and growth. Periodic fires that historically swept across the land have been suppressed. This has allowed increased shrub cover to remain at high levels. A similar scenario holds for the increased distribution of western juniper. Fire is an important component of the ecosystem encompassing Hart Mountain. It maintained shrub cover at lower levels than currently exist and it produced temporary grassland habitats.

Deteriorated riparian habitats primarily are a consequence of heavy to severe livestock grazing. Severe grazing along streams adversely impacted willows and deep-rooted sedges and rushes that stabilize banks by holding soil in place. Unstable streambanks were eroded by high water, ultimately leading to downcut channels and lowered water tables. Lowered water tables and grazing pressure allowed upland grasses and shrubs to replace riparian vegetation in many areas. Upland grasses and shrubs have shallower root systems and do not effectively stabilize banks. They also do not provide habitat conditions required by native wildlife communities of riparian areas. Fire suppression, in conjunction with heavy livestock grazing, also has resulted in degraded aspen stands. Aspen depends on periodic fires.

TIME-FRAME OF LONG-RANGE OBJECTIVES

The time-frame for reaching long-range objectives is set at 200 years. Many long-range objectives are attainable well before 200 years, but others such as (b) and (c) for Wyoming big sagebrush (below) will require at least 200 years. Basing short-term management on long-range objectives is important because of the long-term nature of native processes, the long-term nature of recovery processes, and the large expanse of Refuge lands.

LONG-RANGE OBJECTIVES OF HART MOUNTAIN NAR

WILDLIFE OBJECTIVES

As described previously, wildlife would be managed primarily through managing their habitat. Management would be directed at achieving long-range habitat objectives, which would allow the following wildlife objectives to be reached.

(1) Maximize the probability of maintaining the highest population levels of each native wildlife species in balance with other native wildlife and habitats.

(2) Maintain the full array of native wildlife species on the Refuge.

(3) Prohibit introductions of wildlife species that are not native to the Hart Mountain area.

HABITAT OBJECTIVES

ALL HABITATS

(1) Provide for watershed stability by encouraging native riparian and upland vegetation to stabilize soil, based on site potential.

(2) Emphasize habitat management practices that replicate effects and conditions produced by natural disturbance (e.g., fire).

(3) Minimize man-made structures that degrade wildlife habitat, hinder animal movements, cause injuries or death, or otherwise negatively impact wildlife.

(4) Minimize human disturbance to wildlife populations during critical periods, and in critical habitats, especially during reproductive periods.

(5) When seeding or planting vegetation during restoration efforts, emphasize plant species that are endemic to the area.

UPLAND HABITATS

Map 1-3 presents the distribution of upland vegetation types on the Refuge. A definition of "vegetation type" is provided in the Vegetation and Watershed Values section of Chapter 3 (or see Glossary). Objectives (a) and (d), for vegetation types (1) - (7), provide focal points for management. Objectives (b) and (c) are expectations of conditions that would occur as a result of reaching (a) and (d). Two possible exceptions are Wyoming big sagebrush and big sagebrush bitterbrush, where cheatgrass and diminished seed source of native plants may be factors requiring direct management in order to reach objective (c) for these types. Objective (b) identifies a level of shrub cover that we expect would occur naturally in a late stage of succession. Information from future monitoring efforts and other studies may necessitate adjustments in the future.

Objectives for upland vegetation types were developed with the understanding that plant communities, following a disturbance such as fire, will change over time toward a climax plant community. As pointed out by Krueger (1992a), the tendency is for plant communities to move toward dominance by shrubs [in most upland areas of the Refuge]. Long-range upland habitat objectives do not call for particular areas to be maintained in a certain stage of succession. The process of succession dictates that periodic shrub reduction would be needed throughout a vegetation type to maintain more-or-less constant proportions of particular stages of succession within the vegetation type. This principle, as suggested by Krueger (1992a), Dobkin and Yoakum (USFWS 1993a) and others, forms the basis of long-range objectives for upland habitats.

(1) For the Wyoming big sagebrush vegetation type:

(a) maintain 20-30% of the habitat in early and mid stages of succession (0-50 years) at any given time;

(b) maintain shrub cover averaging 15% or less throughout at least 3/4 of the vegetation type;

(c) maintain native grass and forb cover that collectively exceeds 20% in stands of early and mid succession stages; and

(d) confine each shrub/juniper reduction project within an area of 500-2,000 acres, where the ratio of manipulated to unmanipulated patches ranges from 40:60 to 60:40; emphasize manipulating habitat in areas with greater than 20% cover of shrubs or colonized by juniper less than 100 years of age.

(2) For other desert shrub vegetation types (salt desert shrub, winterfat, black greasewood, black sagebrush, spiny hopsage, squirreltail):

(a) there are no long-range objectives at this time; the short-term objective (15 years) is to maintain existing vegetation composition.

(3) For the low sagebrush vegetation type:

(a) maintain 20-30% of the habitat in early and mid stages of succession (0-40 years) at any given time;

(b) maintain shrub cover averaging 20% or less throughout at least 2/3 of the vegetation type;

(c) maintain grass and forb cover that collectively exceeds 20% in stands of early and mid succession stages; and

(d) confine each shrub/juniper reduction project within an area of 500-2,000 acres, where the ratio of manipulated to unmanipulated patches ranges from 30:70 to 60:40; emphasize manipulating habitat in areas with greater than 20% cover of shrubs.

(4) For the mountain big sagebrush vegetation type:

(a) maintain 25-35% of the habitat in early and mid stages of succession (0-25 years) at any given time;

(b) maintain shrub cover averaging 20% or less throughout at least 3/4 of the vegetation type;

(c) maintain grass and forb cover that collectively exceeds 40% in stands of early and mid succession stages; and

(d) confine each shrub/juniper reduction project within an area of 500-2,000 acres, within which the ratio of manipulated to unmanipulated patches ranges from 40:60 to 60:40; emphasize manipulating habitat in areas with greater than 30% cover of shrubs or stands colonized by juniper less than 100 years-old.

(5) For the big sagebrush-bitterbrush vegetation type:

(a) maintain 25-35% of the habitat in early and mid stages of succession (0-40 years) at any given time;

(b) maintain shrub cover, of different age groups, averaging 30% or less throughout at least 3/4 of the vegetation type;

(c) maintain grass and forb cover that collectively exceeds 30% in stands of early and mid succession stages; and

(d) confine each shrub/juniper reduction project within an area of 500-2,000 acres, where the ratio of manipulated to unmanipulated patches would range from 30:70 to 50:50; emphasize manipulating habitat in areas with greater than 35% cover of shrubs or colonized by juniper less than 100 years of age.

(6) For the wheatgrass vegetation type:

(a) maintain 25-50% of the habitat in early and mid stages of succession (0-40 years) at any given time;

(b) maintain shrub cover averaging 5% or less throughout at least 3/4 of the vegetation type;

(c) maintain grass and forb cover that collectively exceeds 40% in stands of early and mid succession stages; and

(d) confine each treatment project within an area of 200-500 acres, within which the ratio of manipulated to unmanipulated patches ranges from 40:60 to 70:30; emphasize manipulating habitat in stands colonized by juniper less than 100 years-old.

(7) For the basin big sagebrush vegetation type:

(a) maintain 20-30% of the habitat in early and mid stages of succession at any given time;

(b) maintain shrub cover averaging 30% or less throughout at least 1/2 of the vegetation type;

(c) maintain native grass and forb cover that collectively exceeds 20% in stands of early and mid succession stages; and

(d) confine each shrub reduction project within an area of 100-200 acres, where the ratio of manipulated to unmanipulated patches ranges from 40:60 to 60:40.

(8) For the mountain shrub vegetation type:

(a) maintain 25-35% of the habitat in early and mid stages of succession at any given time;

(b) maintain 65-75% of the habitat in late succession; and

(c) confine each shrub/juniper reduction project within an area of 50-100 acres, within which the ratio of manipulated to unmanipulated patches ranges from 40:60 to 60:40; emphasize manipulating habitat in stands colonized by juniper less than 100 years-old.

(9) For the mountain mahogany vegetation type:

(a) maintain stands of ancient trees greater than 150 years of age in areas that provide protection from surface fire; and

(b) maintain low frequency of fire (greater than 150 years).

(10) For the western juniper vegetation type:

(a) maintain stands of ancient trees greater than 200 years of age in areas that provide protection from surface fire; and

(b) maintain low frequency of fire (greater than 200 years) on sites with ancient trees.

(11) For ponderosa pine and white fir stands:

(a) maintain stands of ancient trees (greater than 200 years of age);

(b) maintain moderate frequency of surface fire (15-30 years) in pine and low frequency of surface fire (greater than 100 years) in fir;

(c) use habitat manipulation practices that foster germination of seeds, establishment of seedlings, and survival of mature pine and fir trees; and

(d) minimize ladder fuels (e.g., juniper) within and adjacent to stands.

WETLAND HABITATS

Map 1-4 presents the distribution of wetland vegetation types on the Refuge. It does not, however, illustrate streams within riparian vegetation types. Long-range objectives have not been set for submergent aquatic and non-stream portions of the aquatic non-vegetated vegetation types.

(1) Maintain streams (included in the aquatic non-vegetated vegetation type) with the following characteristics:

(a) natural potential distribution of perennial aquatic habitat;

(b) hydrology of streams functioning at potential;

(c) naturally occurring channel adjustments;

(d) valley and stream features (e.g., potential floodable area, sinuosity, stream channel slope and form, and channel bed characteristics) at potential, as determined by potential Rosgen stream types;

(e) 75-80% of miles of perennial streams shaded by overhanging vegetation;

(f) stable streambanks on at least 95% of the length of perennial streams;

(g) 75% of the gravel in trout spawning areas (riffles) with low silt loads (embeddedness); and

(h) diversity and interspersion of habitat structure afforded by potential natural structural units of channels (e.g., riffle, glide, and pool).

(2) Maintain riparian areas (all riparian vegetation types) with the following characteristics:

(a) natural potential distribution and abundance of plant communities (e.g., greenline belt along perennial streams would be dominated by riparian sedge, rush and grass species, or woody-riparian species);

(b) diversity and interspersion of habitat structure afforded by potential natural communities (community level and regional level diversity); and

(c) residual cover of herbaceous and woody plants associated with streambanks and sites where wet meadow and woody vegetation characterize the potential natural community.

(3) Provide marshes (non-riparian marshes) with the following characteristics:

(a) natural potential distribution and abundance of hydric plant communities, comprised mainly of sedges, rushes and grasses; and

(b) interspersion of residual sedge, rush and grass cover within and among wetland plant communities.

(4) Provide playa habitats with the following characteristics:

(a) natural potential distribution and abundance of hydric and mesic plant communities, comprised mainly of broad-leafed forbs, sedges, rushes, and grasses based on site potential.

PUBLIC USE OBJECTIVES

(1) Provide a range of wildlife and wildlands oriented recreation opportunities that are compatible with Refuge purposes and wildlife objectives by providing a variety of settings from semi-primitive to roaded natural (Recreation Opportunity Spectrum, ROS), with at least one-third of the Refuge maintained in semi-primitive non-motorized (SPNM)[b].

(2) Provide opportunities for Refuge visitors to enhance their awareness and appreciation of the Great Basin ecosystem by offering brochures, other literature, tours, interpretive signs, displays, slide shows, etc. that interpret the wildlife, plants, geology, climate, and history of the Great Basin; and by providing a healthy Great Basin ecosystem for observation and study.

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[b] SPNM areas are at least 2,500 acres in size, at least 1/2 mile from the nearest road in use, predominantly of natural setting where structures are rare and encounters with people are few.

(3) Maintain the rugged, remote, and undeveloped character of the Refuge by keeping facilities minimal, providing necessary structures and signs made of native materials, where possible, and consistent with the surrounding environment, and keeping the road system to the minimum necessary to provide access to a variety of areas on the Refuge.

(4) Maintain the rugged, remote, and undeveloped character of the Refuge by providing a landscape unobstructed by new developments that would detract from the character of the Refuge, according to ROS standards for existing recreation settings on the Refuge.

CULTURAL RESOURCES OBJECTIVE

(1) Identify, preserve, and protect all cultural resource values in accordance with public law.

SECTION THREE - ISSUES

IDENTIFICATION OF ISSUES

Through assessing conditions of the Refuge environment and through the scoping process, many concerns of the public were raised regarding potential effects of a change, or no change, in management direction on various resources on and off the Refuge. Six issues were determined as being significant and timely. These are summarized in issue statements presented on the following pages.

Scoping was an ongoing process until this FEIS was finalized for publication. Scoping is a process whereby the public and Federal, State, and local agencies are invited to participate in the early planning of an EIS to assist the Service in identifying issues and alternative management actions to be considered and evaluated in the EIS. Public participation as it relates to development of alternatives is covered in Chapter 2, Section One.

Initial scoping meetings were held in Lakeview, Oregon on 9 January 1991, and in Bend, Oregon on 10 January 1991. Two-hundred and twenty-five people attended the Lakeview meeting and 52 people attended the Bend meeting. A total of 246 oral comments and 114 written comments were recorded as a result of the meetings. A management planning workshop was held at Hart Mountain NAR on 3-4 August 1991 in which 87 people participated. In addition, a campground workshop, held on 19 October 1991, was attended by 19 people. Beginning on 25 February 1991, periodic meetings were held with the Lake County Chamber of Commerce's Hart Mountain Liaison Committee (Liaison Committee). This committee represents livestock permit holders on Hart Mountain NAR, Lakeview business persons, hunters, rockhounders, and the Order of the Antelope.

Beginning in December of 1990, Planning Updates were sent to people on the Hart Mountain Comprehensive Management Plan/EIS mailing list to keep them informed of progress being made on development of the EIS. People were encouraged to send in comments regarding the contents of the updates or related concerns. A total of nine issues of the Hart Mountain NAR Planning Update was mailed.

Planning Update number 7 was mailed to individuals and organizations on the Refuge's mailing list in May of 1992 describing the five issues identified through this process. In response to this planning update, several respondents requested that the Service reevaluate Hart Mountain NAR for potential Wilderness Study areas and consider additional Research Natural Areas. They requested that special management areas be added as an issue. The Service agreed with the public comments that the planning process should entail an evaluation of Refuge lands for potential Wilderness Study Areas and Research Natural Areas. This issue was outlined in Planning Update number 8.

ISSUES

Six major issues, or "unresolved conflicts concerning alternative uses of available resources" (NEPA, section 102(2)(E)), were identified through scoping. The title of each issue identifies the resource of concern. The ensuing discussion describes the concerns regarding how any changes, or no changes, from current management would affect the resource being addressed.

Issue 1. How will wildlife be affected? Wildlife management at Hart Mountain NAR traditionally emphasized game species such as pronghorn, mule deer, and bighorn sheep. Planners must consider changes in wildlife numbers, agency policies, public values and attitudes, and a large body of biological information that has accrued since the 1970 Plan was developed.

Most concerns regard the effects that changes, or no change, in wildlife population management practices would have on 1) big game populations and their management, 2) nongame wildlife species, 3) threatened and endangered animals, and other species of special concern, 4) predators, and 5) feral animals.

Public interest in a continued emphasis on big game management remains strong. However, many people feel strongly that all native wildlife species should receive equal consideration in management. The major concern regarding nongame wildlife populations on the Refuge is poor habitat conditions in many areas; species inhabiting riparian areas are of special concern. There are no known state or federally listed threatened or endangered animal species that use the Refuge to any significant degree. There are, however, 14 species that are candidates for state or federal classification as threatened or endangered. Some people think that predator control should be considered as a viable strategy for managing wildlife populations that can be negatively impacted by predation. Others think that providing good habitat is the best way to reduce the effects of predation on wildlife. Management of feral horses is of concern to some members of the public. Unless feral horses are controlled, they increasingly will compete with native wildlife for limited habitat resources, especially during drought. Several members of the public expressed concerns regarding control of feral horse populations.

Issue 2. How will habitat be affected? Methods used to manage vegetation and waters, including no active management, can have dramatic effects on wildlife habitat, both positive and negative. Therefore, the selection of management methods and intensity of use is of concern to many people. The existing condition of Refuge habitats also is of concern to many; the relatively low ecological condition of many habitats stem from core problems identified in Section One of this Chapter. Quality habitat supports a diversity of wildlife and fish populations and provides opportunities for education, scientific research, and wildlife-oriented recreation.

Of primary concern are the effects that changes, or no change, in current habitat management practices would have on riparian and upland habitats, and on threatened and endangered plants. Changes in the habitat management program would directly affect the condition of upland and riparian habitats. Livestock grazing presents the most controversial vegetation management method that the Refuge is evaluating for use on the Refuge (see Issue 3). There are no known state or federally listed threatened or endangered plant species on the Refuge. However, one plant species (Eriogonum prociduum) that occurs on the Refuge is a candidate for threatened or endangered status in Oregon.

Issue 3. How will livestock grazing on the Refuge be affected? Domestic livestock grazing on Hart Mountain NAR is, for many members of the public, the most important issue that the Service has addressed in the FEIS. From the standpoint of wildlife habitat, some people argue that livestock grazing serves a critical role in managing habitat on Hart Mountain NAR. Others argue that livestock can be managed for commodity production in such a way as to have very little, if any, impact on wildlife habitat. Another viewpoint is that even minimal use of livestock on the Refuge is detrimental to wildlife habitat, and their use in managing habitat on the Refuge is completely unjustified. And still others argue that livestock grazing is central to the southeastern Oregon economy and so grazing should continue or even increase.

The most direct socio-economic effects of increasing or decreasing livestock grazing are on the individual livestock permittees, whose incomes often depend, in part, on grazing privileges on federal land. Indirect effects also affect the local economy because it may benefit from the income of livestock producers. Many persons in southeastern Oregon consider any reductions in grazing to be a threat to their culture even if they are not livestock producers themselves.

Issue 4. How will recreation opportunities be affected? Any significant change from current management, especially changes in facility development and maintenance, and regulations would have direct effects on opportunities available to the public and the quality of those opportunities. Most concerns expressed by the public were related to potential changes in camping opportunities, road access, facility development, disabled access, livestock grazing management (as it affects visual resources and the outdoor experience), hunting and fishing opportunities, availability of information, and directional signing.

Opinions expressed by visitors and others regarding available opportunities and facilities on Hart Mountain NAR were many and very diverse. There was general agreement that facilities are rustic and rudimentary, on-site control over users is limited, and roads are rough and sometimes in poor condition. How people viewed these conditions varied widely. Some maintained that facilities, roads, and signing should be improved. Many others argued that facilities should be kept as they are to preserve the character of the area. Most facilities are not accessible to disabled visitors.

The lack of design and direction in the campgrounds, overcrowding during certain times of the year, and the mixing of different user groups all have led to visitor conflicts which can decrease the quality of recreation experiences on Hart Mountain. Locations of campgrounds, facilities, and design are important issues mentioned by the public for providing quality camping opportunities on the Refuge.

Opinion varies as to the level of design, facilities, and number of campgrounds. There is general agreement, however, to leave the Refuge camping areas rustic and natural appearing.

Road closures are opposed by many members of the public. However, closing roads in some areas would increase the opportunities for experiences dependent on roadless or non-motorized areas which are sought by other people. Closing roads in prime wildlife habitat would result in greater use of these areas by wildlife, thus increasing hunting and wildlife observation opportunities in the areas. On the other hand, road closures may reduce some recreation opportunities by eliminating road access.

Changes in the livestock grazing program could have direct and indirect effects on the quality of recreational experiences. The presence of livestock and fences on the Refuge detracts from the natural setting of the area as expressed by some. Any damages incurred on the environment by livestock grazing could reflect on the quality of the experience for those seeking natural areas.

To deal with these concerns and conflicts, planning needs to address campground locations and level of development, permanent and seasonal road closures and maintenance levels, information and interpretation, back-country use, use of horses and bicycles, hot springs management, hunting and fishing regulations, and accessibility for disabled visitors.

Issue 5. Are there areas that should be recommended for Wilderness or Research Natural Area study? A number of comments were received requesting that the Service reevaluate Hart Mountain NAR for potential wilderness study areas and consider additional research natural areas. A number of other comments were received expressing opposition to any additional wilderness areas in Lake County.

Based on Service policy and the Wilderness Act of 1964, refuge lands must be reviewed for potential wilderness recommendations. Many changes in road status (primarily closures) and land acquisitions have taken place on Hart Mountain NAR since the last wilderness study and research natural area proposals were made 20 years ago.

Issue 6. How will the local economy be affected? The Lake County economy is based on a combination of timber production, secondary wood-products manufacture, agriculture (including livestock grazing), and tourism. A large share of local employment is composed of federal, state and local government jobs. Hart

Mountain NAR and the Sheldon-Hart Mountain Complex office in Lakeview presently employ 12 full-time and 18 seasonal employees.

Many people are concerned about the effects that changes in Refuge management may have on the local economy. Any change in the livestock grazing program on Hart Mountain can directly affect the permittees holding livestock grazing permits and indirectly affect the Lake County economy through changes in business revenue and employment generated by those permittees. In 1990, four livestock grazing permits were issued for 7,207 Animal Unit Months (AUMs); reductions due to drought resulted in only 3,044 AUMs being used. During 1980-1989, an average of 12,867 AUMs per year were used. No permits have been issued since 1990.

Tourism dollars come from hunters, anglers, birdwatchers, campers, sightseers, and other recreational users of the Refuge. In 1992 an estimated 17,200 visitors came to Hart Mountain NAR. Any change in tourism can directly affect local businesses, as well as have indirect effects on the local economy.

ISSUES ELIMINATED FROM DETAILED STUDY

In addition to the above issues which will be reviewed in detail for their environmental consequences, other issues were identified but not considered for detailed analysis (Refuge files).

Chapter 2
ALTERNATIVES

Chapter 2
ALTERNATIVES

INTRODUCTION

The purpose of comprehensive management planning is to develop the best strategy for directing the management of Hart Mountain NAR for the next 15 years. As with any decision making process, the best approach is to consider and evaluate all reasonable options for performing the task at hand before making a decision on which approach to use. In fact, this is the emphasis of NEPA. NEPA requires that all reasonable alternatives to a proposed course of action be rigorously explored and evaluated in cases where the proposed action may have significant impacts on the environment, economy or culture.

This chapter will explain the alternatives and mitigation being considered; present an overview of the alternative development process including a description of the factors that were considered in developing the alternatives; describe in detail and compare alternatives; and identify alternatives not given detailed study. Factors that were considered in developing alternatives include issues identified during scoping, policy, regulations and legislation directing management of Hart Mountain NAR, previous plans, management recommendations obtained from the public, and budget considerations.

SECTION ONE - ALTERNATIVE DEVELOPMENT

I. DEFINITIONS

A. ALTERNATIVE

In the context of this DEIS, an alternative is one of several possible strategies for managing Hart Mountain NAR for the next 15 years. Each alternative combines habitat management programs, other wildlife management programs, public use programs, and other management programs in a different way. As a result, each alternative presents a different approach for reaching long-term objectives, and thus Refuge goals. Each was evaluated based on how much progress would be made during the next 15 years toward reaching long-range objectives (Chapter 4). Additionally, each was evaluated based on the extent to which it would affect the wildlife, habitat, the livestock grazing program, recreation opportunities, special area management, and the local economy (issues) within the next 15 years. Also evaluated are the effects that would occur over the long-term (50-200 years).

B. MITIGATION

Mitigation measures are actions that are taken to minimize, avoid, or eliminate impacts on the affected resources from proposed management activities. Council on Environmental Quality (CEQ) regulations list five levels of mitigation:

- Avoiding the impact altogether by not taking a certain action or parts of an action.

- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

- Rectifying the impact by repairing, rehabilitating or restoring the affected environment.

- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

- Compensating for the impact by replacing or providing substitute resources or environment.

All mitigation measures that could improve management of the Refuge were identified, and the measures discussed cover the range of impacts of the proposed management plan. Mitigation measures will be considered even for impacts that by themselves would not be considered significant.

In the alternatives, some of the adverse effects that could result from implementation of the management plan have been minimized by including mitigation measures into the alternatives themselves. Mitigation measures must be evaluated as part of the alternative, not simply listed.

II. **ALTERNATIVE DEVELOPMENT**

A. OVERVIEW OF DEVELOPMENT PROCESS

Alternatives were shaped to reflect: (1) major strategies, practices, and theories regarding restoration and management of wildlife and habitats of the northern Great Basin; (2) a variety of scenarios for providing wildlife/wildlands recreation activities associated with the unique setting of Hart Mountain NAR; and (3) other major concerns and opportunities expressed by the public. Concerns and opportunities, or issues, were identified during the scoping process (Chapter 1, Section Three). Long-range objectives provided direction and guidance for alternative development (Chapter 1, Section Two).

Guidance also was provided by policies and legislation that direct and regulate management of the NWRS, including Hart Mountain NAR (Appendix A). However, the fact that a certain alternative would not comply with local or federal law, or Service policy, does not render the alternative unreasonable. For instance, an alternative may be developed to illustrate the strategies advocated by current theory or philosophy, even though the strategies would not comply with current Service policy. The evaluation of such an alternative in an EIS may serve as the basis for proposing modifications to existing Service policy or legislation. For an alternative to be selected, however, it must comply with current policy and legal authorities that regulate management of the Refuge.

The emphasis for the next 15 year planning period is restoration of habitat and natural processes by addressing core habitat problems. This emphasis provided important perspective and guidance in developing the alternatives. Planners evaluated trends in wildlife and public use of the Refuge, and the capability of the Refuge habitat to support these uses. The best available information was used to develop each alternative within the context of the overall strategy being proposed by each. The No Action Alternative (Baseline Management) was developed using the 1970 Hart Mountain NAR Resource Management Plan and other plans directing management of the Refuge from 1971 to 1990.

The Preferred Alternative is the alternative that would make the most progress toward achieving long-range objectives of Hart Mountain NAR within the next 15 years, and would best respond to the identified issues given current authorities, policies, and other management directives. In developing the Preferred Alternative, managers and the interdisciplinary planning team selected the most appropriate means of restoring and maintaining habitat and natural processes on the Refuge, based on information and recommendations obtained from other resource professionals and current scientific literature.

1. Sources of Direction and Information

a) **ISSUES**

Alternatives furnish different ways of responding to issues identified during scoping. Therefore, issues provide an important source of direction for the alternatives and as such they provide the framework of the alternatives. Refer to Section Three of Chapter 1 for descriptions of the issues.

b) **FEDERAL POLICY AND AUTHORITIES DIRECTING MANAGEMENT**

U.S. Fish and Wildlife Service Goals and Policies

Hart Mountain NAR is in the Pacific Region of the U.S. Fish and Wildlife Service Department of the Interior and is one unit of the National Wildlife Refuge System. The primary direction for Refuge management is thus the policies provided by the Service for the NWRS (Appendix A). These policies reflect Service mission and NWRS goals (Chapter 1, Section Two).

Legislation and Regulations Affecting All National Wildlife Refuges

Refuge management must comply with federal environmental laws, executive orders, and regulations affecting land and water use as well as the conservation and management of fish and wildlife resources. The principal federal statutes affecting Refuge planning and management are summarized in Appendix A. Regulations developed to guide implementation of applicable laws are codified under Title 50 of the U.S. Code of Federal Regulations (50 CFR).

Refuge management is guided by the National Wildlife Refuge System Administration Act of 1966. The Act directs the Service to administer Refuges for the conservation of fish and wildlife. Secondary uses of a Refuge are authorized by the act if the Service determines that such uses are compatible with the major purpose for which the Refuge was established.

The Refuge Recreation Act of 1962 requires that any recreational use of refuge lands be compatible with the primary purpose(s) for which a refuge was established and not inconsistent with other previously authorized operations or the primary objectives of the area.

The Endangered Species Act of 1973 instructs federal agencies to carry out programs to conserve endangered and threatened species and to conserve the ecosystems on which they depend. Aside from peregrine falcons and bald eagles which pass through the immediate area during migration, no other state or federally threatened or endangered species have been identified as occurring on Hart Mountain NAR.

Hart Mountain NAR Establishing Authority

The executive order that established Hart Mountain NAR, and the Migratory Bird Conservation Act and the Refuge Recreation Act, under which additional lands were purchased, provided important guidance in developing alternatives. Executive Order 7523 mandates that the Hart Mountain NAR be managed for pronghorn and other wildlife on the Refuge. Refer to Chapter 1, Section Two and Appendix A for further information regarding these authorities.

c. **PREVIOUS PLANS**

The following plans and Environmental Assessments were reviewed during the development of alternatives:

- A Burning Plan for the Sheldon-Hart Mountain Refuges (Deming 1961b)
- Chemical Spray Plan for Sheldon-Hart Mountain Refuges (Deming 1961c)
- 1970 Hart Mountain NAR Resource Management Plan (USFWS 1970)
- 1984 Fire Management Plan for Hart Mountain NAR (Franzen 1984)
- Environmental Assessment for Prescribed Burning on Sheldon-Hart Mountain Refuge Complex (USFWS 1992a)
- Hart Mountain NAR Horse Management Plan EA (USFWS 1979)
- Hart Mountain NAR Bighorn Sheep Hunting EA (Refuge files)
- Shirk Lake Wetland Development EA (USFWS 1991)

d. **PUBLIC INVOLVEMENT**

During alternative development, information and recommendations were obtained from a variety of sources from several disciplines. Sources included the Service, BLM, Oregon Department of Fish and Wildlife, Oregon State University, U.S. Forest

Service, professional natural resource consultants, members of the Lake County Chamber of Commerce's Hart Mountain Liaison Committee, members of several environmental organizations, and professional journals. Disciplines included wildlife biology and management, fish biology and management, range ecology and management, ecology, livestock grazing industry, recreation, and cultural and historic resource management. This information was obtained as oral recommendations, other NEPA documents, in-house reports, reports from other agencies and institutions, and papers from professional journals.

Refuge staff held several meetings on the Refuge in the summer of 1992 to obtain information to be used in alternative development. The first meeting was with experts in the natural history of pronghorn and other big game, riparian birds and small mammals, the ecology of the Great Basin, and fire and riparian areas. These experts are working with the Refuge staff as consultants. They provided site specific information on wildlife-habitat relationships and habitat problems, and recommendations regarding management actions to improve or maintain specific habitats.

The second meeting was with former managers of Hart Mountain NAR. They provided the Refuge staff with a historic perspective of Refuge management and suggestions for future management.

The third meeting was with a variety of members of the public representing the Lake County Chamber of Commerce's Hart Mountain Liaison Committee, Oregon State University Range Department, Oregon Natural Resources Council, Oregon Natural Desert Association, and the Wilderness Society. Participants on this tour provided site-specific information for use in alternative development.

The Lakeview BLM was contacted during the process. In September of 1992, Refuge staff met with the BLM to seek management recommendations, and to obtain input on management activities they would like to be involved with regarding management of Hart Mountain NAR.

Three meetings were held in January and February of 1993 to offer experts working with the Refuge a chance to review the alternatives. These meetings focused on reviewing the livestock grazing program, core habitat problems, goals, objectives, and recommendations for the alternatives.

In April of 1993, Refuge staff met with fisheries experts to identify criteria for assessing habitat condition of Rock and Guano Creeks, identify objectives/benchmarks for these criteria, assess habitat condition of the streams surveyed, and to discuss management strategies. Also in May of 1993, Refuge staff briefed the Lake County Board of Commissioners on current habitat conditions of the Refuge.

Public comments on the Draft EIS that were received during the public comment period (13 August - 12 October) were reviewed, and revisions were made to alternatives where necessary. See Appendix O for Service responses to public comments. In October of 1993, Refuge staff met with ODFW to discuss concerns regarding the Proposed Action, and in December of 1993 and March of 1994, Refuge staff met with BLM to discuss concerns regarding the Proposed Action. Chapter 5 summarizes public involvement.

e. **FUNDING CONSIDERATIONS**

Because all alternatives must be considered for implementation, funding considerations must be addressed. A refuge comprehensive plan is designed for implementation over 15 years and budget scenarios may vary considerably during this period. Therefore, alternatives were not dismissed solely because they would require a larger budget than currently exists or predicted. Also, some alternatives may require intensive management programs within their respective themes, and therefore require additional funding to make them reasonable. During periods of normal or predicted budgets, management activities outlined in the comprehensive plan would be implemented as funds become available. However, during periods when the Refuge budget is lower than predicted, it may be difficult to obtain funding for even the most important projects. Funding constraints may influence the timing of implementation.

SECTION TWO - ALTERNATIVES CONSIDERED IN DETAIL

FEATURES COMMON TO ALL ALTERNATIVES

All alternatives contain some common features. These are presented below to reduce the length and redundancy of the individual alternative descriptions.

All alternatives would comply with existing Service fire policy, except for Alternative E.

The guidelines presented below would be followed regardless of the alternative selected.

- Threatened and endangered plants and animals would be protected under the Endangered Species Act.
- Introduction of exotic species would be prohibited.
- Wildlife populations would be monitored as outlined in Table 2-1.
- The Service would comply with section 504 of the Rehabilitation Act. The Refuge is expected to have full accessibility by 1995, and therefore access for disabled persons will remain the same through all alternatives. Section 504 of the Rehabilitation Act of 1973, as amended, prohibits discrimination on the basis of disabilities in programs and activities that receive Federal financial assistance or are conducted by Federal agencies. The Service also would comply with the Americans with Disabilities Act of 1990. This Act provides standards for addressing discrimination against individuals with disabilities in employment, transportation, telecommunications, public accommodations, and services operated by private entities. The only facilities on the Refuge are a visitor room and restroom, outhouses, and a Hot Springs Bathhouse.
- Bicycles would be permitted on roads open to vehicular traffic only. Due to the dramatic increase in mountain biking in Southeastern Oregon, we feel the need to limit this activity before it becomes too high.
- Current policy regarding rockhounding would be maintained.
- Cultural and historic resources would be managed in accordance with public law (Appendix A).
- The Refuge would conform to all other federal laws and regulations.

- The High Desert Discovery program, a cooperative effort between the Service and the Bureau of Land Management, would be implemented as planned, provided that funds are appropriated. Refer to Section Two on Socio-economic Components for more on this program.

- The Service and BLM Lakeview District office agreed to reevaluate the MOU for grazing administration of the Shirk Ranch and Scattered Refuge Lands (Refuge files).

Table 2-1. Standard inventory procedures for wildlife, Hart Mountain NAR.

Species	Frequency[a]	Time of year	Method	Objectives
Bighorn sheep	Annual	March	Aerial survey	Population size
	Annual	June	Aerial survey	Lambs/100 ewes; rams/100 ewes
Mule deer	Annual	November	Ground survey	Fawns/100 adults; distribution
	Annual	March	Aerial survey	Fawns/100 does; bucks/100 does; distribution
Pronghorn	Annual	July	Aerial survey	Fawns/100 does; bucks/100 does; populations size
	Periodic	Monthly	Aerial survey	Distribution & habitat use
	Periodic	May	Aerial survey	Distribution of fawning does
Sage grouse	Annual	April	Ground census	Males/lek
	Annual	June-July	Ground survey	% hens with broods; chicks/hen; chicks/brood
	Periodic	April	Aerial survey	Leks/area abundance
Songbirds	Annual	June	Ground survey	Species no./area
	Periodic	April-June	Ground census	Species no./area; total birds/area; total species/area (upland)
	Periodic	April-June	Ground census	Species no./area; total birds/area; total species/area (riparian)
Waterfowl	Annual	April-July	Ground survey	Breeding pairs/area; fledgling young/area; total birds/area
Waterbirds	Annual	April-October	Ground survey	Species no./area; total birds/area; species/area

[a] Periodic surveys occur every 5-10 years.

ALTERNATIVE A - BASELINE MANAGEMENT

This is the no action alternative. It would continue the management procedures that occurred on Hart Mountain NAR during the period 1971-1990. Management was guided primarily by the 1970 Hart Mountain National Antelope Refuge Resource Management Plan (1970 Plan). Vegetation would continue to be managed primarily with cattle grazing. Cattle grazing as the major means of managing wildlife habitat is based on the premise that cattle can be controlled to increase the quantity and quality of forage for wildlife and improve plant vigor and watershed conditions (USFWS 1970, Anderson et al. 1990a). According to this premise, harvesting course forage plants would make fall and spring regrowth more attractive to wildlife and grazing plants during the growing season would delay plant development thereby making forage more nutritious and palatable. The prescribed burning program would continue to play a minor role in vegetation management, though total acreage burned would be somewhat higher than that burned during 1971-1990.

Public use was not addressed in the 1970 Plan nor in any other planning documents. Regulation and direction of public use has been minimal. It generally was guided by NWRS goals and policy, the Refuge Manual, the Refuge Recreation Act, and the National Wildlife Refuge System Administration Act. Camping at the Hot Springs and Guano Creek campgrounds would continue as would backcountry camping. Camp sites at campgrounds, established through repeated use by visitors, would not be improved. Opportunities for limited, quality hunts would continue to be made available.

1. HABITAT MANAGEMENT

MANAGEMENT UNIT DELINEATION

The 43 grazing units (livestock-use areas) used in 1990 and 10 non-use areas will continue to be employed under this alternative (Map 2-1). Twenty of the use areas were outlined in the 1970 Plan. Between 1970 and 1990, each of 23 grazing allotments were formed by partitioning allotments.

UPLAND HABITAT MANAGEMENT

Following precedent set by past management (1971-1990), the Refuge would establish a target of eliminating or substantially reducing woody-vegetation cover on up to 2,200 acres of upland habitat during the next 15 years. At this treatment level over the long term, up to 10 percent of upland habitat could be expected to be restored and maintained. Mountain big sagebrush and higher elevation low sagebrush would receive treatment priority (Table 2-2). A 50:50 ratio of treated to untreated patches would be targeted. Prescribed burning

Map 2-1

Existing Management Units

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993

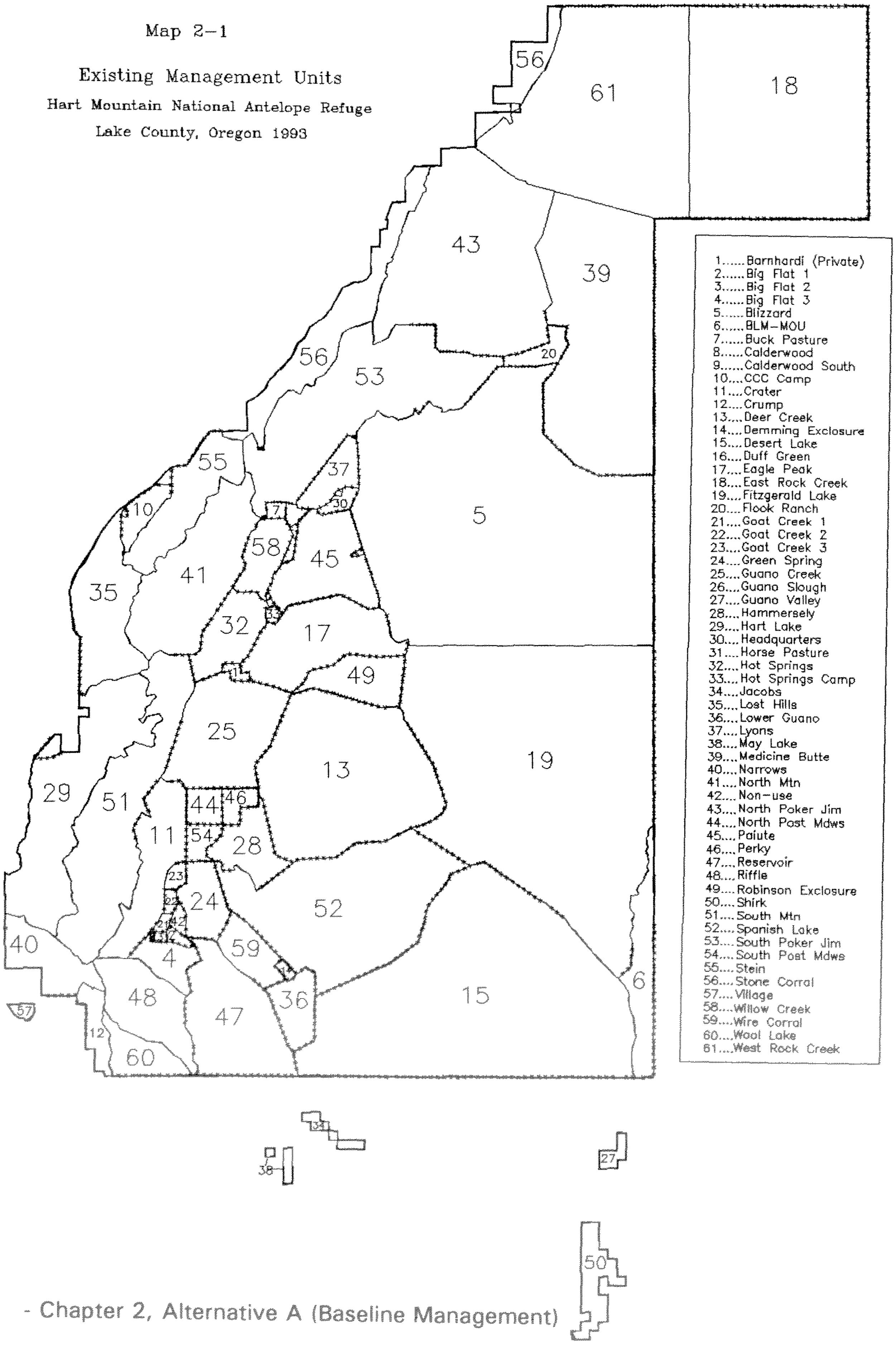


Table 2-2. Number of acres targeted for treatment within the 15-year planning horizon for each alternative.

Vegetation Type	ALTERNATIVES A	B	C	D	E
Wyo. Big Sagebrush	0-400	2,000-3,000	2,000-2,700	6,000-12,000	0
Low Sagebrush	800-1,200	1,500-2,200	3,000-4,500	8,000-15,000	0
Mtn. Big Sagebrush	800-1,200	2,000-3,000	4,500-6,000	4,500-6,000	0
Sagebrush-Bitterbrush	0	200-300	300-450	500-800	0
Wheatgrass	0	0	150	600-1,200	0
Mountain Shrub	0	0	0	400-600	0
Ponderosa Pine	0	0	25	25	0
TOTAL UPLANDS	1,800-2,200	5,700-8,500	10,000-13,800	20,000-35,600	0
Aspen	0	0	100-200	300-500	0
Mixed Dec. Scrub	0	0	0	100	0
Willow	0	0	0	100-200	0
Meadow	200-500	200-500	1,000-2,000	2,000-3,000	0
Silver Sagebrush	0	0	0	200-500	0
TOTAL RIPARIAN	200-500	200-500	1,000-2,200	2,700-4,300	0
GRAND TOTAL	2,000-2,700	6,000-9,000	11,000-16,000	22,500-39,900	0
Average/year	135-180	400-600	735-1,100	1,500-2,660	0

would be the primary means of reducing woody-vegetation cover, though herbicides may be used on occasion.

Fire. Prescribed burning would be used to reduce shrub cover on most, if not all, acreage to be treated. Inholdings and historic structures would be given protection during prescribed burning. All naturally ignited fires and fires accidentally ignited by people would be suppressed.

Mechanical and Herbicide Treatment. Herbicides may be used in Wyoming big sagebrush and low sagebrush below 5,600 feet elevation (tablelands). Mechanical treatment would not be used.

Up to about 270 acres would be treated with herbicides in Alternative A during the next 15 years. The primary herbicides considered for use are 2,4-dichlorophenoxyacetic acid (2,4-D) and granular tebuthiuron (trade name Spike 20P). Application rates for 2,4-D and tebuthiuron would be a maximum of 4 pounds (lb.) active ingredient/acre and 0.75 lb. ai/acre, respectively. Herbicides would be applied from the ground via hand-held or vehicle dispensers and would not be applied within a 100 foot buffer around riparian areas and other wetlands. Herbicide application would occur during spring or summer and would occur no more than once per site. Herbicide applications would be scheduled and designed to minimize potential impacts on water quality and nontarget plants and animals. The rates of application would depend upon the target species, the presence and condition on nontarget vegetation, the soil type, the depth to the water table, and presence of other water sources. Mitigation measures to minimize potential impacts on water quality and nontarget plants and animals would include: 1) minimizing chemical applications prior to anticipated heavy rainfall period; 2) timing pesticide applications so that they have more time to be taken up by growing sagebrush; 3) no use of herbicides during late fall or winter.

A monitoring program would be developed to evaluate herbicide treatment on vegetation and water quality. Based on monitoring strategies outlined in Appendix N, Level 2 or 3 monitoring would be used to monitor effects of herbicides. A water monitoring program would also be implemented to assess and monitor the impacts of herbicide treatments on water quality. Prior to any herbicide application, a Pesticide Use Proposal that includes specific prescriptions, including monitoring, would be developed by the Refuge and would be approved by the Regional Integrated Pest Management Coordinator. Appropriate NEPA documentation would accompany the proposal.

Livestock Grazing. Livestock grazing would be the primary means of managing vegetation, and would be carried out much as it had from 1971-1990. Most livestock grazing would occur on a seasonal (spring, summer, fall, winter, or combination thereof) basis. The goal of the program would be to improve or maintain vegetative condition and vigor, improve nutritional quality of forage for wildlife, and increase availability of forbs for wildlife. In general, cattle would continue to be grazed during the growing season in lower elevation units and after the growing season in higher elevation and meadow units (Appendix M). Some units would be rested periodically. Annual winter use of Shirk Ranch would occur.

The grazing units forming the basis of the livestock grazing program in during 1971-1990 would continue to be used as a basis for the program. There currently are about 160 miles of interior fence on the Refuge. About 50 miles of fence do not meet wildlife standards; these primarily are associated with wetland habitats. The livestock grazing program would remain at 1971-1990 levels. Total livestock Animal Unit Months (AUMs) would range from 10,406 to 17,228 during most years (average AUMs = 12,834). Included in these figures are AUMs for the Shirk Ranch; the number of AUMs on the Shirk Ranch would range from 989 to 3,595 (average AUMs = 2,142). Additional grazing units may be partitioned during the next 15 years to improve control over livestock use of some areas, which would require more fencing. Additional waterholes would not be developed unless needed to improve distribution of cattle in new grazing units. Appendix M provides additional detail on the 1971-1990 livestock grazing program.

Approximately 5 percent of the Refuge would be unavailable to livestock grazing (Map 2-2). The following grazing units would continue to be managed as non-use areas.

Deming Exclosure	Stein
Robinson Draw Exclosure	Narrows
Buck Pasture Exclosure	Crump Lake
Hot Springs Camp	

Seedings and Plantings. Bitterbrush would be planted in several previously burned areas where bitterbrush is not reestablishing or where recruitment is low. Native grasses and forbs would be seeded following herbicide treatment where native grasses and forbs are insufficient.

Noxious Weed Management. Refer to the Noxious Weed Management section under Wetland Habitat Management.

Water Management. Existing waterholes would be maintained on a 10-15 year cycle. Additional waterholes may be developed, depending on future needs. The four existing guzzlers would be maintained, and additional guzzlers may be constructed based on a needs assessment.

Upland Habitat Monitoring. Minimal effort would continue to be put into monitoring vegetation response to prescribed burns, wildfires, and livestock grazing. Existing, permanent vegetation plots would be read approximately every 10 years to assess habitat condition and trend. Approximately six grazing units would be sampled every 15 years to determine utilization levels.

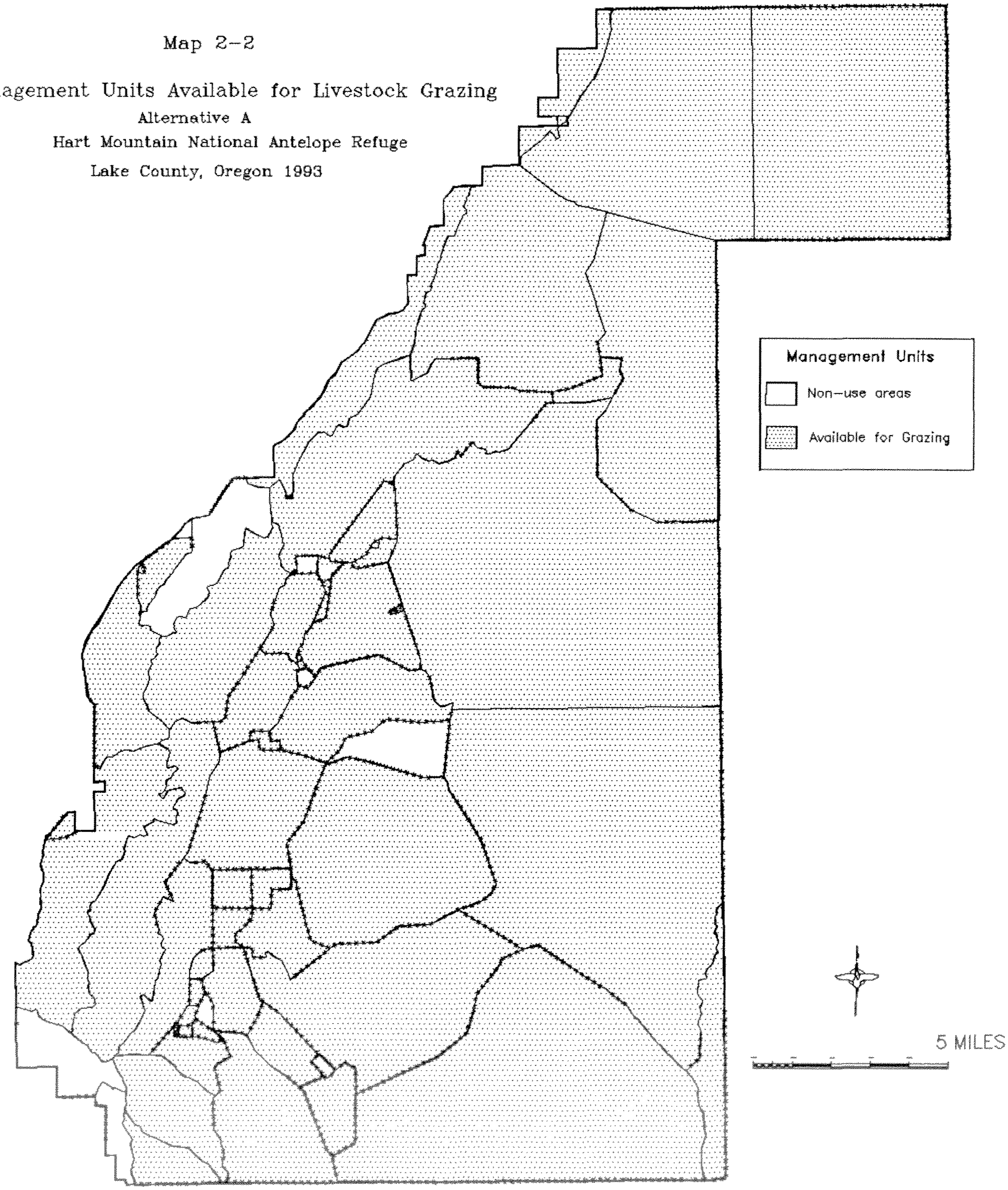
Map 2-2

Management Units Available for Livestock Grazing

Alternative A

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993



WETLAND HABITAT MANAGEMENT

Fire. Prescription fires would be carried out on an infrequent basis in meadows and other riparian areas, as livestock would be the primary means of managing vegetation in these areas. Less than 500 acres would be burned through prescription under this alternative (Table 2-2). All naturally ignited fires and fires accidentally ignited by people would be suppressed.

Mechanical Treatment. Rake-bunch-haying would be used, along with livestock, to manage vegetation on the Shirk Ranch area.

Livestock Grazing. Livestock grazing would be the primary means of manipulating vegetation in large meadows. The objective would be to enhance forage for pronghorn, mule deer and sage grouse. In most grazing units in which riparian areas comprise only a small portion, objectives would be established based on upland habitat conditions. Riparian areas within a given upland cover type would be grazed during the same season as the upland cover type. Duration of use also would be determined based on upland habitat factors. Shirk Ranch would continue to be grazed by livestock during the winter.

Noxious Weed Management. Mechanical treatment and prescribed burning would be the primary means of controlling or eradicating white top, Canada thistle, and Mediterranean sage on the Refuge. Mechanical controls involve mowing or removing flowering heads prior to seed development.

Other Wetland Management Practices. Willows would be planted on a very limited basis. Check dams and juniper revetments would be used in areas where stream channels are entrenched and not showing significant improvement. These procedures would be conducted to enhance the trapping of sediment, promote growth of hydric vegetation, and restore channel structure. A minimum pool of 15 acres would be maintained at Jacob's Reservoir.

Shirk Ranch Area. According to the Shirk Lake Wetland Development Environmental Assessment (USFWS 1991), Shirk Lake will be divided by two major dikes into three sections to increase waterfowl production in this area. Livestock would be grazed during winter months.

Wetland Habitat Monitoring. Riparian and other wetland habitats would not be monitored except for permanent plots that would be read every 10 years (see Upland Habitat Monitoring). Monitoring vegetation response to livestock grazing would be minimal.

2. WILDLIFE POPULATION MANAGEMENT

Wildlife populations, with few exceptions, would be managed through managing upland and wetland habitat. The extent to which other management actions would be used in managing specific wildlife species are described below. Wildlife monitoring is discussed at the beginning of Chapter 2, Section Two.

Hunting. Hunting may be used to manage populations of pronghorn, bighorn sheep, and mule deer if necessary. It would primarily be offered as a recreation opportunity (refer to the Public Use section).

Transplanting. ODFW would continue to capture bighorn sheep from the Refuge and transplant them to other locations. Approximately 20-60 animals would be transplanted each year, based on current and projected populations.

Reintroductions. No reintroductions would be planned.

Predator Control. Predator control, although currently not being employed, may be used if a wildlife species is shown to be at risk due to high predation rates. Predator control would only be used as a temporary solution.

Feral Horses. A population of 50 - 75 feral horses would be managed within a 60,000 acre area in the east-central portion of the Refuge as prescribed by the Hart Mountain National Antelope Refuge Horse Management Plan Environmental Assessment (USFWS 1979). Periodic population reductions would take place, in the form of gathering and selling, as numbers increase above 100 animals. Capturing of horses would take place as outlined in the Horse Management EA.

3. PUBLIC USE MANAGEMENT

Recreation Settings. Approximately 33 percent of the Refuge would be maintained in a Semi-primitive Non-motorized setting, 56 percent in a Semi-primitive Motorized setting, and 11 percent in a Roaded Natural setting (Map 2-3).

Camping. Camping at the Hot Springs and Guano Creek campgrounds would continue with few restrictions, and backcountry tent camping under a permit system would continue as presently managed. Individual camp sites at the campgrounds would not be identified or improved; they evolved through repeated use over time, and this trend would continue. Approximately 35-50 camping opportunities would be available at the Hot Springs Campground under this alternative. Camping at Guano Creek Campground would be permitted only during the hunting season (1 August - 1 November). Approximately 10-15 camping parties could be accommodated at the Guano Creek Campground. The Hot Springs bathhouse, enclosed by a concrete wall, would be maintained as it is.

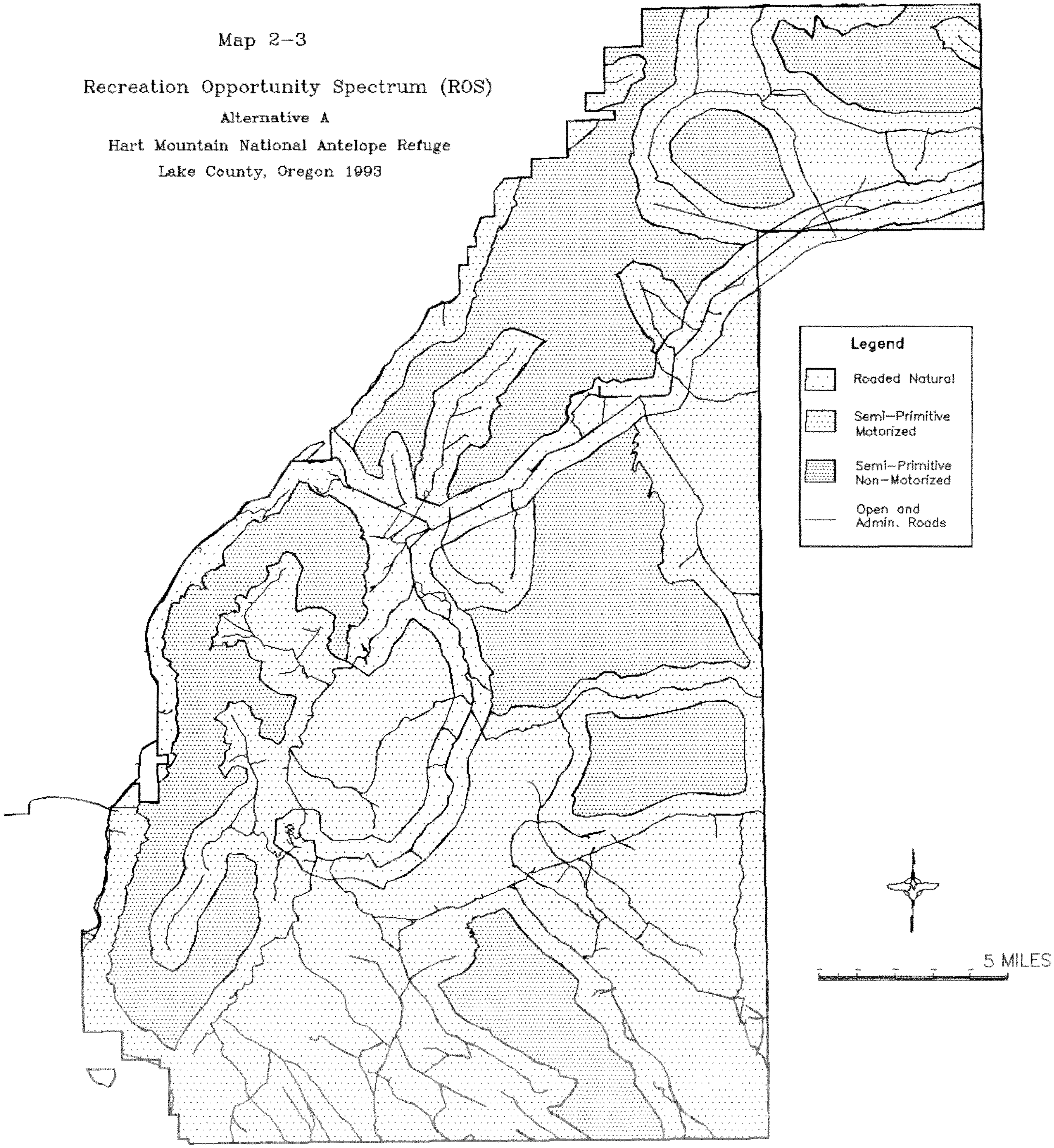
Map 2-3

Recreation Opportunity Spectrum (ROS)

Alternative A

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993



Roads. Road access and maintenance would remain as currently managed. The main roads (linking Refuge headquarters with Plush, Frenchglen, and the Hot Springs Campground) would continue to be open year-round. Blue Sky Road and all spur roads (Maps 2-3 and 2-4) would be seasonally open from the last weekend in May to 1 November. The Barnhardi Road and all spur roads, including Skyline Drive, would be seasonally open from 1 August to 1 November.

There would be approximately 243 miles of open and seasonal roads on the Refuge, 78 miles of closed roads, and 42 miles of administrative roads.

Road closures may occur based on wildlife needs, road conditions and redundancy of roads in a given area, though the extent would be limited.

Natural Resource Interpretation. The visitor room would remain open all year. Existing interpretive signs would be maintained. The currently available brochures and information sheets would remain available. Additional information may be developed.

Hiking and Horseback Riding. Hiking and horseback riding would be permitted throughout the Refuge with minimal restrictions. Hiking trails would not be constructed.

Hunting and Fishing. Limited, quality hunts would continue to take place. The number of tags issued would be determined based on wildlife population size and trend, in cooperation with ODFW. In 1990, 20 tags were available for pronghorn rifle hunts, 20 for pronghorn archery hunts, 12 tags for bighorn sheep hunts (two seasons), 100 tags for mule deer muzzleloader hunts, and 150 tags for mule deer bow hunts. Pronghorn and mule deer hunts currently are buck only, and bighorn sheep hunts currently are ram only. Chukar hunting, under Oregon State regulations, would continue to be available along the west slope of Poker Jim Ridge and the southern portion of Hart Mountain from Hart Lake south.

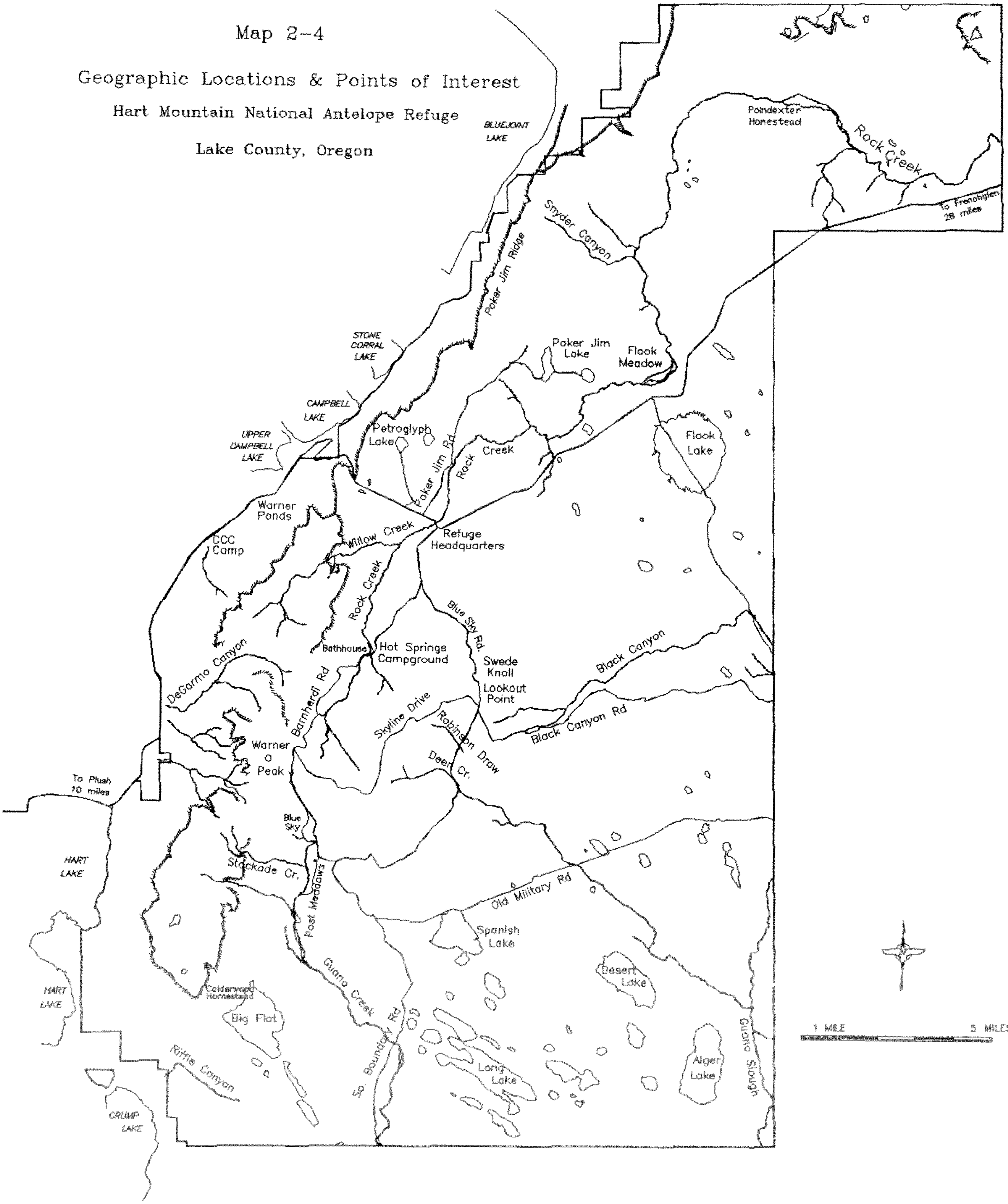
From 1955 until 1991, all Refuge waters were operated under general trout regulations for southeastern Oregon. Regulations set by ODFW stated that trout could be taken by bait or artificial lures and flies, and daily bag limits were not to exceed five trout of at least 6 inches per day. In 1991, regulations changed to a limit of two 6-10 inch trout per day for Guano and Rock Creeks. Only barbless flies and lures are permitted. Rock and Guano creeks may be closed to fishing on occasion due to drought conditions. Warner Pond has a limit of 10 trout per day, a minimum of 6 inches in length, and no more than five over 12 inches, and of these five, no more than 2 over 20 inches. Warner Pond is stocked annually with 400-600 fingerling rainbow trout.

Map 2-4

Geographic Locations & Points of Interest

Hart Mountain National Antelope Refuge

Lake County, Oregon



4. SPECIAL AREAS MANAGEMENT

The Poker Jim Ridge Research Natural Area (Map 2-5) would continue to be managed as directed by the National Wildlife Refuge Administration Act and 8 RM 10 of the Refuge Manual. The RNA encompasses 640 acres. The Poker Jim Ridge recommended Wilderness is pending Congressional action. The Poker Jim Ridge recommended wilderness area encompasses approximately 20,390 acres of FWS and BLM lands. No additional proposals for Research Natural Areas or Wilderness study areas are identified under this alternative.

5. FUNDING / PERSONNEL

Table 2-3 provides an estimate of the costs to implement Alternative A for the 15-year planning horizon. In years of limited funding, budgetary priority for on-the-ground management would be given to the livestock grazing program and long-term wildlife surveys.

Staffing required to implement Alternative A are presented below. Approximately one-third of the Sheldon-Hart Mountain Refuge Complex staffs' duties are directed toward Hart Mountain NAR.

Complex Staff	Refuge Staff
Project Leader	Refuge Manager
Assistant Project Leader	Engineering Equipment Operator
Administrative Support Assistant	Laborer (seasonal)
Purchasing Officer	2 Firefighters (seasonal)
Office Automation Specialist	
Fire Management Officer	
Range Conservationist	

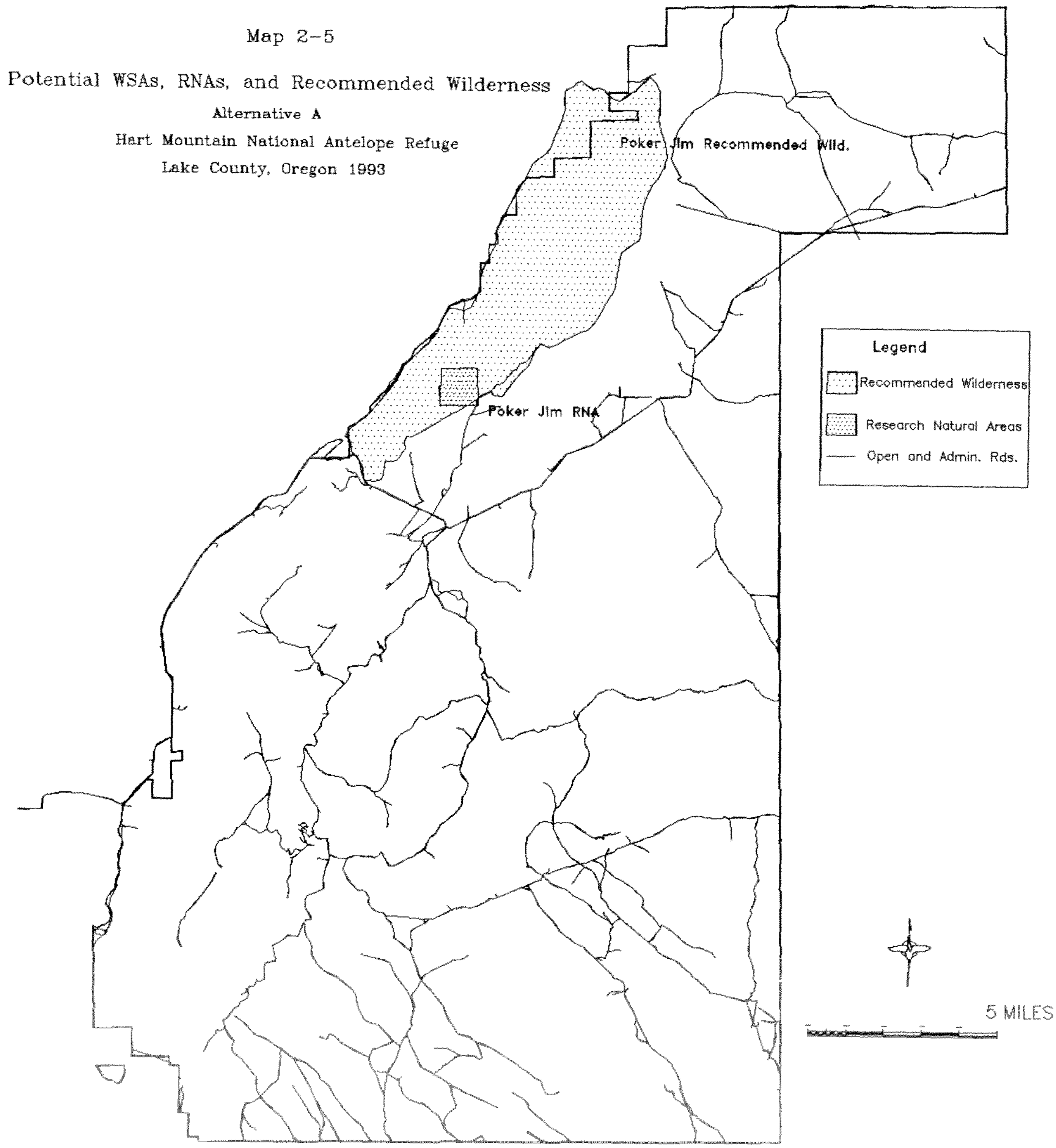

Map 2-5
Potential WSAs, RNAs, and Recommended Wilderness
Alternative A
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
Poker Jim Recommended Wild.
Poker Jim RNA
Legend
Recommended Wilderness
Research Natural Areas
Open and Admin. Rds.
5 MILES

TABLE 2-3. ESTIMATED COST TO IMPLEMENT ALTERNATIVE A

Annual Salaries:	$205,145
Annual Operation and Maintenance	
Administrative Support	20,877
Facility Maintenance	3,886
Vehicle and Equipment Maintenance	23,232
Resource Maintenance	14,784
Supplies and Material	36,491
Contract Services	8,659
TOTAL	107,929

Facility Capital	One Time Capital/ Expenditures	Annual Operation and Maintenance
Pronghorn Research	50,000	
Redband Trout Research	10,000	
Sage Grouse Research		40,000
Construct Bunkhouse	300,000	5,000
Construct Storage Building	115,000	1,000
Juniper Control	25,000	
Headquarters Rehabilitation	18,000	3,000
Stabilize Deteriorating Historic Structures	25,000	
Clean Out Waterholes	30,000	2,000
Rehabilitate and Replace Interior Fences	195,000	11,000
Rehabilitate and Replace Boundary Fences	99,000	8,000
Replace TD-20 Dozer	130,000	
Replace Dikes and Water Control Structures/Shirk	175,000	4,000
Replace Dump Truck	80,000	
Replace Front-End Loader	95,000	
Replace Flat-Bed Truck	75,000	
Replace Tilt-Bed Trailer	15,000	
Overhaul Generators	12,000	
Prescribed Burning		5,000
TOTAL	1,449,000	79,000

ALTERNATIVE B - FEATURED SPECIES MANAGEMENT

This alternative features the combined use of livestock grazing, prescribed burning, and herbicide use to manage vegetation on the Refuge. It combines the premises that livestock grazing is needed to improve and maintain vegetative condition, vigor, and forage quality for key wildlife species and watershed values with the premise that increasing interspersion of succession stages in upland habitats will enhance wildlife populations and watershed values. Habitat management would emphasize the habitat needs of selected wildlife species, namely pronghorn, mule deer, bighorn sheep and sage grouse. This alternative assumes that enhancing habitat for these species would benefit Refuge wildlife in general. Many of the management actions proposed in this alternative were taken from recommendations submitted by the Lake County Chamber of Commerce's Hart Mountain Liaison Committee (LCCC 1992).

This alternative would provide the largest number of recreational opportunities. Centralized camping would be available at the Hot Springs Campground, Guano Creek Campground, and one other site. Two camping areas would be provided for horseback riders, and camping within 100 yards of designated roads would be available as would backcountry camping. Hunting opportunities would be increased from baseline management. Road management would be as currently managed except that more roads would be open to the public. Additionally, the North Mountain road would be open seasonally, and Blue Sky and South Boundary roads would be open year-round.

1. HABITAT MANAGEMENT

MANAGEMENT UNIT DELINEATION

The existing grazing units (livestock-use areas) will continue to be used under this alternative (Map 2-1). Wool Lake Unit would be added as a grazing unit, being partitioned from Riffle Canyon Unit. Additional partitioning may take place to improve distribution of livestock.

UPLAND HABITAT MANAGEMENT

The Refuge would establish a target of eliminating or substantially reducing woody-vegetation cover on 6,000 to 9,000 acres during the next 15 years (Table 2-2). Over the long term, about 20-35 percent of the Refuge uplands could be restored and maintained under this alternative's treatment program. Prescribed burning and herbicides would be used to reach this target. Treatments would be planned to obtain a 50:50 ratio of treated to untreated patches.

Of total acres to be treated during the next 15 years, the approximate distribution among upland vegetation types would be 30-40 percent for Wyoming big sagebrush, 25-40 percent for low sagebrush, 30-40 percent for mountain big sagebrush, and 3-5 percent for sagebrush-bitterbrush.

Fire. Of the 6,000 to 9,000 acres targeted for treatment, prescribed burning would account for up to 75 percent of the total acreage. Mountain big sagebrush, sagebrush-bitterbrush and higher elevation low sagebrush would receive prescribed burning priority. Inholdings and historic structures would be protected during prescribed burning. All naturally ignited fires and fires accidentally ignited by people would be suppressed.

Firing technique and timing would be prescribed to mitigate smoke impacts, including 1) burning late in the day during the period of greatest atmospheric instability, 2) burning during low fuel moisture, and 3) burning during southerly and southwesterly transport winds. This would avoid smoke intrusions in Plush and avoid smoke impacts to Class I airsheds. Direct impacts to wildlife would be mitigated by not burning during the breeding season of most species. Indirect impacts would be mitigated by burning in a patchy mosaic and minimizing adverse impacts to soil. To mitigate impacts to sage grouse, prescribed burns would be carried out in a way that would ensure continued existence of sage grouse nesting habitat in areas adjacent to burns. Additionally, areas around sage grouse leks would be avoided. Prescribed burns would be executed during February-April or September-November.

Mechanical and Herbicide Treatment. Fifty percent or less of the acreage to be type converted would be treated using herbicides. Wyoming big sagebrush and low sagebrush below 5,600 feet in elevation would be treated primarily using herbicides. Mechanical treatments would not be used to reduce shrub cover.

In association with the prescribed burning program, juniper that have invaded sagebrush and bitterbrush cover types would be cut using chainsaws prior to prescribed burning of the area. Mountain big sagebrush-bitterbrush in a late stage of succession would not be treated.

Between 1,500 to 4,500 acres would be treated with herbicides in Alternative B during the next 15 years. The primary herbicides considered for use are 2,4-dichlorophenoxyacetic acid (2,4-D) and granular tebuthiuron (trade name Spike 20P). Application rates for 2,4-D and tebuthiuron would be a maximum of 2 pounds (lb.) active ingredient/acre and 0.75 lb. active ingredient/acre, respectively. Herbicides would be applied from the ground via hand-held or vehicle dispensers, or from the air and would not be applied within a 100-foot buffer around riparian areas and other wetlands (200-foot if aerially applied). Herbicide application would occur during spring or summer and would occur no more than once per site. Herbicide applications would be scheduled and designed to minimize potential impacts on water quality and nontarget plants and animals. The rates of application would depend upon the target species, the presence and condition on nontarget vegetation (including sensitive species), the soil type, the depth to the water table, and presence of other water sources.

Mitigation measures to minimize potential impacts on water quality and nontarget plants and animals would include: (1) minimizing chemical applications prior to anticipated heavy rainfall period; (2) timing pesticide applications so that they have more time to be taken up by growing sagebrush; (3) no use of herbicides during late fall or winter; (4) using a 100-foot buffer zone around wetlands (200-foot if aerially applied); and (5) conducting intensive surveys for threatened, endangered, or otherwise sensitive plants. For aerial application, additional mitigation to reduce drift would include: (1) minimizing height above ground for aircraft; (2) controling droplet size; and (3) applying herbicides only if wind is below 5 mph.

A monitoring program would be developed to evaluate herbicide treatment on vegetation and water quality. Based on monitoring strategies outlined in Appendix N, Level 2 or 3 monitoring would be used to monitor effects of herbicides. A water monitoring program would also be implemented to assess and monitor the impacts of herbicide treatments on water quality. Prior to any herbicide application, a Pesticide Use Proposal that includes specific prescriptions, including monitoring, would be developed by the Refuge and would be approved by the Regional Integrated Pest Management Coordinator. Appropriate NEPA documentation would accompany the proposal.

Livestock Grazing Livestock grazing, in upland habitats, would be used with the objective of improving and maintaining vegetation condition and vigor, and enhancing the nutritional quality of forage for key wildlife species. Livestock grazing prescriptions would be developed on a vegetation type basis. The following general guidelines would be used to formulate specific prescriptions for using livestock in the major vegetation types. The guidelines were designed with intent of minimizing direct impacts during critical periods for several groups of wildlife. Guidelines for wetland habitats are provided in the livestock grazing section under Wetland Habitat Management.

- Wyoming big sagebrush areas in the northeastern portion of the Refuge would be grazed each spring for the following objectives: (1) preconditioning forage for wildlife, (2) reduce accumulation of dead plant material to improve vigor of plants and make succulent forage more available for herbivorous wildlife, (3) reduce cheatgrass and increase cover of native perennial bunchgrasses, (4) disseminate seeds of native herbaceous plants, (5) create firebreaks for prescribed burning. These applications were proposed by Bailey (1991), LCCC (1992), and Krueger and Buckhouse (1993). Item 2 was recommended by the Lakeview District BLM (USFWS 1993b). Season of use would be approximately 15 April - 15 June, and duration of use would range from two weeks to six weeks (LCCC 1992). Preconditioning of forage would only be conducted every other year; livestock would be removed from treatment areas prior to mid-growing season (approximately 15 May). Please refer to Appendix I for further information on each application.

Grazing units: East Rock Creek, West Rock Creek, Medicine Butte (Table 2-1).

- Some low sagebrush areas below 5,600 feet elevation would be grazed every other year in during the summer or fall. Season of use would be approximately 15 July - 1 October, and duration of use would range from two weeks to six weeks (LCCC 1992). Objectives include preconditioning fall forage for pronghorn, mule deer, and sage grouse (Bailey 1991, LCCC 1992).

  Grazing units: Desert Lake, Spanish Lake, Lower Guano Creek, Reservoir Lake, Wool Lake, Riffle Canyon (Table 2-1).

- Other low sagebrush areas below 5,600 feet elevation would be grazed every other year in during the early part of the growing season every other year. Season of use would be approximately 1 April - 20 May, and duration of use would range from two weeks to six weeks (LCCC 1992). Objectives include preconditioning fall forage for pronghorn and sage grouse (Bailey 1991, LCCC 1992).

  Grazing units: Blizzard Ridge, Fitzgerald Lake (Table 2-1).

- Higher elevation low sagebrush areas would be grazed during the first half of the growing season (1 April - 15 May) every other year with the objective of preconditioning forage for pronghorn, mule deer, and sage grouse (LCCC 1992). The grazing units would be rested every other year. Another objective of cattle grazing in higher elevation low sagebrush areas would be to would reduce accumulations of dead plant material to improve vigor of plants and make succulent forage available for pronghorn, mule deer, and sage grouse (Bailey 1991).

  Grazing units: North Poker Jim Ridge, South Poker Jim Ridge (Table 2-1).

- Mountain big sagebrush and big sagebrush-bitterbrush areas would be grazed during the growing season every other year with the objectives of (1) preconditioning bitterbrush-browse for mule deer in bitterbrush areas; (2) enhance growth of bitterbrush plants in the bitterbrush zone; (3) precondition herbaceous forage for mule deer and sage grouse in low sagebrush, mountain big sagebrush, big sagebrush-bitterbrush, and burned areas; (4) precondition forage for pronghorn in low sagebrush areas and recently burned areas; (5) reduce cheatgrass and increase cover of native perennial bunchgrasses in burned areas in the big sagebrush-bitterbrush vegetation type; (6) reduce accumulation of dead plant material to improve vigor of plants and make succulent forage more available for herbivorous wildlife; (7) create firebreaks for prescribed burning; and (8) reduce fire hazards. These applications were proposed by Bailey (1991), LCCC (1992), and Krueger and Buckhouse (1993). Please refer to Appendix I for further information on each application. The strategy for units that encompass the Intermediate Hills and Hart Mountain would be to alternate between early grazing and rest. Season of use during the year of grazing would range between 15 May and 15 July, depending on objectives and moisture, and duration would range from one to four weeks. When the objective is preconditioning, cattle would be removed by mid-growing season (approximately 1 June). See also the guidelines for cattle grazing in riparian habitats.

Grazing units: North Mountain, Willow Creek, Hot Springs, Paiute, Deer Creek, Guano Creek, Hammersly, Green Springs (Table 2-1).

Additional fencing would be needed to more effectively control livestock distribution to protect sensitive riparian areas. Salt blocks would be positioned and water sources developed to improve cattle distribution in uplands. Temporary fences or riders may be used in some cases to reach desired utilization levels, and to ensure protection of sensitive areas. The use of electric ear-tags also would be explored. Riparian areas receiving use within a grazing unit would be intensively monitored.

Stocking rates of livestock would be determined based on specific objectives of the treatment, environmental conditions, and available forage. Burned areas would not be grazed by cattle for two to three years following burning.

Existing grazing units that formed the basis of the livestock grazing program in 1990, with the addition of Wool Lake Unit, would be used as a basis for the program. Overall proposed livestock levels would be approximately 68 percent below baseline (1971-1990) AUM levels. The total number of AUMs would be approximately 4,075 per year. During drought years, AUMs may drop to 0 depending on severity of conditions. Shirk Ranch would not be used.

The following constraints to scheduling would be given high priority when developing site-specific prescriptions for using cattle to improve vegetative vigor and enhance forage for wildlife:

- Avoid the period 1 April - 1 July in pronghorn spring habitat. This encompasses most of the pronghorn fawning period (1 April - 1 August).

- Avoid grazing units that encompass sage grouse nesting habitat prior to 1 June to avoid direct impacts to nesting sage grouse.

- Allow for sufficient regrowth of grass to provide residual cover for sage grouse nesting in grazing units with significant acreage of mountain big sagebrush and Wyoming big sagebrush. This would require removing cattle while there is an adequate amount of moisture for regrowth.

- Remove cattle from units that encompass riparian areas before the end of the growing season to allow for sufficient regrowth of riparian vegetation to provide winter cover and spring nesting cover for birds and small mammals, and for trapping sediment along the streamside corridor.

Approximately 20 percent of the Refuge would be unavailable to livestock grazing (Map 2-6). The following grazing units would be managed as non-use areas ([A's] identify those that also are designated as non-use areas in Alternatives A). Livestock grazing would not be permitted in these areas.

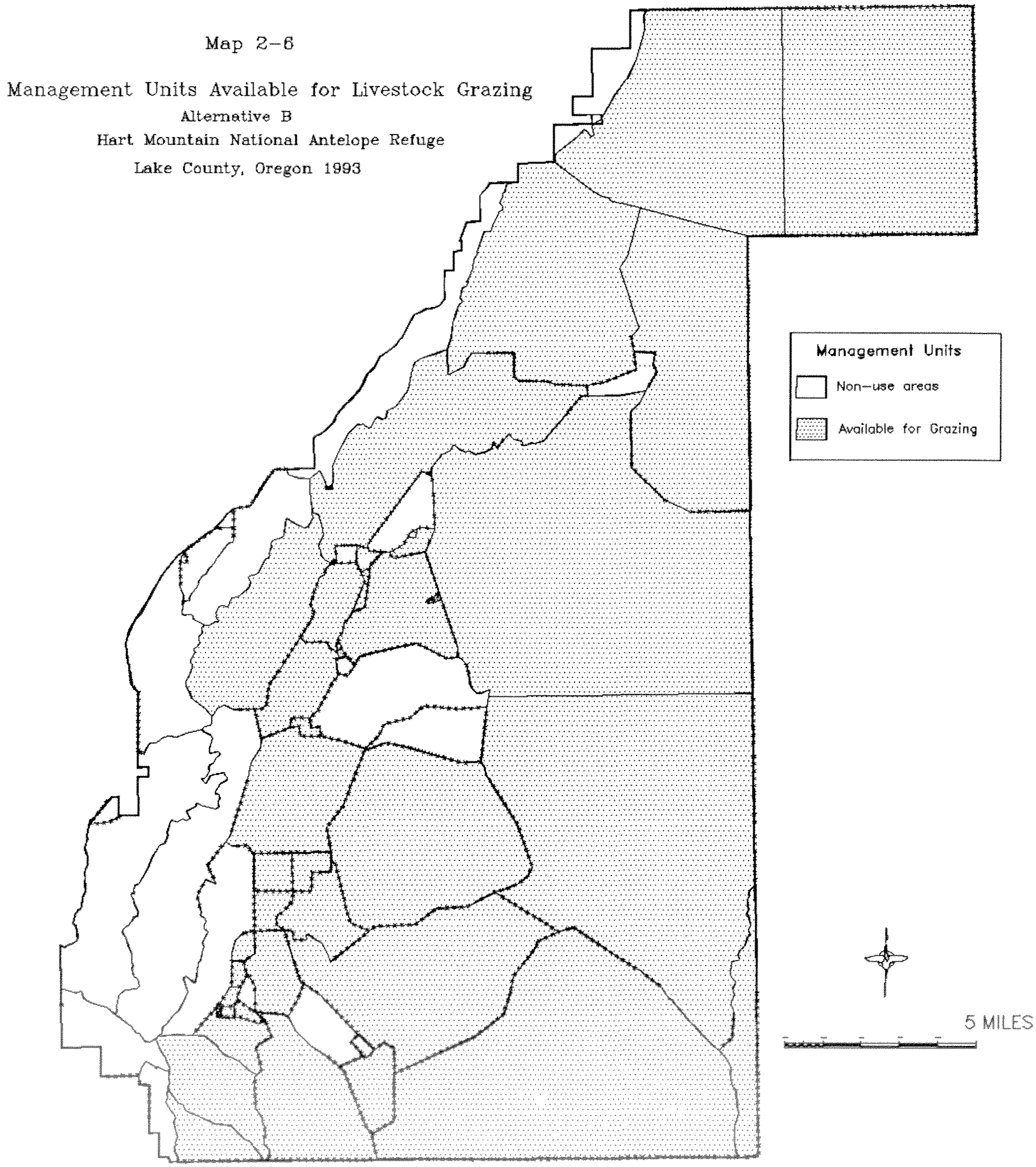
Flook Ranch
Lyons Meadow
Wire Corral Flat
Deming Exclosure[A]
South Mountain
Buck Pasture Exclosure[A]
Eagle Peak
Robinson Draw Exclosure[A]
Hot Springs Camp[A]

Crater
Stone Corral
Stein[A]
Lost Hills
CCC Camp
Hart Lake
Narrows[A]
Crump Lake[A]
Shirk Ranch

Seedings and Plantings. Bitterbrush would be planted in several previously burned areas in which bitterbrush is not reestablishing or in which recruitment is low. Certified weed-free seeds of native grasses and forbs would be seeded following herbicide application where native grasses and forbs are insufficient. In some cases, cattle would be used to disseminate seeds as described in the livestock grazing section.

Noxious Weed Management. Refer to the Noxious Weed Management section under Wetland Habitat Management.

Water Management. Natural sources of water would be restored and maintained (see Wetland Habitat Management). Existing waterholes would be maintained on a 10-15 year cycle. Additional waterholes would be developed as necessary to account for changes in fencing and distribution of cattle, and to manage their distribution. In some areas, water may be piped from riparian areas to reduce damage to these areas. The four existing guzzlers would be maintained, and additional guzzlers may be constructed based on a needs assessment. New waterholes may be developed to improve livestock distribution.


Map 2-6
Management Units Available for Livestock Grazing
Alternative B
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
Management Units
Non-use areas
Available for Grazing
5 MILES

Upland Habitat Monitoring. An extensive approach would be taken to monitor vegetation response to prescribed burning, mechanical treatments, herbicide treatments, and wildfires. The effort would be minimal to moderate where response is known, and intensive where predictability of response is low. Vegetation monitoring associated with livestock grazing would be intensive to determine utilization and trend. Existing, permanent vegetation plots would be read approximately every 10 years to assess habitat condition trend. Several additional plots would be established. Distribution of cattle and utilization levels would be monitored and recorded at a minimum of every other year that a grazing unit is grazed by cattle. Information collected during monitoring would be used to periodically review management strategies. It would provide a basis to adjust management programs where necessary to ensure that core problems are effectively being resolved and that management is directed at reaching long-range objectives.

WETLAND HABITAT MANAGEMENT

Fire. Prescribed burning would only be used when livestock grazing would not serve the purpose or provide the same end result. Therefore, prescribed burning of meadows would generally not be practiced. However, because Lyons and Flook meadows would not be grazed by cattle, they would be burned. Meadows of Shirk Ranch also would be burned through prescription. Prescribed burning also may be used to eliminate juniper from riparian areas. All naturally ignited fires and fires accidentally ignited by people would be suppressed.

Mechanical Treatment. In association with the prescribed burning program, junipers that have invaded aspen stands may be cut and burned.

Livestock Grazing. Livestock grazing would be the primary means of manipulating vegetation in riparian areas. Meadows would primarily be grazed to enhance forage for pronghorn, mule deer and sage grouse. To obtain desired results, additional fencing, temporary fences, and riders would be utilized. Vegetation on Shirk Ranch would not be grazed by cattle.

In developing prescriptions for using cattle to improve vegetative vigor and enhance forage for wildlife, five constraints would be imposed on scheduling. These are presented in the livestock grazing section for upland habitats.

The following guidelines would be used to formulate specific prescriptions for using cattle in major wetland vegetation types:

- Riparian grazing units (sedge-rush-bluegrass, bluegrass-ryegrass, and willow vegetation types) would be grazed every other year during the growing season for the following objectives: (1) prolong the succulence of forbs for pronghorn and sage grouse, (2) enhance forb availability for pronghorn and sage grouse, (3) enhancing willow growth, (4) increase the amount of streamside for the thermal protection (shading) of waterways, and (5) control noxious weeds. These applications were proposed by Bailey (1991), LCCC (1992), and Krueger and Buckhouse (1993). Using cattle to prolong the succulence also was discussed by Krueger (1991, 1992a, 1992b). Please refer to Appendix I for further information on each application. When preconditioning and increasing availability of forbs is an objective, overall utilization would not exceed 50 percent. This should provide a mosaic of moderately to heavily used patches and ungrazed to lightly grazed patches (Klebenow and Burkhardt 1982). It also would provide at least some residual cover for small mammals and birds through the winter and following spring. Season of use would be approximately 1 May - 30 June, and duration of use would not exceed four weeks.

  Grazing units: North Post Meadow, South Post Meadow, Goat Creek 1. Many of these guidelines would also be incorporated into managing riparian areas in the following upland grazing units: South Poker Jim, North Mountain, Willow Creek, Hot Springs, Paiute, Deer Creek, Guano Creek, and Green Springs (Table 2-1).

- Big Flat area would be grazed each summer for the following objectives: (1) prolonging the duration of succulent forbs for pronghorn and sage grouse, (2) increasing forb availability for pronghorn and sage grouse, (3) rejuvenating waterfowl nesting habitat, (4) enhancing waterfowl brooding habitat, and (5) controlling noxious weeds. These applications were proposed by Bailey (1991), LCCC (1992), and Krueger and Buckhouse (1993); please refer to Appendix I for further information on each application. Season of use would be approximately 1 August - 15 October, and duration of use would not exceed four weeks to avoid direct impacts to waterfowl nesting. Additional fencing would ensure adequate residual vegetation cover in designated waterfowl nesting areas; temporary fences would be used initially. Fenced waterfowl nesting areas would be grazed by cattle approximately every 3-7 years to remove dead vegetation and stimulate new growth.

  Grazing units: Big Flat 1, Big Flat 2, Big Flat 3 (Table 2-1).

- Permanent or temporary fences would be used to reduce grazing pressure in aspen stands.

Densities of livestock, turn-out dates, and duration of use would be determined based on specific objectives of the treatment, environmental conditions, and available forage. Intensive fencing (including temporary fences) or intensive riding would be required when upland areas are being targeted for grazing, and use of riparian areas would be undesirable.

Noxious Weed Management. An Integrated Pest Management (IPM) approach would be used to manage white top, Canada thistle, and Mediterranean sage. IPM would make use of mechanical methods, biological controls, herbicides, and prescribed burning. Emphasis would be placed on implementing the least toxic technique. Mechanical controls would involve mowing or removing flowering heads prior to seed development. Livestock grazing would be used as a biological control, as recommended by Krueger and Buckhouse (1993). Other biological controls presently exist for Canada thistle and Mediterranean sage, but not for white top. Prescribed burning may require reseeding of certified weed-free seeds of native vegetation. Herbicides labeled for Canada thistle include 2,4-D, Banvel (dichlorophenoxyacetic acid), or Stinger (clopyralid). Herbicides labeled for white top include 2,4-D, Telar (chlorsulfuron), and Escort (metasulfuron). Herbicides would be used in accordance with EPA regulations and Service Integrated Pest Management Policy to mitigate adverse impacts. One option for minimizing adverse impacts would be to use a wiping or wicking device for applying herbicides.

Other Wetland Management Practices. Willows would be planted along sections of streams formerly occupied by willows, but only in cases where recolonization is not taking place. Check dams and juniper revetments would be used in areas where stream channels are entrenched and not showing significant improvement in recovery. These procedures would be conducted to enhance the trapping of sediment, promote growth of hydric vegetation, and restore channel structure. Water would be impounded at Shirk Ranch to create waterfowl foraging and brood-rearing habitat. Jacob's Reservoir would be managed so that a minimum pool of 15 acres would be maintained.

Shirk Ranch Area. According to the Shirk Lake Wetland Development Environmental Assessment (USFWS 1991), Shirk Lake will be divided by two major dikes into three sections to increase waterfowl production in this area. Under this alternative, manipulation of water levels, prescribed burning, and haying would be the primary means of managing vegetation. Prescribed burning and haying would periodically be used to rejuvenate nesting cover for waterfowl and other migratory birds, and create feeding areas for cranes, geese, and ducks during the breeding season.

Wetland Habitat Monitoring. A riparian habitat evaluation would be completed every 10-15 years to track shape of stream channel characteristics and distribution of riparian vegetation communities throughout all watersheds of the Refuge. Intensive sampling of riparian areas at permanent monitoring plots would be completed once every 10-15 years; sampling would include a description of plant community distribution and stream morphology. Vegetation monitoring associated with livestock grazing would be intensive to determine utilization and trend. Information collected during monitoring would be used to periodically review management strategies. It would provide a basis to adjust management programs where necessary to ensure that core problems are effectively being resolved and that management is directed at reaching long-range objectives.

2. WILDLIFE POPULATION MANAGEMENT

Big game populations would be managed to maximize hunting opportunities on Hart Mountain NAR. Wildlife populations, in general, would be managed through managing upland and wetland habitat. The extent to which other management actions would be used in managing specific wildlife species are described below. Wildlife monitoring is discussed at the beginning of Chapter 2, Section Two.

Hunting. Hunting may be used to manage populations of pronghorn, mule deer and bighorn sheep when necessary. It would primarily be offered as a recreation opportunity (refer to the Public Use section).

Transplanting. ODFW would continue to capture bighorn sheep from the Refuge and transplant them to other locations. Approximately 20-60 animals would be transplanted each year, based on current and projected populations.

Reintroductions. No reintroductions would be planned.

Predator Control. A limited to moderately-intensive program would be initiated to control predators, primarily coyotes and common ravens. The purpose of this effort would be to enhance nesting success of sage grouse and other ground nesting birds, and fawn survival of pronghorn and mule deer.

Feral Horses. As under baseline management, a population of 50 - 75 feral horses would be managed within a 60,000 acre area in the east-central portion of the Refuge as prescribed by the Hart Mountain National Antelope Refuge Horse Management Plan Environmental Assessment (USFWS 1979). Periodic population reductions would take place, in the form of gathering and selling, as numbers increase above 100 animals. Capturing of horses would take place as outlined in the Horse Management EA.

3. PUBLIC USE MANAGEMENT

The emphasis of this alternative is to provide the maximum number of recreation opportunities while not substantially detracting from the rugged, remote and undeveloped character of the Refuge. Some of these qualities may be reduced in some areas due to increased facility development. Campgrounds and facilities would be developed and regulated to better accommodate visitors, and to reduce habitat degradation.

Recreation Settings. Approximately 26 percent of the Refuge would be maintained in a Semi-primitive Non-motorized setting, 63 percent in a Semi-primitive Motorized setting, and 11 percent in a Roaded Natural setting (Map 2-7). This alternative would have the largest amount of Semi-primitive Motorized areas.

Camping. Camp sites would be developed and clearly marked at the Hot Springs and Guano Creek campgrounds. Parking areas would be provided for each camp site, and parking areas would be provided for walk-in camping. Approximately 35-50 camping parties could be accommodated at the Hot Springs Campground under this alternative. The Hot Springs bathhouse would be redesigned to blend in with the surrounding environment. Camping at Guano Creek Campground would be permitted only during the hunting season (1 August - 1 November). Approximately 10-15 camping parties would continue to be accommodated at the Guano Creek Campground.

Dispersed camping areas would be developed at the western end of Flook Meadow, Stockade Creek area, and possibly one other undetermined site, pending inventories and assessments by appropriate specialists. Two other camping areas would be developed for horseback riders, one to be located at the southern end of Lyon's Meadow and the other on Post Meadows. Existing corrals would be available at these areas. Five to 10 camping sites would be available at each area. Camping within 100 yards of Black Canyon Road and the road between Post Meadows and Big Flat would be made available, and backcountry tent camping under a permit system would be maintained.

Compared to the Baseline Management Alternative, more camping opportunities would be available for drive-up tent camping, walk-in tent camping, and recreational vehicle camping. This alternative would provide the largest number of camping opportunities.

Roads. Road access and maintenance would remain as currently managed except that there would be fewer permanent road closures on the Refuge (Map 2-4 and 2-7) and that the main roads would be reshaped and graveled. Blue Sky Road and South Boundary Road would remain open year-round, weather permitting. Spur roads coming off of these roads would be open from the last weekend in May to 1 December. North Mountain Road, Barnhardi Road and Skyline Drive also would be open seasonally from 1 August to 1 December. There would be approximately 363 miles of open and seasonal roads on the Refuge.

Natural Resource Interpretation. The visitor room would remain open all year. Existing interpretive signs would be maintained, and additional interpretive signs would be positioned at significant natural and historic features; attempts would be made to maintain the undeveloped character of the Refuge. Additional brochures and information sheets would be developed.

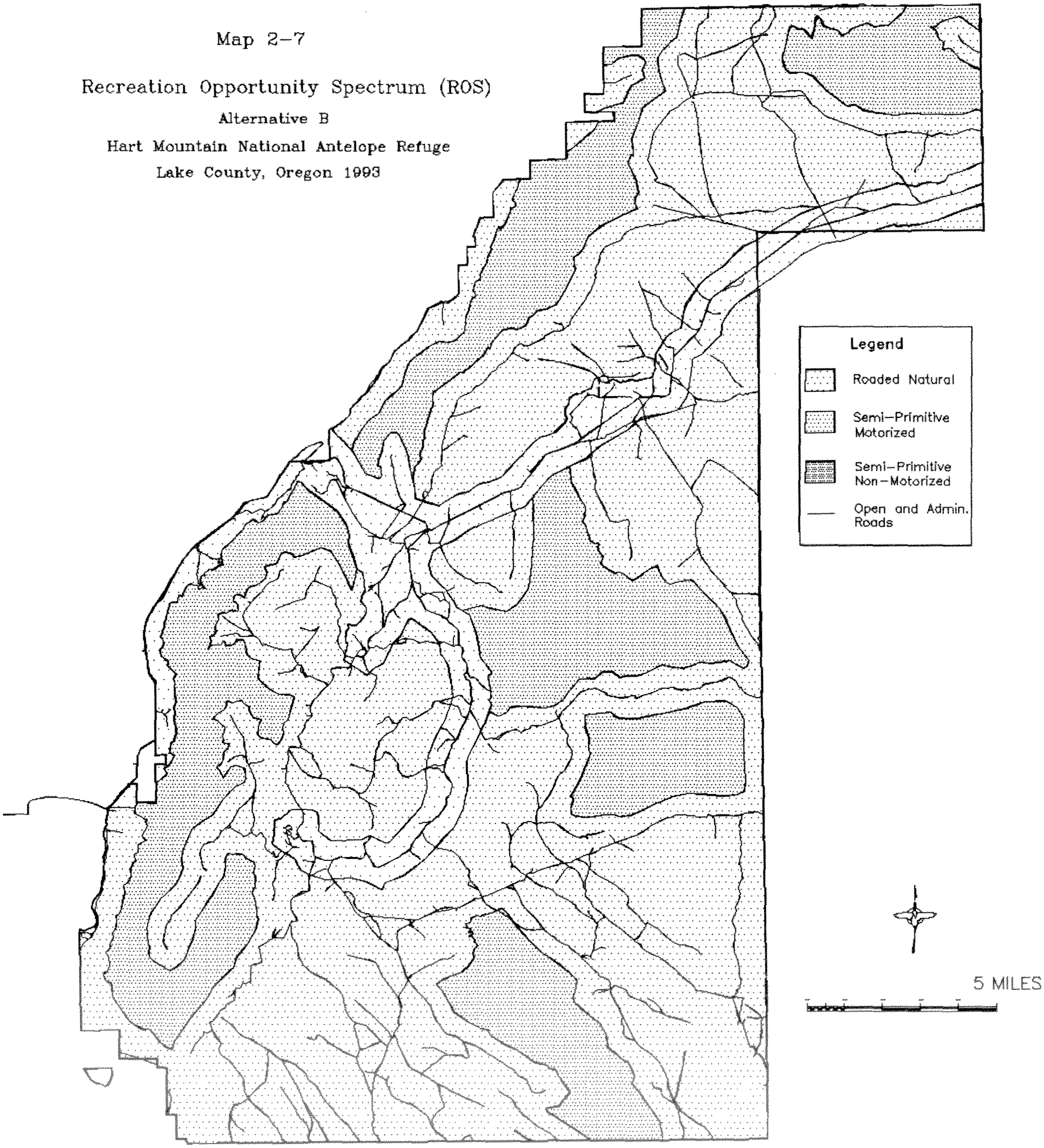
Map 2-7

Recreation Opportunity Spectrum (ROS)

Alternative B

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993



Hiking and Horseback Riding. Hiking trails would be designated along Bond and Stockade Creeks, and in DeGarmo Canyon as funding permits. Trail heads and small parking areas would be developed at each site. Several hiking areas would be described in brochures, as would the hiking trails. Horseback riding would be permitted throughout the Refuge except on the Stockade Creek and DeGarmo hiking trails.

Hunting and Fishing. The hunting program would be coordinated with ODFW to increase hunting opportunities on the Refuge. Tag numbers would increase from the present level. The number of tags issued would be determined based on wildlife populations and trends, in cooperation with ODFW. Fishing would continue as under baseline management. Fishing opportunities would exist for Rock and Guano Creeks, although closures may occur due to drought conditions. Guano Creek may be stocked to supplement fish stocks.

4. SPECIAL AREAS MANAGEMENT

The Poker Jim Ridge Research Natural Area (640 acres) (Map 2-8) would continue to be managed as directed by the National Wildlife Refuge Administration Act and 8 RM 10 of the Refuge Manual. The Poker Jim Ridge recommended Wilderness (20,390 acres) is pending Congressional action. No additional proposals for Research Natural Areas or Wilderness study areas are identified under this alternative.

5. FUNDING / PERSONNEL

Table 2-4 provides an estimate of the costs to implement Alternative B for the 15-year planning horizon. In years of limited funding, budgetary priority of on-the-ground management would be given to the livestock grazing program, long-term wildlife surveys, and habitat monitoring associated with management activities (e.g., livestock grazing).

Staffing required to implement Alternative B are presented below. Approximately one-third of the Sheldon-Hart Mountain Refuge Complex staffs' duties are directed toward Hart Mountain NAR.

Complex Staff	Refuge Staff
Project Leader	Refuge Manager
Assistant Project Leader	2 Engineering Equipment Operator
Administrative Support Assistant	Wildlife Biologist
Purchasing Officer	2 Firefighters (seasonal)
Office Automation Specialist	Biological Technician (seasonal)
Fire Management Officer	Recreation Aid (seasonal)
Complex Biologist	Range Aid (seasonal)
Range Conservationist	

Map 2-8

Potential WSAs, RNAs, and Recommended Wilderness

Alternative B

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993

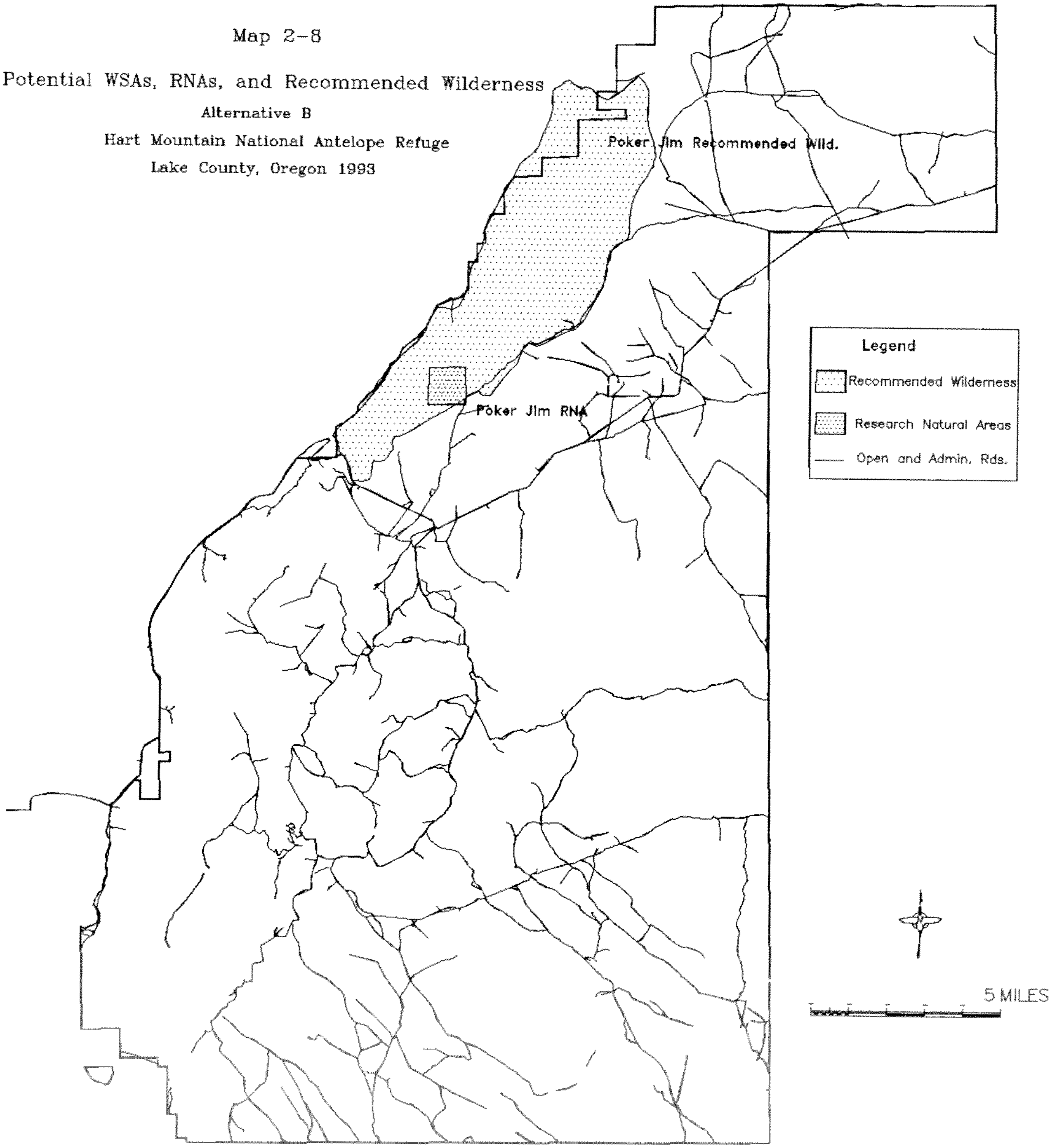


TABLE 2-4. ESTIMATED COST TO IMPLEMENT ALTERNATIVE B

Annual Salaries:	$311,050
Annual Operation and Maintenance	
Administrative Support	35,521
Facility Maintenance	5,900
Vehicle and Equipment Maintenance	35,211
Resource Maintenance	22,407
Supplies and Material	55,307
Contract Services	13,124
TOTAL	167,470

Facility Capital	One Time Capital/ Expenditures	Annual Operation and Maintenance
Pronghorn Research	50,000	
Rehabilitate Visitor Room	50,000	
Redband Trout Research	10,000	
Sage Grouse Research		40,000
Construct Bunkhouse	300,000	5,000
Construct Storage Building	115,000	1,000
Reconstruct Public Use Facilities	225,000	2,000
Juniper Control	25,000	
Headquarters Rehabilitation	18,000	3,000
Stabilize Deteriorating Historic Structures	25,000	
Gravel Refuge Roads	845,000	
Clean Out Waterholes	30,000	2,000
Rehabilitate and Replace Interior Fences	195,000	11,000
Rehabilitate and Replace Boundary Fences	99,000	8,000
Replace TD-20 Dozer	130,000	
Replace Dikes and Water Control Structures/Shirk	175,000	4,000
Realign Headquarters Road	200,000	
Replace Dump Truck	80,000	
Replace Front-End Loader	95,000	
Replace Flat-Bed Truck	75,000	
Replace Tilt-Bed Trailer	15,000	
Overhaul Generators	12,000	
Prescribed Burning		16,300
Herbicide Treatment	220,000	
TOTAL	2,989,000	92,300

ALTERNATIVE C - HABITAT RESTORATION

This alternative emphasizes habitat restoration while providing forage for livestock. It is based on the premise that (1) natural fire historically was the dominant disturbance factor that maintained a mosaic of succession stages in northern Great Basin upland habitats, and (2) herbivores played a minor role in influencing these habitats prior to introduction of domestic livestock. However, it maintains that a limited amount of forage can periodically be made available for livestock without significant ecological impacts if several preconditions are met prior to permitting livestock grazing, and several guidelines are followed during the grazing period.

This alternative emphasizes the use of prescribed burning as the primary means of restoring and maintaining upland habitats. Mechanical treatments or herbicides would be used to reduce shrub cover in areas where prescribed burning would not be feasible. Minimizing impacts from livestock would be the primary means of restoring riparian areas. Structural devices would be used to speed recovery in some areas, and prescribed burning would be used to restore aspen stands.

Recreational use associated with the uniqueness of the area would be emphasized. Camping would be available at the Hot Springs Campground, at several dispersed sites, and in the backcountry. Camp sites at campgrounds would be improved to mitigate impacts. Hunting opportunities would continue as under baseline management, with limited, quality hunts being emphasized. Road management would be as currently managed, except that additional duplicate roads and roads with excessive erosion would be closed. Use of roads on North and South Hart Mountain by Refuge staff would be restricted to once per year or less (except access to the radio-repeater).

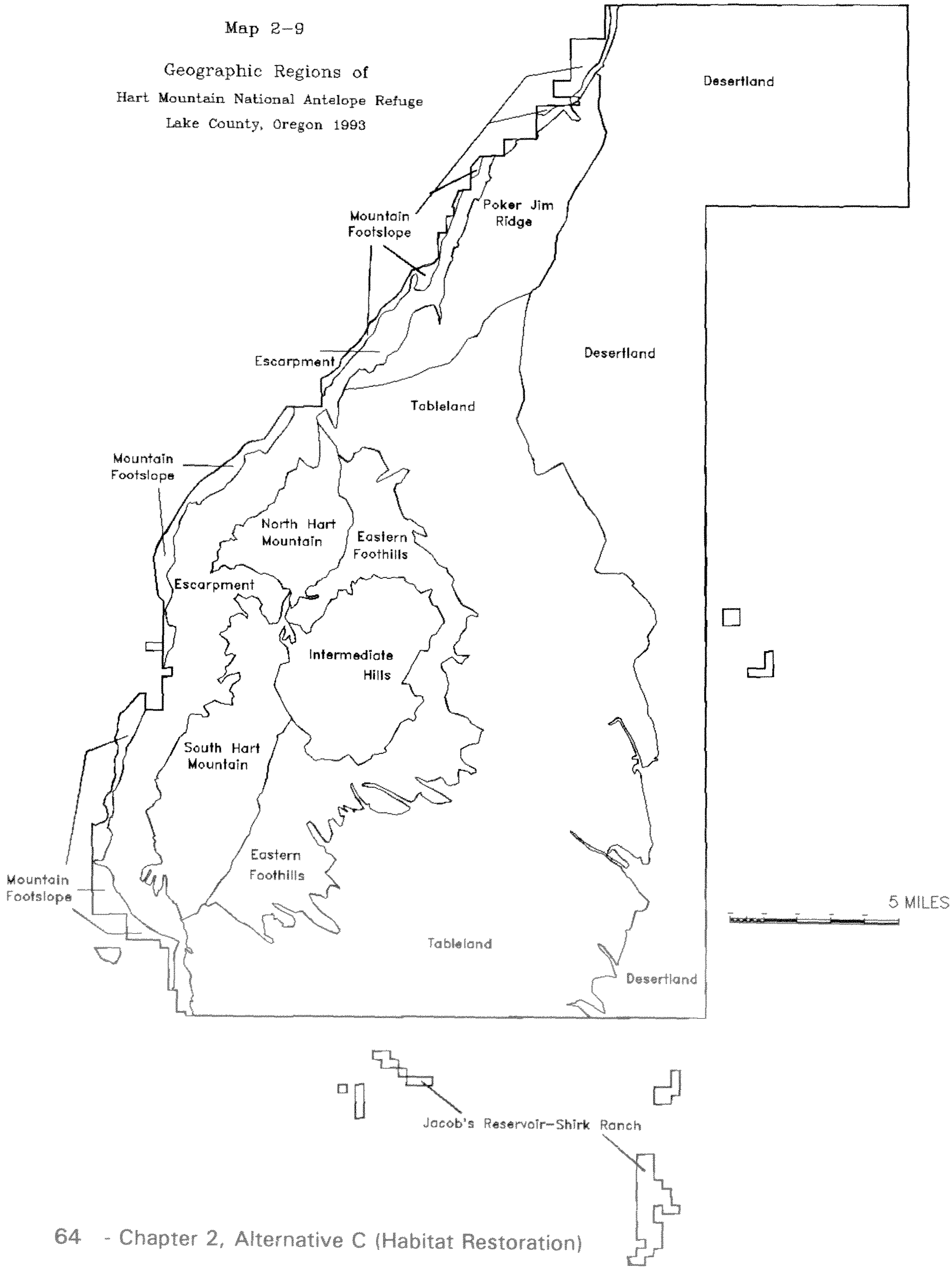
1. HABITAT MANAGEMENT

MANAGEMENT AREA DELINEATION

The Refuge would be divided into ten management areas based on geographic regions (Map 2-9). Delineation of units primarily was based on geomorphology, soils, hydrology, and vegetative site potential. Existing grazing units would be used in the livestock grazing program (Map 2-1), though they may be modified to improve control over livestock distribution.

UPLAND HABITAT MANAGEMENT

The Refuge would establish a target of eliminating or substantially reducing woody-vegetation cover on 11,000 to 16,000 acres of upland habitats during the next 15 years (Table 2-2). At this treatment level over the long-term, up to half of the Refuge upland habitat could be restored and maintained. Prescribed burning and mechanical treatments would be employed to reach this target.


Map 2-9
Geographic Regions of
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
Desertland
Poker Jim Ridge
Mountain Footslope
Escarpment
Desertland
Tableland
Mountain Footslope
North Hart Mountain
Eastern Foothills
Escarpment
Intermediate Hills
South Hart Mountain
Eastern Foothills
Mountain Footslope
5 MILES
Tableland
Desertland
Jacob's Reservoir-Shirk Ranch

Treatments would be planned to obtain a 50:50 interspersion of burned to unburned patches in most vegetation types. In areas where cheatgrass invasion is a potential, treatments would be prescribed to reduce the extent of invasion.

Of total acres treated during the next 15 years, the approximate distribution among upland vegetation types would be 15-25 percent for Wyoming big sagebrush, 25-40 percent for low sagebrush, 40-50 percent for mountain big sagebrush, less than 5 percent for mountain big sagebrush-bitterbrush, 1 percent for wheatgrass and less than 1 percent for pine (underburning).

Fire. Prescribed burning would be the primary means of periodically eliminating or reducing shrub cover (at least 75 percent of the total acreage to be treated). Emphasis would be placed on burning mountain big sagebrush, higher elevation low sagebrush and areas invaded by juniper. Juniper may or may not be cut prior to burning.

Firing technique and timing would be prescribed to mitigate smoke impacts, including 1) burning late in the day during the period of greatest atmospheric instability, 2) burning during low fuel moisture, and 3) burning during southerly and southwesterly transport winds. This would avoid smoke intrusions in Plush and avoid smoke impacts to Class I airsheds. Direct impacts to wildlife would be mitigated by not burning during the breeding season of most species. Indirect impacts would be mitigated by burning in a patchy mosaic and minimizing adverse impacts to soil. To mitigate impacts to sage grouse, prescribed burns would be carried out in a way that would ensure continued existence of sage grouse nesting habitat in areas adjacent to burns. Additionally, areas around sage grouse leks would be avoided. Prescribed burns would be executed during February-April or September-November.

Inholdings and historic structures would be given protection during prescribed burning. All naturally ignited fires that fall under a prescribed fire plan would be treated as a prescribed natural fire. Adequate fire management personnel and equipment would be available to obtain desired objectives. All other naturally ignited fires and fires accidentally started by people would be suppressed.

Mechanical and Herbicide Treatment. Mechanical methods, including railing, chaining, and roto-beating, would be used to treat a large portion of Wyoming big sagebrush on tableland areas. Low sagebrush would be treated mechanically where possible. Use of equipment, such as the Schmeiser Till an' Pak® pulled by a tractor, would result in the death of sagebrush with the least amount of disturbance to soil. Other mitigation measures to mitigate adverse impacts to soils include avoiding areas with slopes over 15 percent and treating vegetation during the winter (when soils are frozen) when soils are least vulnerable to disturbance from churning and compression. Winter treatments would mitigate adverse impacts to wildlife by avoiding the breeding season. Another mitigation relative to wildlife is that large blocks would not be treated, and treatment patterns would be mosaics in nature. Mechanical treatments would only be applied on a small scale initially to test effectiveness and allow further evaluations of environmental impacts.

In association with the prescribed burning program, juniper that have invaded sagebrush and bitterbrush cover types may be cut using chainsaws prior to prescribed burning of the area. Herbicides would not be used under this alternative.

Livestock Grazing. Under this alternative, livestock grazing may be used to manipulate vegetation quality and structure. However, the primary focus of the livestock grazing program would be to provide a limited amount of forage for cattle when it would not have significant ecological impacts. The Service would impose the following constraints to govern livestock grazing under this alternative.

- No more than 2,500 AUMs would be permitted during any given year.

- Livestock grazing would be permitted on the Refuge no more than 1 out of every 3 years (the entire Refuge would be rested from livestock grazing for at least two years following each year of grazing).

- Riparian habitat in a grazing unit must be at least in moderate ecological condition prior to that unit being grazed by livestock.

- The five-year running mean of crop-year precipitation must be greater than the 30-year average before livestock could be grazed on the Refuge.

- Sufficient Refuge staff must be available to intensively monitor cattle distribution and forage utilization levels prior to grazing any livestock on the Refuge.

- Livestock would be removed from the area being grazed prior to 30 percent utilization of herbaceous vegetation along any stream corridor, any other part of a meadow, or in adjacent uplands.

- Duration of livestock grazing in any grazing unit would not exceed 30 days.

- Livestock grazing would not occur on the Refuge during the period 1 June - 1 August.

- Livestock would not be permitted in grazing units for at least three years of above average precipitation following fires within the grazing unit.

Temporary fences or riders, and additional permanent fences would be used in some areas to ensure that maximum utilization levels are not exceeded, and to ensure protection of sensitive areas. Livestock would be excluded from all aspen stands. Compliance with these constraints would be intensively monitored. As part of this program, several exclosures would be constructed within each area receiving treatment by livestock. Exclosures would be used to track changes in habitat condition inside and outside exclosures.

Approximately 80 percent of the Refuge would be unavailable to livestock grazing (Map 2-10). The following grazing units would be non-use areas ([A's] identify those that are designated as non-use areas in Alternatives A and B, [B's] identify those that were added to Alternative B). Livestock grazing would not be permitted in these areas.

East Rock Creek
West Rock Creek
Medicine Buttes
North Poker Jim
Flook Ranch[B]
Blizzard Ridge
Lyons Meadow[B]
Fitzgerald Lake
Desert Lake
Wire Corral Flat[B]
Deming Exclosure[A]
Spanish Lake
Lower Guano Creek
North Mountain
South Mountain[B]
Buck Pasture Exclosure[A]
Eagle Peak[B]
Robinson Draw[A]
Hot Springs Camp[A]
Crater[B]
Stone Corral[B]
Stein[A]
Lost Hills[B]
CCC Camp[B]
Hart Lake[B]
Narrows[A]
Crump Lake[A]
Shirk Ranch[B]

In addition, the ponderosa pine stand at Blue Sky would be fenced to exclude cattle from using the stand. The boundary fence and interior fences being used in this alternative would be maintained. Fences not used in the livestock grazing program in this alternative would not be maintained. Efforts would begin during this planning period to remove livestock grazing facilities (fences, cattleguards, etc.) associated with the grazing units listed below. These units are not expected to be used in the foreseeable future (following the 15-year planning period) due to their (1) relatively low ecological status, (2) conflicts with wildlife, and/or (3) relatively low value as livestock grazing range.

East Rock Creek
West Rock Creek
Medicine Buttes
North Poker Jim
Flook Ranch
Blizzard Ridge
Fitzgerald Lake
Lower Guano Creek
North Mountain
South Mountain

Others to be evaluated include Desert Lake, Spanish Lake, Stone Corral, Stein, Lost Hills, CCC Camp, Hart Lake, Narrows, and Crump units (Map 2-1).

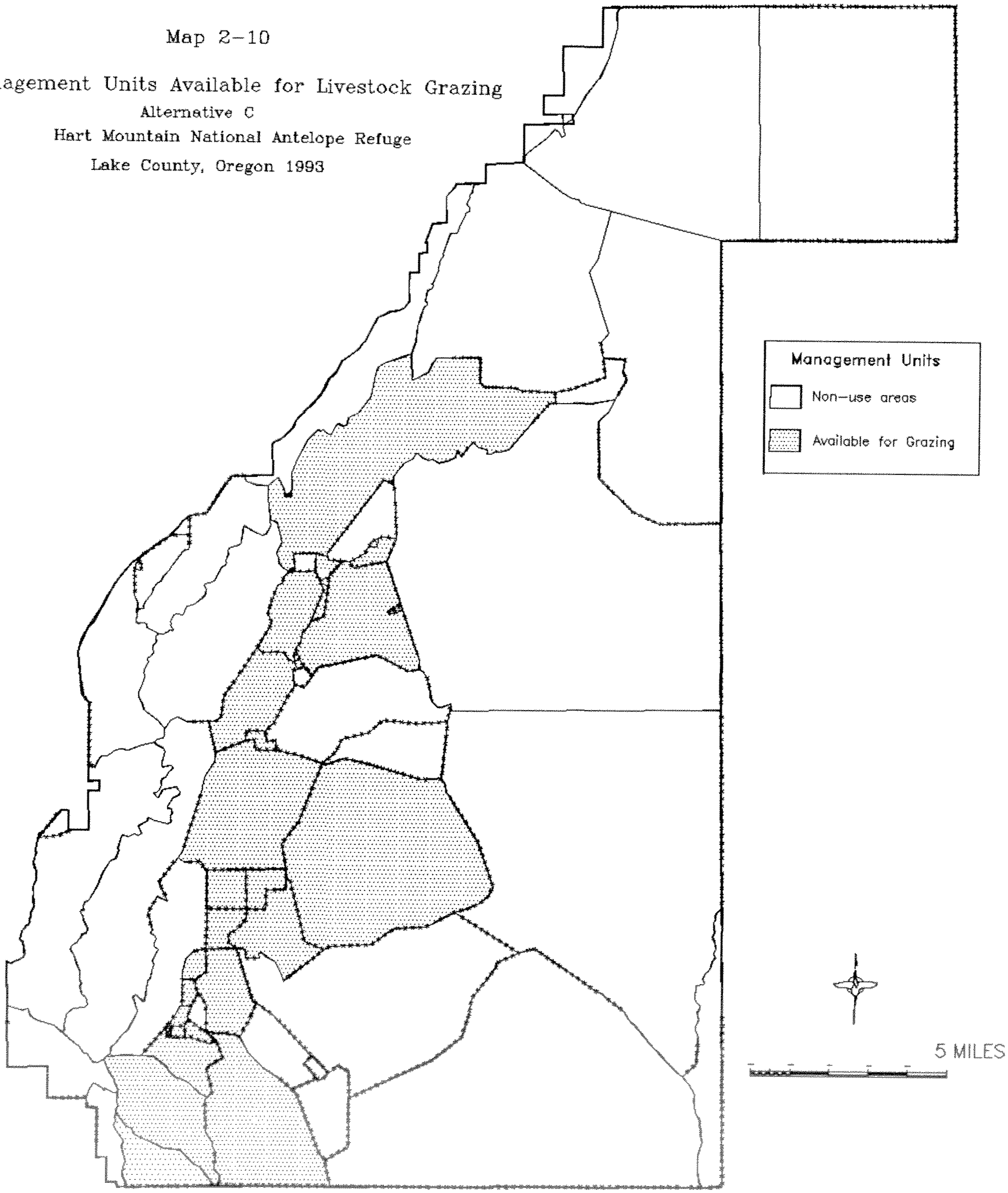
Map 2-10

Management Units Available for Livestock Grazing

Alternative C

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993



Seedings and Plantings. Bitterbrush would be planted in several previously burned areas where bitterbrush is not reestablishing or where recruitment is low. Seeding of native grasses and forbs, using certified weed-free seeds, would be implemented after shrub removal where native grasses and forbs are insufficient. Seeding of native grasses and forbs following wildfires may be implemented if warranted and feasible. Sources of seed, collection procedures, storage and planting methods would be developed and analyzed.

Noxious Weed Management. Refer to the Noxious Weed Management section under Wetland Habitat Management.

Water Management. This alternative would emphasize restoration and maintenance of natural sources of water (streams, springs, wetlands, etc.; refer to the Wetland Habitat Management section), along with maintenance of existing waterholes in lakebeds. Existing lakebed waterholes would be maintained on a 5-15 year cycle. Water impoundments located in drainages would be evaluated regarding their ecological impacts, and removed if negative impacts outweigh benefits. The four existing guzzlers would be maintained, and additional guzzlers may be constructed based on a needs assessment. No new waterholes are planned.

Upland Habitat Monitoring. An extensive approach would be taken to monitor vegetation response to prescribed burning and wildfires. The effort would be minimal to moderate where response is known, and intensive where predictability of response is low. Experimental areas treated mechanically or with herbicides would be monitored intensively. Vegetation monitoring associated with livestock grazing would be intensive to track utilization and distribution of cattle. Existing, permanent vegetation plots would be read every 10 years to assess habitat condition trend. Additional permanent plots would be established to increase the sample size. Information collected during monitoring would be used to periodically review management strategies. It would provide a basis to adjust management programs where necessary to ensure that core problems are effectively being resolved and that management is directed at reaching long-range objectives.

WETLAND HABITAT MANAGEMENT

Minimizing impacts from livestock would be the primary means of restoring riparian areas. Structural devices would be used to speed recovery in some areas, and prescribed burning would be used to restore aspen stands.

Fire. Of the total number of acres that would be burned through prescription under this alternative, approximately 10 percent would be in riparian areas (Table 2-2). During this planning period, a number of aspen stands would be burned by prescription to enhance restoration. Following recovery, the primary emphasis of the fire program would be to burn riparian areas at the same frequency as adjacent uplands. Meadows would be burned periodically to improve productivity and change vegetation structure for the benefit of some wildlife species. Other uses of prescribed burning would be to reduce shrub and tree cover in meadows invaded by sagebrush, rabbitbrush, and western juniper.

All naturally ignited fires that fall under a prescribed fire plan would be treated as a prescribed natural fire. All other naturally ignited fires and fires accidentally started by people would be suppressed.

Mechanical Treatment. In association with the prescribed burning program, junipers that have invaded aspen stands and areas adjacent to springs may be cut prior to burned. Haying would not be used under this alternative.

Livestock Grazing. Restoration of streams through minimizing impacts by livestock would be the emphasis of the riparian area recovery program. This would be accomplished primarily through (1) limiting use of livestock to less than once out of every three years, (2) excluding livestock from sensitive riparian areas and those in less than moderate ecological condition, (3) removing cattle before 30 percent utilization of stream-side herbaceous vegetation is reached, and (4) strictly controlling season and duration of use. Additional constraints are outlined in the Upland Habitat section.

The livestock grazing program would primarily focus on providing forage for cattle, with the recognition that at times it may be used to reach specific wildlife habitat objectives. Livestock grazing would not occur on Shirk Ranch.

Noxious Weed Management. An Integrated Pest Management approach, making use of mechanical methods, biological controls, and prescribed burning would be used to manage white top, Canada thistle, and Mediterranean sage. Emphasis would be placed on implementing the least toxic technique. Mechanical controls would involve mowing or removing flowering heads prior to seed development. Biological controls presently exist for Canada thistle and Mediterranean sage, but not for white top. Prescribed burning may require reseeding of native vegetation. Herbicides would not be used for noxious weed management under this alternative.

Other Wetland Management Practices. Willows would be planted along sections of streams formerly occupied by willows, but only on sites where recolonization is not taking place. Check dams would be constructed in areas where degradation is severe and where natural restoration is not taking place or is occurring at a slow rate. These procedures would be carried out to enhance the trapping of sediment, promote growth of riparian vegetation, and restore channel structure. Jacob's Reservoir would be managed so that a minimum pool of 15 acres would be maintained.

Shirk Ranch Area. According to the Shirk Lake Wetland Development Environmental Assessment (USFWS 1991), Shirk Lake will be divided by two major dikes into three sections to increase waterfowl production in this area. Vegetation treatment was not covered under the 1991 EA. Under this alternative, manipulation of water levels and prescribed burning would be the primary means of managing vegetation. Prescribed burning would periodically be used to rejuvenate nesting cover (if necessary) for waterfowl and other migratory birds, and create feeding areas for cranes, geese, and ducks during the breeding season.

Wetland Habitat Monitoring. A riparian habitat evaluation would be completed every 10-15 years to track condition of stream channel morphology and vegetation conditions in riparian areas throughout all watersheds of the Refuge. Intensive sampling of riparian areas at existing set points would be completed once every 10-15 years at set stations; sampling would include a description of plant species composition, stream morphology and structural diversity, and would be conducted to track trends within sampling areas. Vegetation sampling associated with livestock grazing would be intensive to monitor utilization and trend. Information collected during monitoring would be used to periodically review management strategies. It would provide a basis to adjust management programs where necessary to ensure that core problems are effectively being resolved and that management is directed at reaching long-range objectives.

2. WILDLIFE POPULATION MANAGEMENT

Wildlife populations, with few exceptions, would be managed through managing upland and wetland habitat. The extent to which other management actions would be used in managing specific wildlife species are described below. Wildlife monitoring is discussed at the beginning of Chapter 2, Section Two.

Hunting. Hunting may be used to manage populations of pronghorn, mule deer, and bighorn sheep if necessary. It would primarily be offered as a recreation opportunity; refer to the Public Use section.

Transplanting. ODFW would continue to capture bighorn sheep from the Refuge and transplant them to other locations. Approximately 30-60 animals would be transplanted each year, based on current and projected populations.

Reintroductions. Sharp-tailed grouse may be reintroduced to the Refuge, based on an assessment of quality and amount of habitat on the Refuge. Sharp-tailed grouse formerly inhabited the Refuge, but since have been extirpated.

Predator Control. Predator control may be used if a wildlife species is shown to be at risk due to a high rate of predation, and other measures are not feasible or timely. Predator control would only be used as a temporary solution.

Feral Horses. Under this alternative, all feral horses would be removed from the Refuge, and horses that subsequently move on to the Refuge would be periodically removed. Service policy directs that feral horses will not be maintained on Hart Mountain NAR (USFWS 1982:7 RM 6.2). This alternative was presented in the Hart Mountain NAR Horse Management Plan Environmental Assessment (USFWS 1979), but it could not be selected because Regional Policy Update No. 13 precluded the selection of the alternative at that time. The environmental assessment (EA) concluded that this alternative would have allowed for the greatest amount of habitat recovery, would have eliminated [reduced] competition with wildlife for forage and water, and would have benefited Refuge goals and objectives. Capturing feral horses would take place as outlined in the Horse Management EA.

3. PUBLIC USE MANAGEMENT

The emphasis of this alternative is to provide quality wildlife/wildlands-oriented recreation opportunities that depend on the rugged, remote and undeveloped character of the Refuge. Therefore, campgrounds would only be developed and regulated to the extent necessary to reduce habitat degradation and wildlife disturbance.

Recreation Settings. Approximately 32 percent of the Refuge would be maintained in a Semi-primitive Non-motorized setting, 57 percent in a Semi-primitive Motorized setting, and 11 percent in a Roaded Natural setting (Map 2-11).

Camping. Individual camp sites would be identified and minimally developed at the Hot Springs Campground, and the Barry Spring and Flook Lake sites. Backcountry tent camping under a permit system would be maintained. Guano Creek Campground would be closed. Approximately 30-45 camping opportunities would be available at the Hot Springs Campground. Sites would be available for drive-up tent campers, walk-in tent campers, and recreational vehicles. For drive-up camping areas, signs would identify specific camp sites, and parking areas would be delineated for each site. Parking areas would be provided for walk-in campers. No camping would be permitted adjacent to the Hot Springs bathhouse, which would be redesigned to blend in with the surrounding environment.

Dispersed camping areas would be located north of Flook Lake and Barry Spring (just east of Blue Sky) pending inventories and assessments by appropriate specialists. One additional camping area would be developed for horseback

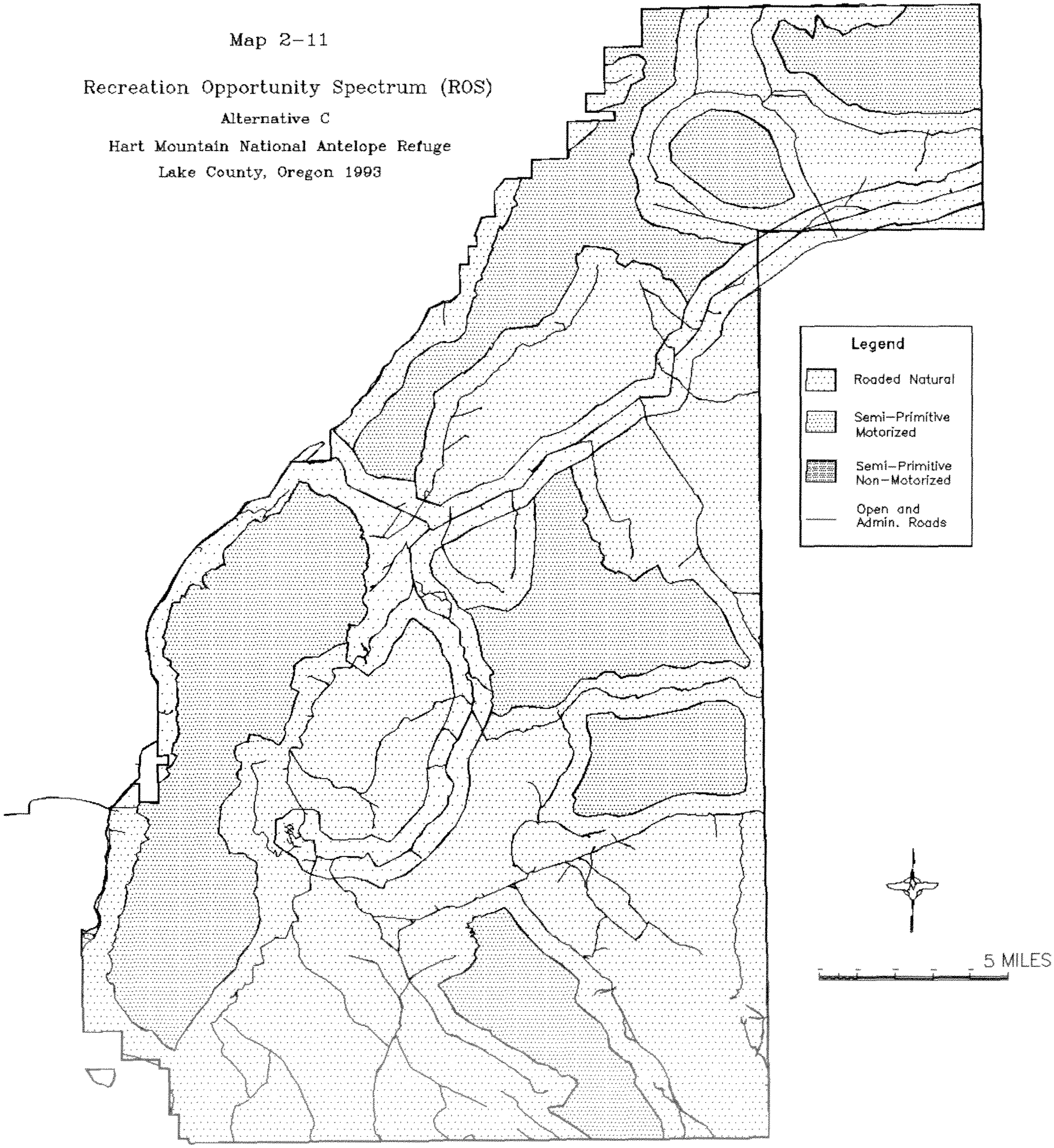
Map 2-11

Recreation Opportunity Spectrum (ROS)

Alternative C

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993



riders at Post Meadows. Existing corrals would be available at this area. Ten to twenty camping sites would be available at each area. Occupancy limits would be established for each campground. Increases in camping on the Refuge would be mitigated for by establishing a set number of camping areas and not allowing use to exceed this number. If use increases beyond the carrying capacity of the Refuge, then visitors will have to camp off of the Refuge. Additional new campgrounds will not be established.

Roads. In this alternative, road access would remain as under the Baseline Management alternative, except that several other roads would be closed (Map 2-4 and 2-11), and the Blue Sky Road and all spur roads would be closed until 15 June each year (versus 1 May). Roads would be closed up until 15 June to reduce disturbance to pronghorn does and fawns on fawning grounds during most of the fawning period (1 May - 1 July). Use of roads by Refuge personnel on North and South Hart Mountain would be restricted to once per year or less (except access to the radio-repeater). Other roads may be evaluated during the 15-year planning horizon to assess their impacts on wildlife and extent of soil erosion. There would be approximately 202 miles of open and seasonal roads, 127 miles of closed roads, and 34 miles of administrative roads on the Refuge. In addition, the main roads would be reshaped and graveled.

Natural Resource Interpretation. The visitor room would remain open all year. Existing interpretive signs would be maintained, and a small number of additional signs may be erected; emphasis would be on maintaining the undeveloped character of the Refuge.

Hiking and Horseback Riding. Hiking and horseback riding would be permitted, but trails would not be developed. Horse use would be restricted to open roads only. Several hiking areas would be described in brochures, and parking areas may be developed at these sites. Hiking areas described in brochures would include DeGarmo Canyon and Stockade Creek.

Hunting and Fishing. Hunting would continue as under baseline management with limited, quality hunts being emphasized. The number of tags issued would be determined based on wildlife populations and trends, in cooperation with ODFW. Fishing would continue as under baseline management. Fishing opportunities would exist for Rock Creek, Guano Creek and Warner Ponds, although closures may occur due to drought conditions. Fishing opportunities would remain limited.

4. SPECIAL AREAS MANAGEMENT

The Poker Jim Ridge RNA (640 acres) would continue to be managed according to National Wildlife Refuge Administration Act and the Refuge Manual (8 RM 10). Three areas would be recommended for study: (1) Warner Creek watershed to meet Oregon Natural Heritage Plan cell needs for big sagebrush and mountain mahogany communities (3,089 acres), (2) Cooper Canyon watershed to meet Oregon Natural Heritage Plan cell needs for high gradient, first-order streams in pristine condition (618 acres), and (3) the Water Canyon area within the Desert Lake watershed for pronghorn and low sagebrush (Desert Lake RNA- 7,569 acres) (Map 2-12, previous page).

The Poker Jim Ridge recommended Wilderness (20,390 acres) is pending action in Congress. Two additional areas would be recommended for further study to assess their wilderness potential: (1) the land encompassed by the Semi-primitive Non-motorized area on Hart Mountain (30,519 acres), and (2) the Semi-primitive Non-motorized area adjacent to the southern boundary of the Refuge (15,765 acres) (Map 2-12).

5. FUNDING / PERSONNEL

Table 2-5 provides an estimate of the costs to implement Alternative C for the 15-year planning horizon. In years of limited funding, budgetary priority for on-the-ground management would be given to the prescribed burning program, long-term wildlife surveys, and habitat monitoring associated with management activities (e.g., prescribed burning, livestock grazing).

Staffing required to implement Alternative C are presented below. Approximately one-third of the Sheldon-Hart Mountain Refuge Complex staffs' duties are directed toward Hart Mountain NAR.

Complex Staff	Refuge Staff
Project Leader	Refuge Manager
Assistant Project Leader	2 Engineering Equipment Operator
Administrative Support Assistant	Wildlife Biologist
Purchasing Officer	4 Firefighters (seasonal)
Office Automation Specialist	Biological Technician (seasonal)
Fire Management Officer	Recreation Aid (seasonal)
Complex Biologist	
Assistant Fire Management Officer	

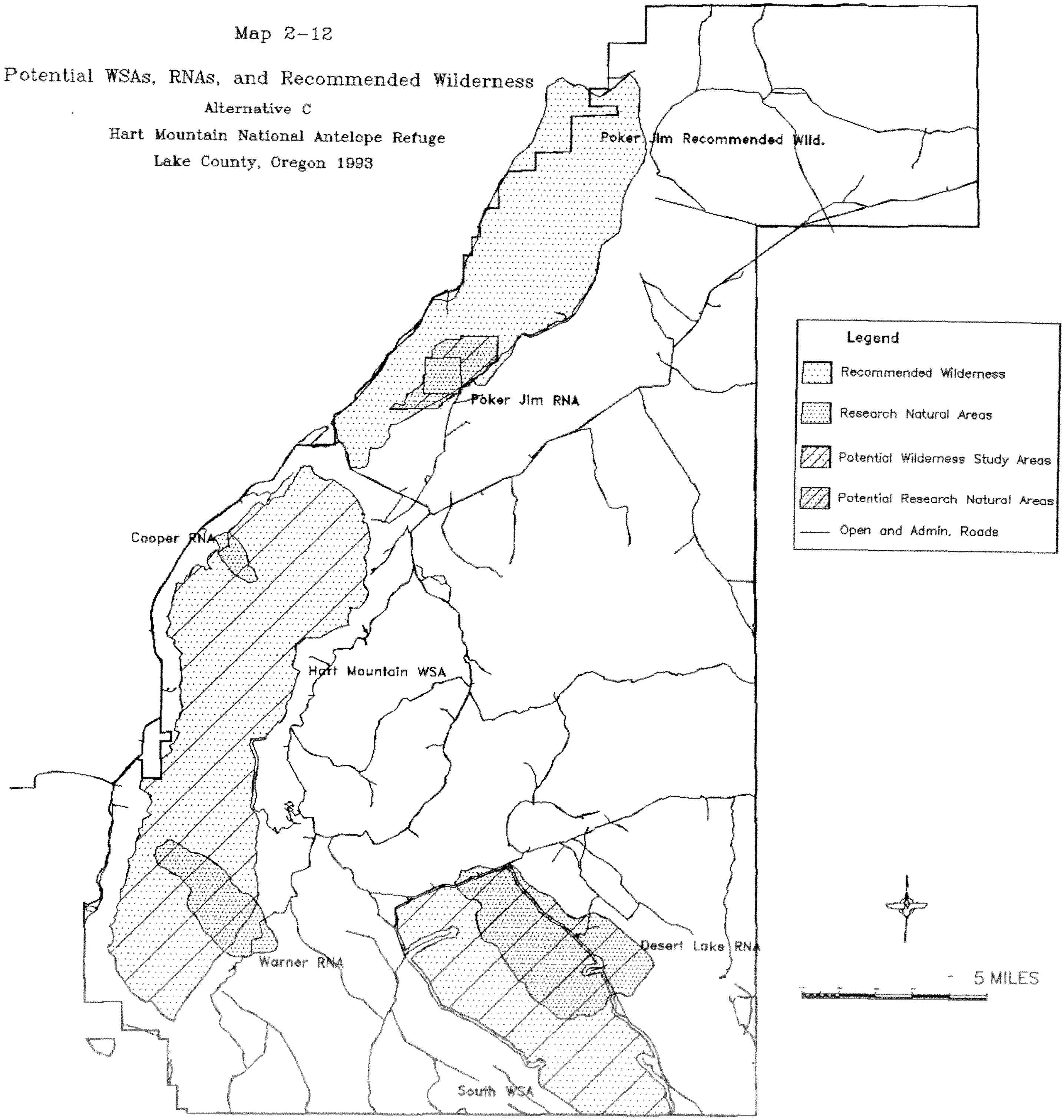

Map 2-12
Potential WSAs, RNAs, and Recommended Wilderness
Alternative C
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
Poker Jim Recommended Wild.
Poker Jim RNA
Cooper RNA
Hart Mountain WSA
Warner RNA
Desert Lake RNA
South WSA
Legend
Recommended Wilderness
Research Natural Areas
Potential Wilderness Study Areas
Potential Research Natural Areas
Open and Admin. Roads
5 MILES

TABLE 2-5. ESTIMATED COST TO IMPLEMENT ALTERNATIVE C

Annual Salaries:	$319,808
Annual Operation and Maintenance	
Administrative Support	32,620
Facility Maintenance	6,072
Vehicle and Equipment Maintenance	36,300
Resource Maintenance	23,100
Supplies and Material	57,018
Contract Services	13,530
TOTAL	168,640

Facility Capital	One Time Capital/ Expenditures	Annual Operation and Maintenance
Pronghorn Research	50,000	
Rehabilitate Visitor Room	50,000	
Redband Trout Research	10,000	
Sage Grouse Research		40,000
Construct Bunkhouse	300,000	5,000
Construct Storage Building	115,000	1,000
Reconstruct Public Use Facilities	225,000	2,000
Juniper Control	25,000	
Headquarters Rehabilitation	18,000	3,000
Stabilize Deteriorating Historic Structures	25,000	
Gravel Refuge Roads	845,000	
Clean Out Waterholes	30,000	2,000
Rehabilitate and Replace Interior Fences	95,000	11,000
Rehabilitate and Replace Boundary Fences	99,000	8,000
Replace TD-20 Dozer	130,000	
Replace Dikes and Water Control Structures/Shirk	175,000	4,000
Realign Headquarters Road	200,000	
Replace Dump Truck	80,000	
Replace Front-End Loader	95,000	
Replace Flat-Bed Truck	75,000	
Replace Tilt-Bed Trailer	15,000	
Overhaul Generators	12,000	
Prescribed Burning		29,800
Mechanical Treatment	300,000	
TOTAL	2,969,000	105,800

ALTERNATIVE D - NATIVE COMMUNITY RESTORATION

This is the preferred alternative. It would focus management on restoring habitats and ecosystem processes as the primary means of maintaining viable populations of all native wildlife species on the Refuge. This alternative is based on the following premises: (1) natural fire historically was the dominant disturbance factor that maintained a mosaic of successional stages in northern Great Basin upland habitats, (2) herbivores played a minor role in influencing these habitats prior to introduction of domestic livestock, (3) any use by livestock would slow habitat recovery, and (4) native wildlife communities depend on habitat conditions created by native processes. Livestock would not be used as a management option during this planning period on Hart Mountain NAR. It would however, be revaluated after 15 years.

This alternative emphasizes the use of prescribed burning as the primary means of restoring and maintaining upland habitats, and passive restoration for rehabilitating riparian areas. Mechanical and herbicide treatments may be used on an experimental basis to determine the most effective means of reducing shrub cover in areas where prescribed burning would not be feasible. Once these areas are restored and contain sufficient native grass cover to support a fire, prescribed burning would be used to maintain them.

Recreational use associated with the uniqueness of the area would be emphasized. Backcountry camping would continue under a permit system. Camping also would be available at the Hot Springs Campground, and at several dispersed sites. Camp sites at campgrounds would be improved. Hunting opportunities would continue as under baseline management, with limited, quality hunts being emphasized. Redundant roads, short spur roads, roads travelling through sensitive riparian areas, and roads causing excessive erosion would be rerouted or closed. Use of roads on North and South Hart Mountain by Refuge personnel would be restricted to prescribed burning activities and maintenance of the radio-repeater.

1. HABITAT MANAGEMENT

MANAGEMENT AREA DELINEATION

The Refuge would be divided into ten management areas based on geographic regions (Map 2-9). Delineation of units primarily was based on geomorphology, soils, hydrology, and vegetative site potential.

UPLAND HABITAT MANAGEMENT

The Refuge would establish a target of substantially reducing woody-vegetation on 22,000 to 40,000 acres of upland habitat during the next 15 years (Table 2-2). At this treatment level over the long-term, up to three-quarters of the

Refuge upland habitat could be restored and maintained. An integrated approach would make use of prescribed burning, mechanical treatments, and herbicides to reach this target. Primary emphasis would be placed on prescribed burning. Treatments would be planned to obtain a 50:50 interspersion of treated to untreated patches. In areas where cheatgrass invasion is a potential, treatments would be prescribed to reduce the extent of invasion.

Fire. Prescribed burning would be the primary means of periodically reducing shrub cover (at least 90 percent of the total acreage treated) to mimic historic burns. Initial emphasis would be placed on burning mountain big sagebrush, higher elevation low sagebrush, and areas invaded by juniper. Juniper would be cut and/or burned. Increasing emphasis would be placed on treating Wyoming big sagebrush and tableland low sagebrush as the 15-year planning horizon progresses. Prescribed burning would be used in Wyoming big sagebrush and low sagebrush (below 5,600 feet elevation) in areas where sufficient fine fuels are available. Mechanical treatments or possibly herbicides treatments would be used to reduce shrub cover if prescribed burning would not be feasible.

Of total acres treated during the next 15 years, the approximate distribution among vegetation types would be 20-40 percent for Wyoming big sagebrush, 30-50 percent for low sagebrush, 15-20 percent for mountain big sagebrush, less than 5 percent for mountain big sagebrush-bitterbrush, less than 5 percent for wheatgrass, and less than 1 percent for pine (underburning). Although a large number of acres would be targeted for Wyoming big sagebrush and low sagebrush below 5,600 feet elevation, reaching these targets would be contingent on the success of burning these areas. A contingency plan would be developed for these areas.

Firing technique and timing would be prescribed to mitigate smoke impacts, including 1) burning late in the day during the period of greatest atmospheric instability, 2) burning during low fuel moisture, and 3) burning during southerly and southwesterly transport winds. This would avoid smoke intrusions in Plush and avoid smoke impacts to Class I airsheds. Predominant use of head fires would produce the most efficient method of combustion. Direct impacts to wildlife would be mitigated by not burning during the breeding season of most species. Indirect impacts would be mitigated by burning in a patchy mosaic, minimizing adverse impacts to soil, and re-seeding with native grasses and forbs where necessary. To mitigate impacts to sage grouse, prescribed burns would be carried out in a way that would ensure continued existence of sage grouse nesting habitat in areas adjacent to burns. Additionally, areas around sage grouse leks would be avoided. Prescribed burns would be executed during February-April or September-November. Further mitigation measures will be disclosed in a Fire Management Plan.

Inholdings and historic structures would be given protection during prescribed burning. All naturally ignited fires that fall under a prescribed fire plan would be treated as a prescribed natural fire. All other naturally ignited fires and fires accidentally started by people would be suppressed.

Mechanical and Herbicide Treatment. Mechanical and herbicide treatments would initially be used on an experimental basis to identify the most effective technique to reduce shrub cover where prescribed burning is ineffective or undesirable. Although mechanical treatment would receive higher priority than herbicide treatment, there may be situations in which mechanical treatment would disturb soil excessively, resulting in cheatgrass invasion.

Mechanical treatments such as railing, chaining and discing would be considered. Mechanical treatments would only be used in Wyoming big sagebrush and possibly low sagebrush on level tableland areas. Use of equipment, such as the Schmeiser Till an' Pak® pulled by a tractor, would result in the death of sagebrush with the least amount of disturbance to soil. Other measures to mitigate adverse impacts to soils include avoiding areas with slopes over 15 percent, treating vegetation during the winter (when soils are frozen) when soils are least vulnerable to disturbance from churning and compression, and re-seeding with certified weed-free seeds of native grasses and forbs where seed-source of native vegetation is scarce. Winter treatments would mitigate adverse impacts to wildlife by avoiding the breeding season. Another mitigation relative to wildlife is that large blocks would not be treated, and treatment patterns would be mosaics in nature. Mechanical treatments would only be applied on a small scale initially to test effectiveness and allow further evaluations of environmental impacts.

Up to about 2,000 acres would be treated with herbicides in Alternative D within the next 15 years. The primary herbicides considered for use are 2,4-dichlorophenoxyacetic acid (2,4-D) and granular tebuthiuron (trade name Spike 20P). Application rates for 2,4-D and tebuthiuron would be a maximum of 2 pounds (lb.) active ingredient/acre and 0.75 lb. active ingredient/acre, respectively. Herbicides would be applied from the ground via hand-held or vehicle dispensers, or from the air and would not be applied within a 100-foot buffer around riparian areas and other wetlands (200-foot if aerially applied). Herbicide application would occur during spring or summer and would occur no more than once per site. Herbicide applications would be scheduled and designed to minimize potential impacts on water quality and nontarget plants and animals. The rates of application would depend upon the target species, the presence and condition on nontarget vegetation (including sensitive species), the soil type, the depth to the water table, and presence of other water sources.

Mitigation measures to minimize potential impacts on water quality and nontarget plants and animals would include: 1) minimizing chemical applications prior to anticipated heavy rainfall period; 2) timing pesticide applications so that they have more time to be taken up by growing sagebrush; 3) no use of herbicides during late fall or winter; and 4) using a 100-foot buffer zone around wetlands (200-foot if aerially applied); and (5) conducting intensive surveys for threatened, endangered, or otherwise sensitive plants. For aerial application, additional mitigation to reduce drift would include: (1) minimizing height above ground for aircraft; (2) controling droplet size; and (3) applying herbicides only if wind is below 5 mph.

A monitoring program would be developed to evaluate herbicide treatment on vegetation and water quality. Based on monitoring strategies outlined in Appendix N, Level 2 or 3 monitoring would be used to monitor effects of herbicides. A water monitoring program would also be implemented to assess and monitor the impacts of herbicide treatments on water quality. Prior to any herbicide application, a Pesticide Use Proposal that includes specific prescriptions, including monitoring, would be developed by the Refuge and would be approved by the Regional Integrated Pest Management Coordinator. Appropriate NEPA documentation would accompany the proposal.

In association with the prescribed burning program, juniper that have invaded sagebrush and bitterbrush cover types may be cut using chainsaws prior to burning.

Livestock Grazing. Livestock would not be permitted on Refuge lands for any purpose during this planning period. The boundary fence would be maintained. Interior fences would not be maintained. Efforts would begin during this planning period to remove livestock grazing facilities (fences, cattleguards, etc.). Fence removal would be initiated in areas where conflicts between fences and wildlife are highest. As such, it would begin in the area of Hart Mountain and the Intermediate Hills, and would continue out from there. Additionally, priority would be given to removing fences that do not meet wildlife standards (50 of the 160 miles of interior fence do not meet wildlife standards). Many of the fences that do not meet wildlife standards are associated with riparian meadows and other wetland areas in the area of Hart Mountain. Three-quarters of the interior fences are targeted for removal during the 15-year planning horizon.

Seedings and Plantings. Bitterbrush would be planted in several previously burned areas where bitterbrush is not reestablishing or where recruitment is low. Seeding of certified weed-free seeds of native grasses and forbs following shrub reduction would be implemented where native grasses and forbs are insufficient. Native grasses and forbs may be seeded following wildfires if warranted and feasible. Sources of seed, collection procedures, storage and planting methods would be developed and analyzed.

Noxious Weed Management. Refer to the Noxious Weed Management section under Wetland Habitat Management.

Water Management. This alternative would emphasize restoration and maintenance of natural sources of water (streams, springs, wetlands, etc.; refer to the Wetland Habitat Management section). Existing lakebed waterholes would be maintained on a 5-15 year cycle. Water impoundments located in drainages would be evaluated as to their ecological impacts, and removed if negative impacts outweigh benefits. The four existing guzzlers would be maintained, and additional guzzlers may be constructed based on a needs assessment. No new waterholes are planned.

Upland Habitat Monitoring. An extensive approach would be taken to monitor vegetation response to prescribed burning; minimal to moderate where response is known, and intensive where predictability of response is low. Areas treated mechanically or with herbicides would be monitored intensively. Plots in and adjacent to burned areas, and areas treated mechanically or with herbicides would be read every 5 years. Information collected during monitoring would be used to periodically review management strategies. It would provide a basis to adjust management programs where necessary to ensure that core problems are effectively being resolved and that management is directed at reaching long-range objectives. Appendix N describes the monitoring program of the Proposed Action in further detail.

WETLAND HABITAT MANAGEMENT

This alternative would emphasize passive restoration of riparian areas, although management actions would be undertaken to reduce length of recovery time in some areas. Riparian areas would be allowed to recover, primarily through (1) non-use by livestock, (2) a prescription burning program in aspen stands, (3) repairing, rerouting or closing roads that cause significant damage to riparian areas (refer to Public Use section), and (4) redesigning campgrounds to reduce habitat degradation (refer to Public Use section). Management actions, aside from non-use by livestock, would include prescribed burning, willow planting and instream structures.

Fire. During this planning period, some riparian areas would be burned through prescription to enhance restoration. Approximate distribution among vegetation types would be approximately 10-15 percent for aspen, mixed deciduous shrub and willow combined, 60-90 percent for sedge-rush-bluegrass and bluegrass-ryegrass types, and 5-15 percent for silver sagebrush (Table 2-2). Following recovery, the primary emphasis of the fire program would be to burn riparian areas at the same frequency as adjacent uplands. Secondarily, some areas (e.g., bluegrass-ryegrass, sedge-rush-bluegrass) would be burned periodically (5-10 years or so) to improve productivity and change vegetation structure for the benefit of some wildlife species (e.g., waterfowl and cranes on the Shirk Ranch).

Other specific applications of prescribed burning would be to reduce shrub and tree cover in meadows and aspen stands invaded by sagebrush, rabbitbrush and western juniper, and to stimulate resprouting of aspen. Mitigation measures are described in the Upland Habitat Management section.

All naturally ignited fires that fall under a prescribed fire plan would be treated as a prescribed natural fire. Adequate fire management personnel and equipment would be available to obtain desired objectives. All other naturally ignited fires and fires accidentally started by people would be suppressed; in other words, these fires would be treated as wildfires.

Mechanical Treatment. In association with the prescribed burning program, junipers that have invaded aspen stands and areas adjacent to springs would be cut and burned. See also the discussion under the Shirk Ranch Area section.

Livestock Grazing. Livestock would not be permitted during this planning period for any purposes on the Refuge. Cattle grazing would not be used on the Shirk Ranch.

Noxious Weed Management. An Integrated Pest Management (IPM) approach would be used to manage white top, Canada thistle, and Mediterranean sage. IPM would make use of mechanical methods, biological controls, herbicides, and prescribed burning. Emphasis would be placed on implementing the least toxic technique. Mechanical controls would involve mowing or removing flowering heads prior to seed development. Biological controls presently exist for Canada thistle and Mediterranean sage, but not for white top. Prescribed burning may require reseeding of certified weed-free seeds of native vegetation. Herbicides labeled for Canada thistle include 2,4-D, Banvel (dichlorophenoxyacetic acid), or Stinger (clopyralid). Herbicides labeled for white top include 2,4-D, Telar (chlorsulfuron), and Escort (metasulfuron). Herbicides would be used in accordance with EPA regulations and Service Integrated Pest Management Policy to mitigate adverse impacts. One option for minimizing adverse impacts would be to use a wiping or wicking device for applying herbicides.

Other Wetland Management Practices. Passive restoration of streams would be emphasized. This would be accomplished primarily through excluding livestock from riparian areas. Willows would be planted along sections of streams formerly occupied by willows where recolonization is not expected to take place. Check dams would be constructed on a limited basis, and only in areas where degradation is severe and where natural restoration is not taking place or is occurring at a slow rate. These procedures would be carried out to enhance sediment trapping, recovery of wetland vegetation, and to restore channel structure. A minimum pool of 15 acres would be maintained at Jacob's Reservoir.

Shirk Ranch Area. According to the Shirk Lake Wetland Development Environmental Assessment (USFWS 1991), Shirk Lake will be divided by two major dikes into three sections to increase waterfowl production in this area. Vegetation treatment was not covered under the 1991 EA. Under this alternative, manipulation of water levels, prescribed burning, and haying would be the primary means of managing vegetation. Prescribed burning and haying would periodically be used to rejuvenate nesting cover (if necessary) for waterfowl and other migratory birds, and create feeding areas for cranes, geese, and ducks during the breeding season.

Wetland Habitat Monitoring. A riparian habitat evaluation would be completed every 5-10 years to track condition of stream channel morphology and vegetation conditions in riparian areas throughout all watersheds of the Refuge. If funds and personnel are available, monitoring would be conducted more frequently and systematically (e.g., sampling a subset every one to two years) to document recovery rates of riparian systems. Intensive sampling of riparian areas at existing set points would be completed once every 10-15 years at set stations; sampling would include a description of plant species composition, stream morphology and structural diversity, and would be conducted to track trend within sampling areas. Information collected during monitoring would be used to periodically review management strategies. It would provide a basis to adjust management programs where necessary to ensure that core problems are effectively being resolved and that management is directed at reaching long-range objectives. Appendix N describes the monitoring program of the Proposed Action in further detail.

2. WILDLIFE POPULATION MANAGEMENT

Wildlife populations, with few exceptions, would be managed through managing upland and wetland habitat. The extent to which other management actions would be used in managing specific wildlife species are described below. Wildlife monitoring is discussed at the beginning of Chapter 2, Section Two.

Hunting. Hunting may be used to manage populations of pronghorn, bighorn sheep, and mule deer if necessary. It primarily would be offered as a recreation opportunity (refer to the Public Use section).

Transplanting. ODFW would continue to capture bighorn sheep from the Refuge and transplant them to other locations. Approximately 20-60 animals would be transplanted each year, based on current and projected populations.

Reintroductions. Sharp-tailed grouse may be reintroduced to the Refuge, based on an assessment of quality and amount of habitat on the Refuge. Sharp-tailed grouse formerly inhabited the Refuge, but since have been extirpated.

Predator Control. Predator control may be used if a wildlife species is shown to be at risk due to a high rate of predation, and other measures are not feasible or timely. Predator control would only be used as a temporary solution. Predator control to enhance waterfowl and crane nesting success would be maintained on the Shirk Ranch Area.

Feral Horses. Under this alternative, all feral horses would be removed from the Refuge, and horses that subsequently move on to the Refuge would be periodically removed in accordance with NWRS Policy (7 RM 6.2 and 6.9, Refuge Manual) and provisions of 50 CFR 30.12. This alternative was presented in the Hart Mountain National Antelope Refuge Horse Management Plan Environmental Assessment (USFWS 1979), but it was not selected because Regional Policy Update No. 13 precluded the selection of the alternative at that time. Changes in policy now make this alternative permissible. The 1979 environmental assessment (EA) concluded that this alternative would have allowed for the greatest amount of habitat recovery, would have eliminated [reduced] competition with wildlife for forage and water, and would have benefited Refuge goals and objectives. Capturing feral horses would take place as outlined in the Horse Management EA and in accordance with NWRS Policy (7 RM 6.9, Refuge Manual). Service policy directs that feral horses will not be maintained on Hart Mountain NAR (USFWS 1982:7 RM 6.2).

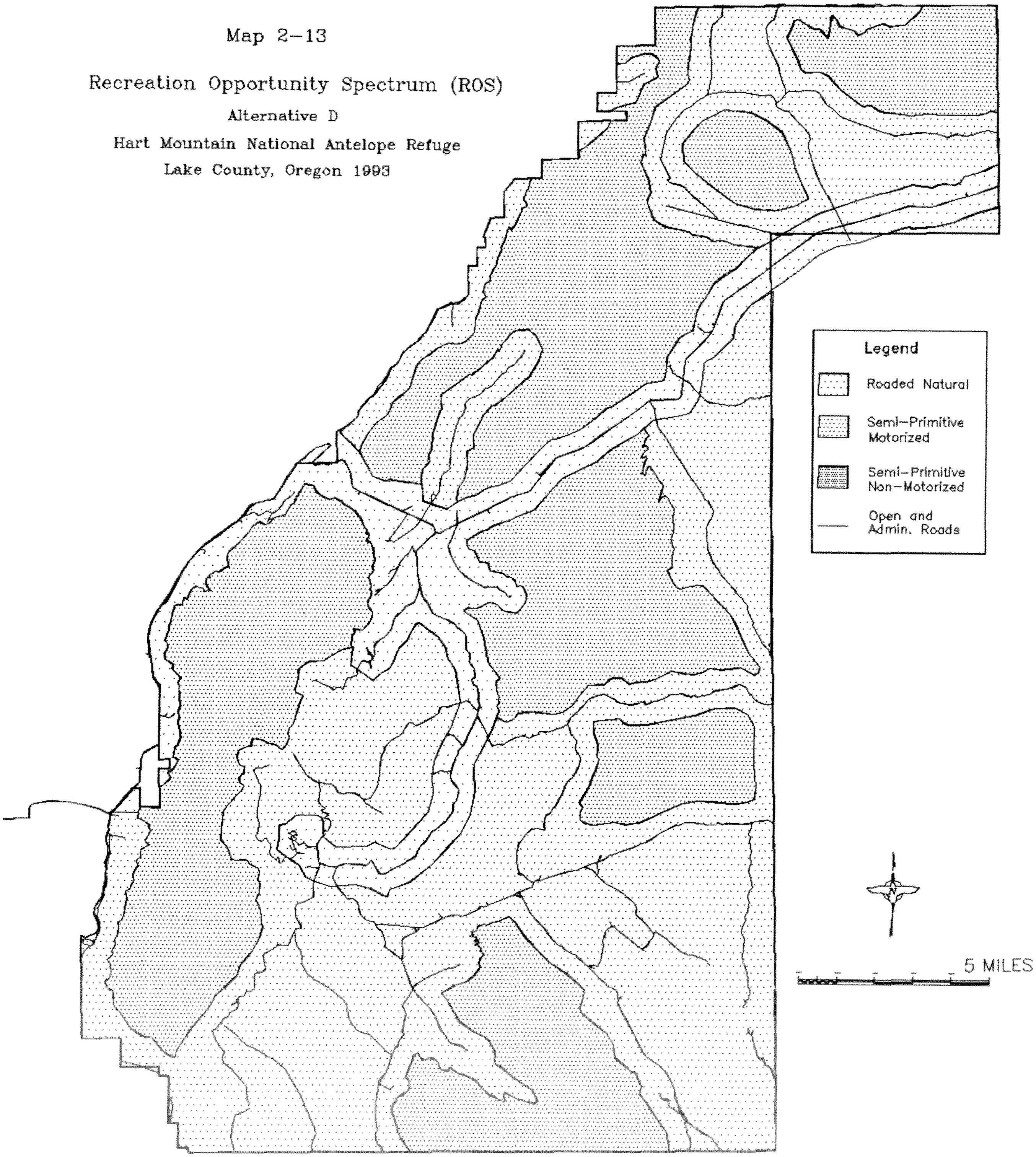
3. PUBLIC USE MANAGEMENT

The public use portion of this alternative, aside from road management, horse use, and the associated ROS characterization, is similar to Alternative C.

The emphasis of this alternative, as in Alternative C, is to provide quality wildlife/wildlands-oriented recreation opportunities that depend on the rugged, remote and undeveloped character of the Refuge. Therefore, campgrounds and facilities, including roads, would be developed and regulated only to the extent necessary to reduce habitat degradation and wildlife disturbance.

Recreation Settings. Approximately 45 percent of the Refuge would be maintained in a Semi-primitive Non-motorized setting, 44 percent in a Semi-primitive Motorized setting, and 11 percent in a Roaded Natural setting (Map 2-13). This alternative would have the largest amount of Semi-primitive Non-Motorized area while still maintaining road access.

Camping. Individual camp sites would be identified and minimally developed at the Hot Springs Campground, and the Barry Spring and Flook Lake sites. Backcountry tent camping under a permit system would be maintained. Guano


Map 2-13
Recreation Opportunity Spectrum (ROS)
Alternative D
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
Legend
Roaded Natural
Semi-Primitive Motorized
Semi-Primitive Non-Motorized
Open and Admin. Roads
5 MILES

Creek Campground would be closed. Approximately 30-45 camping opportunities would be available at the Hot Springs Campground. Sites would be available for drive-up tent campers, walk-in tent campers, and recreational vehicles. For drive-up camping areas, signs would identify specific camp sites, and parking areas would be delineated for each site. Parking areas would be provided for walk-in campers. No camping would be permitted adjacent to the Hot Springs bathhouse, which would be redesigned to blend in with the surrounding environment.

Dispersed camping areas would be located north of Flook Lake and Barry Spring (just east of Blue Sky) pending inventories and assessments by appropriate specialists. One additional camping area would be developed for horseback riders at Post Meadows. Existing corrals would be available at this area. Ten to twenty camping sites would be available at each area. Occupancy limits would be established for each campground. Maps in Appendix N identify locations of proposed new camping areas.

Increases in camping on the Refuge would be mitigated for by establishing a set number of camping areas and not allowing use to exceed this number. If use increases beyond the carrying capacity of the Refuge, then visitors will have to camp off of the Refuge. Additional new campgrounds will not be established.

Roads. In this alternative, several roads would be closed to (1) reduce soil erosion, (2) increase the amount of riparian habitat in some areas, (3) improve overall habitat quality, and (4) reduce disturbance to wildlife (Map 2-4 and 2-13). Maintaining road access while mitigating habitat problems and disturbance to wildlife was emphasized in determining which roads should be closed under this alternative. In some situations, closed roads would be replaced by a new road that is more suitably located. Closing of roads that access private inholdings would not preclude access to these sites. More specifically:

- Two portions of the Barnhardi Road would be rerouted to restore aspen and streamside habitat along Guano Creek and an aspen stand southeast of Hot Springs Campground. By rerouting roads out of these areas, disturbance to wildlife would be reduced. Maps in Appendix N illustrate proposed locations of rerouted roads.

- Barnhardi Road from approximately 1 mile south of Hot Springs Campground to its junction with Skyline Drive would be closed to all vehicle use, including bicycles. This would serve to allow restoration of aspen and other riparian habitat, and reduce disturbance, while still maintaining access to the divide between Rock and Guano Creeks and to the base of Hart Mountain.

- The road between Post Meadows and Big Flat would be rerouted around meadows where possible, and effects to meadows would be mitigated where such action is not possible.

- Other roads travelling through meadows would be assessed as to the impacts they have on meadow habitat, and would be modified to lessen identified impacts.

- The main road going through the Refuge headquarters would be rerouted to eliminate traffic through the headquarters compound.

- The road accessing Warner Ponds would be closed three-quarters of a mile below the ponds because of severe erosion. The ponds would still be accessible by foot (one-quarter to three-quarters of a mile depending on route taken), and access would be granted for stocking fish into the ponds. Fishing would be permitted as under baseline management.

Exact placement of new roads, through rerouting, would be determined through evaluations conducted by appropriate specialists including road engineers, hydrologists, and cultural resource professionals. There would be approximately 162 miles of open and seasonal roads, 181 miles of closed roads, and 20 miles of administrative roads on the Refuge.

Blue Sky Road would remain open year-round, weather permitting. Spur roads coming off of these roads would be open from the 15 June to 1 December, weather permitting. Roads would be closed up until 15 June to reduce disturbance to pronghorn does and fawns on fawning grounds during most of the fawning period (1 May - 1 July). Use of roads on North and South Hart Mountain by Refuge personnel primarily would be restricted to prescribed burning activities (except access to the radio-repeater). In addition, the main roads would be reshaped and graveled.

The 5 roads that would be open only to administrative use are 1) the road accessing the radio repeater on Warner Peak, 2) the road along Guano Creek between the road to Big Flat and the South Boundary Road, 3 & 4) the 2 roads that extend south of Big Flat, and 5) the road that runs parallel the east boundary of the Refuge south of the Old Military Road.

<u>Natural Resource Interpretation</u>. The visitor room would remain open all year, 24 hours per day until the Interagency Interpretive Center is open, at which time the visitor room would be closed. Existing interpretive signs would be maintained, and a small number of additional signs may be erected; emphasis would be on maintaining the undeveloped character of the Refuge.

<u>Hiking and Horseback Riding</u>. Hiking and horseback riding would be permitted, but trails would not be developed. Horse use would be permitted over the entire Refuge; however, if use greatly increases or becomes a problem, then certain areas would be closed to horse use and/or certain times of the year the Refuge would be closed to horse use. Hiking areas would be described in brochures, and parking areas may be developed at these sites. Also, hiking

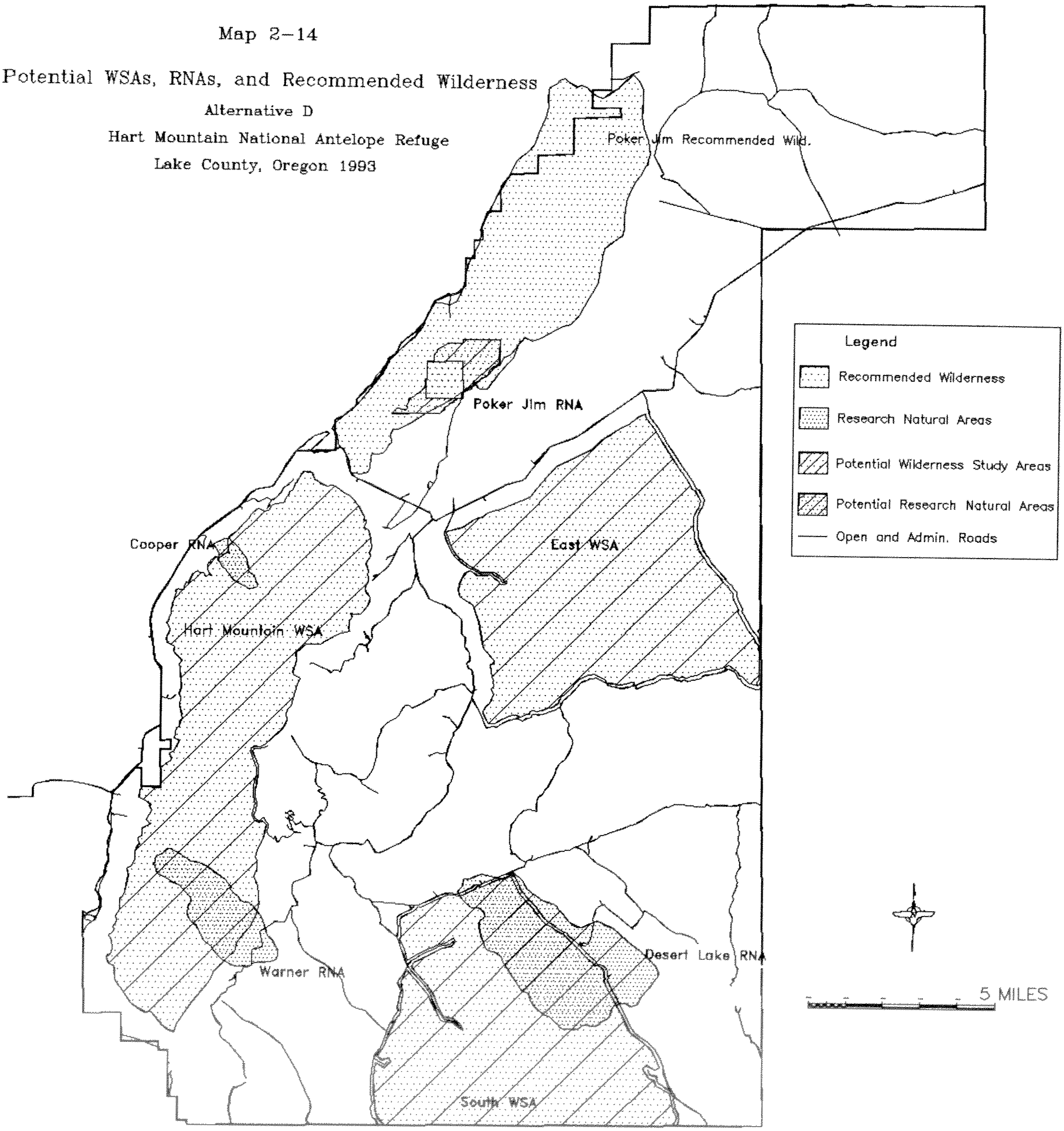
Map 2-14

Potential WSAs, RNAs, and Recommended Wilderness

Alternative D

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993



would be permitted on all closed roads on the Refuge. Hiking areas described in brochures would include DeGarmo Canyon, Stockade Creek, and others. Hiking is not anticipated to increase greatly. However, if use becomes a problem (wildlife disturbance, erosion) then certain areas may be closed and/or hiking may be restricted during certain times of the year.

Hunting and Fishing. Hunting would continue as under baseline management with limited, quality hunts being emphasized. Changes may be made to reflect changing population status and demographics. The number of tags issued would be determined based on wildlife populations and trends, in cooperation with ODFW. Fishing would continue as under baseline management. Fishing opportunities would exist for Rock Creek, Guano Creek and Warner Ponds, although closures may occur due to drought conditions. Fishing opportunities would remain limited.

4. SPECIAL AREAS MANAGEMENT

The Poker Jim Ridge RNA (640 acres) would continue to be managed according to the National Wildlife Refuge Administration Act. Three areas would be recommended for study to assess their RNA potential: (1) Warner Creek watershed to meet Oregon Natural Heritage Plan cell needs for big sagebrush and mountain mahogany communities (3,089 acres), (2) Cooper Canyon Watershed to meet Oregon Natural Heritage Plan cell needs for high gradient, first-order streams in pristine condition (618 acres), and (3) the Water Canyon area within the Desert Lake watershed for a unique intermittent stream, low sagebrush, and playas (Desert Lake RNA - 7,569 acres) (Map 2-14, previous page).

The Poker Jim Ridge recommended Wilderness (20,390 acres) is pending action in Congress. Three additional areas on the Refuge would be recommended for further study to assess their wilderness potential: (1) the land encompassed by the Semi-primitive Non-motorized area on Hart Mountain (30,519 acres), (2) the Non-motorized area adjacent to the southern boundary of the Refuge (23,849 acres), and (3) the land encompassed by the Semi-primitive Non-motorized area east of the Refuge Headquarters (26,173 acres) (Map 2-14).

5. FUNDING / PERSONNEL

Table 2-6 provides an estimate of the costs to implement Alternative D for the 15-year planning horizon. In years of limited funding, budgetary priority for on-the-ground management would be given to the prescribed burning program, long-term wildlife surveys, and habitat monitoring associated with management activities (e.g., prescribed burning).

Staffing required to implement Alternative D are presented below. Approximately one-third of the Sheldon-Hart Mountain Refuge Complex staffs' duties are directed toward Hart Mountain NAR.

Complex Staff
Project Leader
Assistant Project Leader
Administrative Support Assistant
Purchasing Officer
Office Automation Specialist
Fire Management Officer
Complex Biologist
Assistant Fire Management Officer

Refuge Staff
Refuge Manager
2 Engineering Equipment Operators
Wildlife Biologist
4 Firefighters (seasonal)
Biological Technician (seasonal)
Recreation Aid (seasonal)

TABLE 2-6. ESTIMATED COST TO IMPLEMENT ALTERNATIVE D

Annual Salaries:	$319,808
Annual Operation and Maintenance	
Administrative Support	32,620
Facility Maintenance	6,072
Vehicle and Equipment Maintenance	36,300
Resource Maintenance	23,100
Supplies and Material	57,018
Contract Services	13,530
TOTAL	168,640

Facility Capital	One Time Capital/ Expenditures	Annual Operation and Maintenance
Pronghorn Research	50,000	
Rehabilitate Visitor Room	50,000	
Redband Trout Research	10,000	
Sage Grouse Research		40,000
Construct Bunkhouse	300,000	5,000
Construct Storage Building	115,000	1,000
Reconstruct Public Use Facilities	225,000	2,000
Juniper Control	25,000	
Headquarters Rehabilitation	18,000	3,000
Stabilize Deteriorating Historic Structures	25,000	
Gravel Refuge Roads	845,000	
Clean Out Waterholes	30,000	2,000
Rehabilitate and Replace Boundary Fences	99,000	8,000
Replace TD-20 Dozer	130,000	
Replace Dikes and Water Control Structures/Shirk	175,000	4,000
Realign Headquarters Road	200,000	
Replace Dump Truck	80,000	
Replace Front-End Loader	95,000	
Replace Flat-Bed Truck	75,000	
Replace Tilt-Bed Trailer	15,000	
Overhaul Generators	12,000	
Prescribed Burning		72,200
Mechanical Treatment	300,000	
Herbicide Treatment	220,000	
TOTAL	3,094,000	137,200

ALTERNATIVE E - CUSTODIAL MAINTENANCE

This alternative emphasizes the total exclusion of human intervention in terms of wildlife habitat and population management. The foundation of this alternative rests on the premise that if left alone, the Refuge would return to a natural state. All natural fires would be permitted to burn, except under circumstance in which they threaten developed areas on the Refuge (e.g., headquarters, CCC Camp), or significant cultural resources. This conflicts with current Service fire policy.

Day-use by the public would be permitted, but no overnight camping would be allowed. Hunting and fishing would not be permitted.

1. HABITAT MANAGEMENT

MANAGEMENT UNIT DELINEATION

Discrete management units would not be needed under this alternative, and therefore none would be used.

UPLAND HABITAT MANAGEMENT

Fire. Wildfires would be permitted to burn except those threatening the Refuge headquarters, other Refuge facilities, cultural and historic sites, inholdings, and those near Refuge borders that could spread to private or BLM lands. Prescribed burning would not be used.

Mechanical and Herbicide Treatment. Mechanical and herbicide treatments would not be used.

Livestock Grazing. Livestock would not be permitted on the Refuge for any purpose under this alternative.

Seedings and Plantings. The Refuge would not make use of seedings or plantings.

Noxious Weed Management. No attempt would be made to control or eradicate noxious weeds.

Water Management. Under this alternative, existing waterholes would not be maintained, no new waterholes would be developed, and existing guzzlers on the Refuge would be removed.

Habitat Monitoring. A minimal amount of monitoring would take place under this alternative. Vegetation sampling would be conducted on a periodic basis to monitor vegetation response to wildfires, and to track frequency and distribution of the fire regime.

WETLAND HABITAT MANAGEMENT

Fire. Refer to the Fire section under Upland Habitat Management.

Mechanical Treatment. Mechanical treatments would not be used.

Livestock Grazing. Livestock would not be permitted on the Refuge for any purpose under this alternative.

Noxious Weed Management. No attempt would be made to control or eradicate noxious weeds.

Other Wetland Management Practices. Riparian areas would be permitted to restore without human intervention.

Shirk Lake Wetland Development. Any existing water impoundments would be removed from Shirk Lake.

Habitat Monitoring. A minimal amount of monitoring would take place under this alternative. A riparian habitat evaluation would be completed every 10-20 years to track condition of stream channel morphology and vegetation conditions in riparian areas throughout all watersheds of the Refuge. Existing, permanent vegetation plots would be read every 10 years to assess habitat condition trend. Habitat monitoring would be conducted to determine if restoration is occurring.

2. WILDLIFE POPULATION MANAGEMENT

Wildlife populations would not be managed, except through non-use of the Refuge by livestock and by allowing natural processes to occur without intervention by humans. This is covered under Habitat Management.

Hunting. Hunting would not be used as a wildlife control mechanism or as a recreational activity.

Transplanting. Capturing and transporting bighorn sheep would be discontinued.

Reintroductions. Wildlife species that formerly inhabited the Refuge, but since have been extirpated would not be reintroduced under this alternative.

Predator Control. Predator control would not be employed.

Feral Horses. Feral horse populations on the Refuge would be allowed to increase and decrease as biological factors dictate as described in the No Action alternative of the Hart Mountain NAR Horse Management Plan EA (1979, Refuge files).

3. PUBLIC USE MANAGEMENT

Recreation Settings. Approximately 26 percent of the Refuge would be maintained in a Primitive setting, 63 percent in a Semi-primitive Non-motorized setting, none in a Semi-primitive Motorized setting, and 11 percent in a Roaded Natural setting (Map 2-15). This alternative provides the largest amount of non-motorized area (including primitive areas), and the least amount of road access. This is the only alternative that would provide primitive areas on the Refuge.

Camping. Overnight camping on the Refuge would not be permitted, and all associated facilities including outhouses would be removed. The Hot Springs bathhouse would be dismantled and the springs would be closed to all use. The springs would be restored to a natural condition.

Roads. All roads, except the main road linking the Refuge headquarters with Plush and Frenchglen, Hot Springs Road, and Blue Sky Road would be closed to public access (Map 2-4 and 2-15). Open roads would be maintained at the current level.

Natural Resource Interpretation. The visitor room at the Refuge headquarters would be closed. A kiosk would be constructed somewhere on the main Frenchglen road to provide information to visitors.

Hiking and Horseback Riding. Hiking and horseback riding would be permitted. Horse use would be permitted over the entire Refuge; however, if use greatly increases or becomes a problem, then certain areas would be closed to horse use and/or certain times of the year the Refuge would be closed to horse use. Hiking trails would not be developed, and hiking areas would not be described in brochures.

Hunting and Fishing. Hunting and fishing would not be permitted on the Refuge.

4. SPECIAL AREAS MANAGEMENT

The Poker Jim Ridge Research Natural Area (RNA) would continue to be managed according to National Wildlife Refuge Administration Act (Map 2-16). No additional areas are recommended for study as RNAs.

The Poker Jim recommended Wilderness (20,390 acres) is pending action in Congress. Two areas, together comprising approximately 80 percent of the Refuge, would be recommended for further study as Wilderness Study Areas. The

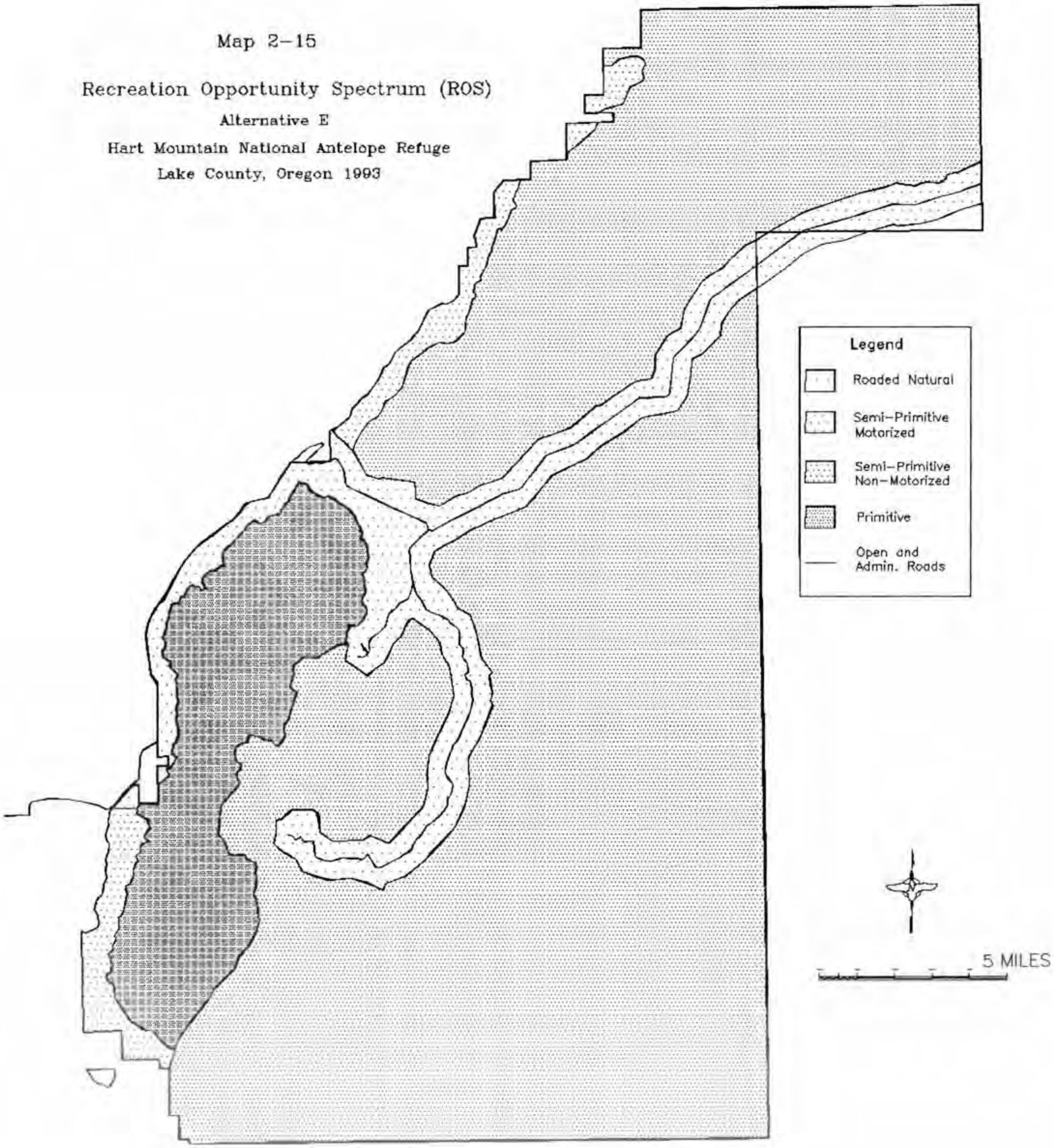
Map 2-15

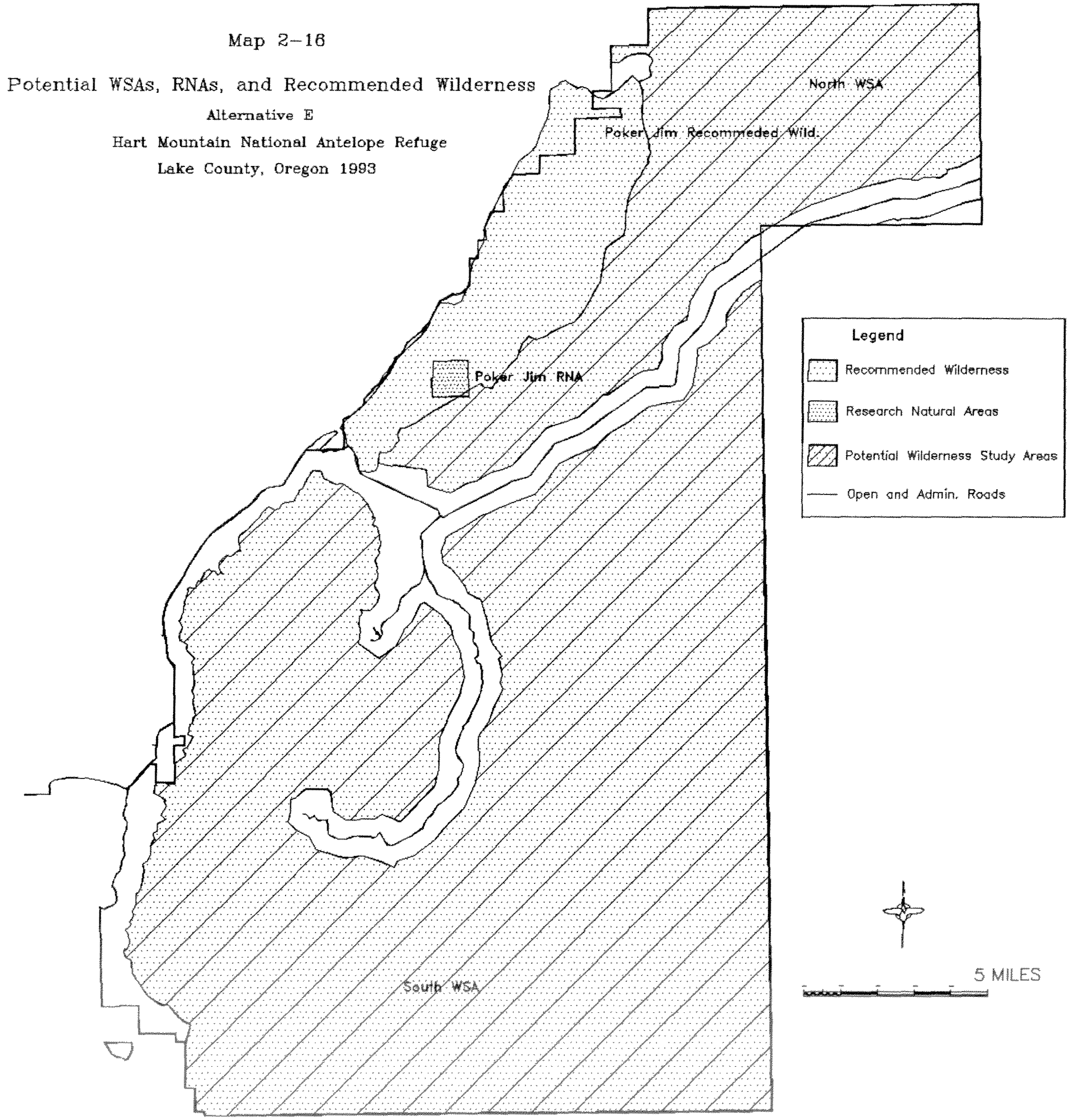
Recreation Opportunity Spectrum (ROS)

Alternative E

Hart Mountain National Antelope Refuge

Lake County, Oregon 1993




Map 2-16
Potential WSAs, RNAs, and Recommended Wilderness
Alternative E
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
North WSA
Poker Jim Recommeded Wild.
Poker Jim RNA
South WSA
Legend
Recommended Wilderness
Research Natural Areas
Potential Wilderness Study Areas
Open and Admin. Roads
5 MILES

areas are classified as Semi-primitive Non-motorized and Primitive using ROS (Map 2-16). The northern areas encompasses approximately 47,809 acres, and the southern area encompasses approximately 174,245 acres.

5. FUNDING / PERSONNEL

Table 2-7 provides an estimate of the costs to implement Alternative E for the 15-year planning horizon.

Staffing required to implement Alternative E are presented below. Approximately one-third of the Sheldon-Hart Mountain Refuge Complex staffs' duties are directed toward Hart Mountain NAR.

Complex Staff	Refuge Staff
Project Leader	Refuge Manager
Assistant Project Leader	Engineering Equipment Operator
Administrative Support Assistant	
Purchasing Officer	
Office Automation Specialist	
Fire Management Officer	
Complex Biologist	

TABLE 2-7. ESTIMATED COST TO IMPLEMENT ALTERNATIVE E

Annual Salaries:		$173,905
Annual Operation and Maintenance		
Administrative Support		17,615
Facility Maintenance		3,279
Vehicle and Equipment Maintenance		19,602
Resource Maintenance		12,474
Supplies and Material		30,790
Contract Services		7,306
TOTAL		91,066

Facility Capital	One Time Capital/ Expenditures	Annual Operation and Maintenance
Pronghorn Research	50,000	
Redband Trout Research	10,000	
Sage Grouse Research		40,000
Headquarters Rehabilitation	18,000	3,000
Stabilize Deteriorating Historic Structures	25,000	
Rehabilitate and Replace Boundary Fences	99,000	8,000
Remove Dikes and Water Control Structures/Shirk	20,000	
Realign Headquarters Road	200,000	
Overhaul Generators	12,000	
TOTAL	434,000	51,000

COMPARISON OF ALTERNATIVES

Table 2-8. Major features of alternatives presented in the Hart Mountain National Antelope Refuge Comprehensive Management Plan EIS.

	Alternatives	
Feature	Baseline Management (No Action) (A)	Featured Species Management (B)
HABITAT MANAGEMENT		
Shrub Cover Reduction	2,000-2,700 acres/15 years	6,000-9,000 acres/15 years
Prescribed Burning	≥90%	50-75%
Mechanical Treatment	0%	0%
Herbicide Treatment	0-10%	25-50%
Livestock Grazing	11,000-17,000 AUMs/year	3,9000-4,300 AUMs/year
Seeding/planting	willow planting along streams; bitterbrush planting	willow planting along streams; bitterbrush planting; native herb planting in treated areas
Instream Structures	limited	moderate use
Waterhole Management	maintain existing waterholes; new waterholes possible	maintain existing waterholes; new waterholes possible
Biological Monitoring	minimal	moderate (intensive monitoring associated with livestock program)
WILDLIFE POPULATION MANAGEMENT		
Reintroductions	none	none
Predator Control	limited	moderate
RECREATION MANAGEMENT		
Camping	Hot Springs and Guano Creek campgrounds would be unimproved and unregulated; backcountry camping maintained	Hot Springs and Guano Creek campground improved; five additional camping areas developed, (two for horseback riders); camping along two roads; backcountry camping maintained
Roads	240 miles of roads open to public; 42 miles of administrative roads;	363 miles of roads open to public; no administrative roads; no permanent closures, pending further review
Recreation Opportunity Spectrum (ROS)[a]	33% classified as SPNM; 56% classified as SPM; 0% classified as Primitive	26% classified as SPNM; 63% classified as SPM; 0% classified as Primitive
Hiking/Horseback Riding	no developed trails; horseback riding throughout Refuge	3-4 trails developed; horseback riding throughout Refuge
Hunting	limited, quality hunts	increased opportunities
SPECIAL AREA MANAGEMENT		
lands to be evaluated for wilderness or RNA potential	none	none

[a] abbreviations for ROS classes: SPNM = Semiprimitive Non-Motorized, SPM = Semiprimitive Motorized

Table 2-8. Continued

Alternatives		
Habitat Restoration (C)	Native Community Restoration (Proposed Action) (D)	Custodial Maintenance (E)
11,000-16,000/15 years 60-80% 20-40% 0%	22,000-40,000 acres/15 years ≥90% 0-5% 0-5%	0 acres/15 years
0-2,500 AUMs 1 of 3 years max.	0 AUMs/year	0 AUMs/year
willow planting along streams; bitterbrush planting; native herb planting in treated areas	willow planting along streams; bitterbrush planting; native herb planting in treated areas	none
moderate use	limited use	none
maintain existing waterholes; no new waterholes developed	maintain existing waterholes; no new waterholes developed	no waterhole maintenance or development
heavy emphasis (prescribed burning and livestock programs)	heavy emphasis (prescribed burning program)	limited
sharp-tailed grouse possible	sharp-tailed grouse possible	none
limited	limited	none
Hot Springs campground redesigned; Guano Creek campground closed; three additional camping areas developed, (one for horseback riders); backcountry camping maintained	Hot Springs campground redesigned; Guano Creek campground closed; three additional camping areas developed, (one for horseback riders); backcountry camping maintained	no overnight camping
202 miles of roads open to public; 34 miles of administrative roads;	162 miles of roads open to public; 20 miles of administrative roads;	50 miles of roads open to public; no administrative roads
32% classified as SPNM; 57% classified as SPM; 0% classified as Primitive	45% classified as SPNM; 44% classified as SPM; 0% classified as Primitive	63% classified as SPNM; 0% classified as SPM; 26% classified as Primitive
no developed trails; horseback riding limited to open roads	no developed trails; horseback riding throughout Refuge	no developed trails; horseback riding throughout Refuge
limited, quality hunts	limited, quality hunts	no hunting
46,284 acres for wilderness; 11,276 acres for RNAs	80,541 acres for wilderness; 11,276 acres for RNAs	222,054 acres for wilderness; 0 acres for RNAs

SUMMARY OF IMPACTS OF ALTERNATIVES

Effects of implementing the alternatives are summarized in the following discussion and in Tables 2-9 and 2-10.

EFFECTS ON WILDLIFE (Issue 1)

Alternative D (Proposed Action) would provide the most benefits to wildlife during the 15-year planning horizon, and would make the most progress toward achieving Refuge goals and objectives related to wildlife. All featured species of wildlife would benefit over the long-term, except possibly mule deer, as would wildlife diversity. Benefits to wildlife would be increased to the extent that habitat is restored (next section). Reducing shrub cover, increasing early and mid succession stages of upland habitats, maintaining residual grass and forb cover, and allowing riparian areas to recover, are key components to benefiting Refuge wildlife. Alternative C is second to Alternative D in terms of benefits to featured species (e.g., pronghorn, sage grouse, trout) and wildlife diversity. Alternative A would provide the least amount of benefits to wildlife, relative to other alternatives.

EFFECTS ON HABITAT (Issue 2)

Alternative D (Proposed Action) would make the most progress in resolving core habitat problems; benefits to wildlife would increase to the extent that these problems are resolved. Alternative D would result in the highest amount of habitat diversity in upland habitats, would reduce shrub cover to the greatest extent, and would allow riparian areas to recover at the fastest rate of any alternative. As such, Alternative D would make the most progress toward reaching long-term habitat objectives. Prescribed burning would be a key to managing upland habitats and some riparian habitats such as aspen. Alternative C would provide similar results, except to a lesser extent. Riparian area recovery would be similar in alternatives C and D. Although Alternative B would make considerable progress in restoring riparian habitat compared to baseline management, the limited acres of shrub reduction would not substantially improve upland habitat conditions. Alternative E, although highly beneficial from the standpoint of wetland recovery, would do very little to restore upland habitats, which comprise 94 percent of the Refuge. Limited recovery of upland and riparian habitats would occur under Alternative A.

Alternatives C, D, and E would maintain higher residual vegetation cover in wetland habitats because of the sharp reduction in or elimination of cattle grazing. Alternative A would provide the lowest amount. Maintenance of residual cover in Alternative B would be intermediate between A and C. The amount of herbaceous residual cover would be second lowest in Alternative B.

EFFECTS ON THE LIVESTOCK GRAZING PROGRAM (Issue 3)

All alternatives, except for A, would adversely affect the livestock grazing program. Alternative B proposes a reduction by two-thirds. Implementation of Alternative C could result in as much as a 95 percent cut in the program. Alternatives D (Proposed Action) and E prescribe no use of cattle for the 15-year planning period. The amount of livestock grazing that would be permitted in Alternative C would be no more than 2,500 AUMs in one of every three years in contrast to about 4,000 AUMs per year in Alternative B. The average number of AUMs removed from the Refuge under baseline management is about 12,800 per year.

EFFECTS ON RECREATION OPPORTUNITIES (Issue 4)

Alternative B would maximize recreation opportunities by offering the most camping, hunting, and road access of all the alternatives. However, the primitive and undeveloped character of the Refuge may be diminished somewhat, and roadless areas would be reduced. Alternative E would provide the least amount of recreation opportunities, for there would not be any camping or hot springs use, and road access would be extremely limited. Although this would substantially increase non-motorized areas, use would be limited because people would only be allowed to go on foot or horseback for one day at a time. Alternative D would offer a high degree of recreation opportunities while still maintaining the primitive and undeveloped character of the Refuge. Alternative C is similar to D except that D offers more roadless areas, with the second highest amount of road closures (second to Alternative E). Alternative A maintains the primitive and undeveloped character of the Refuge by having very few facilities. However, the lack of direction and information provided for visitors fosters user conflicts and degraded camping areas.

EFFECTS ON SPECIAL MANAGEMENT AREAS (Issue 5)

No foreseeable changes would occur in management of special areas within the 15-year planning horizon. Determinations as to whether or not wilderness or Research Natural Areas (RNAs) would be added to Hart Mountain NAR cannot be made at this time. Areas proposed by various alternatives would be recommended for study. Initiation of the study process for particular areas by no means guarantees that these lands will be designated as wilderness or RNA, whichever the case may be.

Alternatives A and B do not recommend additional areas be studied to determine wilderness or Research Natural Area potential. Alternative E proposes the largest proportion of the Refuge to be studied for wilderness potential (nearly all of it) because road closures are extensive. Alternatives C and D propose nearly equal amounts of land to be recommended for study.

Table 2-9. Predicted effects of alternatives on issues[a] after 15 years of implementation.

ISSUES	ALTERNATIVES				
	BASELINE MANAGEMENT (A)	**FEATURED SPECIES MANAGEMENT (B)**	**HABITAT RESTORATION (C)**	**NATIVE COMM. RESTORATION (D)**	**CUSTODIAL MAINTENANCE (E)**
1. WILDLIFE					
Pronghorn	0	0	+	+	0
Bighorn Sheep	0	0	+	+	0
Mule Deer	0	0	0	0	0
Sage Grouse	0	+	+	+	0
Trout	0	0	+	+	+
Diversity	0	0	+	+	0
Predator Control	0	+ +	0	0	-
Feral Horses	+	+	--	--	+
2. HABITAT[b]					
Uplands	0	+	+ +	+ +	0
Riparian Areas	0	+	+ +	+ +	+
Other Wetland	0	0	+	+	+
3. LIVESTOCK PROGRAM					
Ave. # AUMs/yr.	0	--	---	---	---
4. RECREATION					
# acres SPNM	0	-	0	+ +	+ + +
Camping Opp's	0	+ +	+	+	---
Open Roads	0	+	-	--	---
Hunting Opp's	0	+	0	0	---
Wildlife Viewing	0	0	+	+	--
5. SPECIAL AREAS					
Recommended areas to study	0	0	+ +	+ +	+ + +
6. LOCAL ECONOMY					
Total Business Revenue	0	+ +	+	+	--
Revenue from Agriculture	0[c] 0[c]	- -	-- -	-- -	-- -
Revenue from Tourism	0	+ +	+	+	--

[a] Information provided in this table is intended to allow readers to make general comparisons of effects that alternatives may have on particular issues. Pluses (+'s) and minuses (-'s) cannot meaningfully be added within columns to determine the "best" alternative because each issue has a different and unknown weighting factor. They can only be compared within a particular row.

[b] Amount of habitat in healthy condition.

[c] The costs for ranchers associated with reduced grazing below levels identified in Alternative A will occur in one of two ways:
- Ranchers will cut back local production. Their loss will equal foregone revenue minus associated variable costs.
- Ranchers will switch to private pasture, incurring an additional cost to their operation.

KEY (expressed as changes to populations or amount)

Large increase	+ + +
Moderate increase	+ +
Slight increase	+
No significant change	0
Slight decrease	-
Moderate decrease	--
Large decrease	---

Table 2-10. Predicted effects of alternatives on issues[a] for the long-term (over 50 years).

ISSUES	ALTERNATIVES				
	BASELINE MANAGEMENT (A)	FEATURED SPECIES MANAGEMENT (B)	HABITAT RESTORATION (C)	NATIVE COMM. RESTORATION (D)	CUSTODIAL MAINTENANCE (E)
1. WILDLIFE					
Pronghorn	0	+	+ +	+ +	+
Bighorn Sheep	0	+	+	+ +	+
Mule Deer	0	0	0	0	-
Sage Grouse	--	0	+	+ +	0
Trout	-	+	+	+ +	+ +
Diversity	-	+	+ +	+ +	+
Predator Control	0	+ +	0	0	-
Feral Horses	0	0	--	--	+
2. HABITAT[b]					
Uplands	-	+	+ +	+ + +	+
Riparian Areas	-	+	+ +	+ + +	+ +
Other Wetland	0	+	+ +	+ +	+
3. LIVESTOCK PROGRAM					
Ave. # AUMs	0	--	---	---	---
4. RECREATION					
# acres SPNM	0	-	0	+ +	+ + +
Camping Opp's	0	+ +	+	+	---
Open Roads	0	+	-	--	---
Hunting Opp's	0	+	0	0	---
Wildlife Viewing	0	0	+	+ +	--
5. SPECIAL AREAS					
Recommended areas to study	0	0	+ +	+ +	+ + +
6. LOCAL ECONOMY					
Total Business Revenue	0	+ +	+ +	+ +	--
Revenue from Agriculture	0[c] 0[c]	- -	-- -	-- -	-- -
Revenue from Tourism	0	+ +	+ +	+ +	--

[a] Information provided in this table is intended to allow readers to make general comparisons of effects that alternatives may have on particular issues. Pluses (+'s) and minuses (-'s) cannot meaningfully be added within columns to determine the "best" alternative because each issue has a different and unknown weighting factor. They can only be compared within a particular row.

[b] Amount of habitat in healthy condition.

[c] The costs for ranchers associated with reduced grazing below levels identified in Alternative A will occur in one of two ways:
- Ranchers will cut back local production. Their loss will equal foregone revenue minus associated variable costs.
- Ranchers will switch to private pasture, incurring an additional cost to their operation.

KEY (expressed as changes to population or amount)

Large positive increase	+ + +
Moderate positive increase	+ +
Slight positive increase	+
No significant change	0
Slight negative decrease	-
Moderate negative decrease	--
Large negative decrease	---

SOCIO-ECONOMIC IMPACTS (Issue 6)

A decisional analysis of interests affected by Hart Mountain NAR indicates that Alternative D (Proposed Action), followed by Alternatives B and C would maximize gains when all interests are considered (note that Table S-4, explained below, only presents economic benefits). A more conservative decisional approach, minimizing losses from alternative actions at Hart Mountain NAR, would focus on Alternative C, followed by Alternative D.

Selection of Alternatives B, C, D, or E would impact cattle grazing adversely. The magnitude of impact would depend on whether ranchers could find alternative pasture in the local area (impacts would be low), or whether they would need to reduce production (impacts would be more substantial).

By the 15-year benchmark, increased business revenue associated with recreation/tourism under Alternatives B, C, or D would exceed adverse impacts on agriculture if ranchers are able to find alternative local pasture. If not, business revenues will be greater at the 15-year benchmark only under Alternative B. At the 50 years, net business revenues would have increased by $157,000 to $697,000, depending on assumptions used, for all alternatives save E. Inclusion of non-market beneficial effects would increase these net differentials further. Total market and non-market economic benefits for each alternative, relative to Alternative A, are identified in Table 2-11.

Table 2-11. Total market and non-market economic benefits for each alternative, relative to the Baseline Management Alternative (Alternative A).

	Alternative			
Basic Assumption(s)	B	C	D	E
	----- thousands of annual dollars -----			
At 15 years:				
low impact on grazing:	735	248	266	-707
higher impact on grazing:	642	22	-11	-984
At 50 years:				
low impact on grazing:	1,045	568	702	-786
higher impact on grazing:	952	342	425	-1,063

SECTION THREE - ALTERNATIVES CONSIDERED, BUT NOT STUDIED IN DETAIL

Multiple Use Alternative

A number of people advocated a multiple use alternative. It was not developed because 1) a multiple use alternative would not significantly contribute toward the achievement of Refuge goals, and 2) the National Wildlife Refuge System Administration Act and the Refuge Recreation Act specify that all units of the NWRS must be managed under the principle of dominant use. Although a variety of uses may be permitted on the Refuge, they must be compatible with the purpose for which the Refuge was established.

Maximum Recreational Use

Developing tourism to its maximum use and allowing camping anywhere, including alongside all roads, on the Refuge was not considered in detail because this alternative (1) would be incompatible with the Refuge's purpose, (2) conflicts with Refuge goals, and (3) would have significant negative impacts to wildlife and other natural resources.

Maximize Commercial Livestock Production

Maximizing commercial livestock production on the Refuge was not considered in detail because it would be incompatible with the purpose for which the Refuge was established. In general, environmental impacts would be severe.

No Public Use of the Refuge

The alternative of closing the Refuge to all public use was not considered in detail because of the importance for people to see and learn about the natural environment, and for the public to have the opportunity to enjoy their public lands. This alternative would conflict with Service policy, NWRS goals, Refuge goals, and a number of acts directing management of the Refuge.

Other Management Strategies not Studied in Detail

Introduction of wolves was not considered in detail because information was not found to support that wolves were resident in the area of Hart Mountain. Introduction of bison to be used in place of cattle also was not considered in detail. Campground fees were not studied in detail because of the relatively small number of people visiting the Refuge annually and the extensive amount of administrative time and cost of running such a program.

Chapter 3

AFFECTED ENVIRONMENT

SECTION ONE - REFUGE ECOSYSTEM

The Refuge ecosystem is made up of many interacting and interdependent components. Ecosystems are much too complex to describe without addressing components of the system separately. However, each component or subcomponent does not exist in isolation from the other components. Changes incurred by one component of the environment affect other components, which in turn affect others, and so on.

This section describes the existing condition of various components of the Refuge ecosystem. Combined, these components directly and indirectly affect wildlife on the Refuge. Vegetation and watershed values are addressed together because vegetation, soil, and water-cycling are integrally interrelated. Vegetation cover has substantial influence on soil characteristics. Conversely, soil characteristics can greatly influence vegetation cover. Soil and vegetation characteristics interact to influence water cycling, etc.

The two core habitat problems outlined in Chapter 1, Section Two identify the primary underlying factors currently limiting healthy and balanced populations of native wildlife on the Refuge. As such, particular attention is given to the conditions of environmental components addressed by these problems. The two core problems, restated from Chapter 1, are: (1) shrub and juniper cover are unnaturally high throughout the Refuge, and periodic fires are lacking in these habitats; and (2) stream channels are eroded, and riparian vegetation on streambanks is deficient along the majority of Refuge streams.

The discussion of the Refuge ecosystem is presented in three parts. The Habitat section describes geological features, climate, soils, water, and vegetation of the Refuge. The Wildlife section describes five featured species of wildlife and wildlife species richness. The third section describes special management areas.

I. HABITAT

A. LOCATION, ELEVATION, AND LANDFORMS

Hart Mountain NAR is located in the northwestern corner of the Great Basin. The Great Basin encompasses virtually all of Nevada, and it extends into adjoining states, including southeastern Oregon. The total area encompassed within Hart Mountain NAR's borders is 277,893 acres. This includes 11,998 acres of state-owned inholdings, and 14,600 acres of privately-owned or county-owned inholdings.

Elevation ranges from 4,400 feet in the Warner Valley to 8,060 feet on the peak of Hart Mountain. Most of the high tableland of the Refuge is between 6,000 and

6,500 feet. The steep escarpment on the western edge of the Refuge was formed by faulting; it rises 1,500-2,500 feet above the Warner Valley. Although the ridge is continuous from the south end of the Refuge to the north end, it is divided by name into Hart Mountain (southern segment) and Poker Jim Ridge (northern segment). Hart Mountain consists of a massive upthrust fault block 12 miles long and 4 miles wide, bounded on all sides by very steep escarpments. Poker Jim Ridge, generally of lower elevation, is only bounded on the west by a steep escarpment. The east face slopes gently into the tableland. A group of dome shaped hills, the Intermediate Hills, adjoin the east slope of Hart Mountain.

Most of the Refuge consists of lava tableland, sloping gently eastward from Hart Mountain and Poker Jim Ridge toward Catlow and Guano Valleys. Minor faulting has produced many low rimrock escarpments throughout this area, especially in the southern portion of the Refuge. There also are numerous dry lake beds, playas, and small drainages scattered over the tableland, often in association with rimrock areas.

Shirk Ranch, 1,400 acres, is located four miles south of the main part of the Refuge. It is situated at the end of Guano Creek where it enters the northern end of Guano Valley. Guano Valley is bounded on the west by a fault, a portion of which pass through the southeastern corner of the main part of the Refuge. Shirk Lake receives spring runoff from Guano Creek in all but the driest years. Guano Creek is controlled for downstream use by Jacob's Reservoir, located about 12 miles upstream from Shirk Lake.

B. CLIMATE

Climate on the Refuge is generally characterized by dry, hot summers and cold, sometimes severe winters. Annual precipitation generally ranges from 6-8 inches along the footslope of the west escarpment, 8-12 inches on the tableland, to 12-18 inches on the mountain. Much of this precipitation is received as snow. The frost-free period is believed to be less than 50 days, except for the footslope area which has a maximum frost-free period of 110 days.

C. SOILS

Soils on Hart Mountain NAR primarily are a product of volcanic activity, lake sedimentation, and water erosion. A level 2 soil survey was conducted by the Soil Conservation Service (SCS) in the late 1980s (USSCS 1993). About 85 percent of the soils on the Refuge were classified to order. Another 3 percent were classified as rock outcrop or rubble, and the remaining 12 percent were classified as inclusions or were not described. Inclusions generally were patches of soils less than about 100 acres. As such, the survey primarily described upland soils. Soils usually classified to family; 301 series were classified. The following discussion addresses the 85 percent that were described.

Five soil orders are represented on the Refuge. They are Aridisols, Mollisols, Vertisols, Alfisols, and Inceptisols. Aridisols are characterized by low moisture conditions; when soils are warm enough for plant growth, moisture is usually deficient. They are light in color and have a low organic content. A consequence of low organic content is a low amount of nitrogen available to plants. As such, vegetation generally is sparse, and because leaching of minerals is prevented, calcification is common. In spite of their low organic content, they are well developed soils. Some of the Aridisols are very shallow, having a hardpan in the B horizon. This soil order accounts for about 57 percent of Refuge soils. They are the major soil of the tableland and desertland of the Refuge (Map 2-9). They also occur on fans, footslopes, and terraces.

Mollisols are relatively fertile, dark-colored soils found in higher precipitation zones and in alluvial floodplains on the Refuge. They are high in organic matter, meaning that decaying plant material is a common feature of these soils. Mollisols account for about 27 percent of Refuge soils, and are the major soil of uplands in the Intermediate Hills and on Hart Mountain (Map 2-9). They also occur in valley bottoms (riparian areas) and basins.

Vertisols, because of their varying moisture levels and high clay content, have high shrink swell rates. Deep cracks form during dry periods and these fuse back together when wetted. Top soil gradually mixes into the soil profile by falling into cracks. This has earned them the reputation of being self-plowing. Vertisols, occurring primarily in valley bottoms and basins, comprise about 1 percent of Refuge soils.

Alfisols are relatively fertile. They have a relatively high content of clay, but this is located in the B horizon (below the top soil). The clayey accumulation generally is not favorable to plant growth, especially where erosion has occurred exposing clay as a surface layer. Alfisols, comprising less than 1 percent of Refuge soils, are found in valley bottoms and basins.

Inceptisols are characterized by limited to moderate development (i.e., they are not substantially different than their parent material). They comprise about 2 percent of soils on the Refuge, and also are found in valley bottoms and basins. Additional information on soils is provided under each major heading of section F (Vegetation and Watershed Values), and in Appendix C.

D. WATER

Major water sources on Hart Mountain NAR are streams, springs, lakes, reservoirs, and aquifers. There are over 150 miles of perennial and semi-perennial streams, less than 200 acres of permanently flooded lakes and reservoirs, and an undetermined amount of ground water. Streams and springs, a small number of perennial lakes, and water developments in several other lakes are critical sources of water for wildlife in the Refuge proper. Four water guzzlers are located on Poker Jim Ridge.

Major impacts to water quality on Hart Mountain NAR primarily are sedimentation and elevated water temperature in streams. Limited information exists on sedimentation and fecal coliform bacteria levels. Information on ground water is not available for the Refuge. Because of these data limitations, further analysis of ground water quality in this EIS will not be attempted.

Upland vegetation types affect water quality primarily to the extent that soil erosion causes sedimentation of streams and lakes. Habitat conditions within wetland vegetation types affect water quality of streams to the extent that (1) vegetation traps sediments coming from uplands, (2) vegetation traps sediment during flooding events, (3) erosion of streambanks contributes to sedimentation, (4) riparian meadows store water. The pondweed and aquatic non-vegetated types are the primary open water habitats on the Refuge. Lakes that usually have year-round water are classified either as pondweed or aquatic non-vegetated types. All streams on the Refuge are classified as aquatic non-vegetated.

Additional physical and biological information on water sources is provided under section F, part 7. Acreages are listed in Table 3-6. Chemical characteristics are unavailable for waters of Hart Mountain (however, see the response to comment 528, Appendix O).

E. AIR QUALITY

Air quality in the area is considered good, although information specific to Hart Mountain NAR is unavailable at present. The most commonly experienced weather patterns in Southeastern Oregon are stable continental air masses and frontal weather conditions. Transport wind (free air) direction during stable continental air mass conditions is southwesterly. Transport wind (free air) direction during frontal passage is generally northwesterly. These two climactic conditions comprise the greatest percentage of upper air movement days. However, changes are abrupt and transitioning conditions can be from any direction.

F. VEGETATION AND WATERSHED VALUES

Wildlife distribution and abundance primarily is influenced by vegetation, landscape features and water. Therefore, knowing how vegetation and other habitat features are distributed over the landscape is important for understanding wildlife distribution and abundance. With this in mind, the Service mapped vegetation

Table 3-1. Dominant plants of succession stages of upland vegetation types of Hart Mountain NAR, Oregon. Two types of plants separated by a dash (-) are co-dominants. Plants listed before a slash (/) are dominant over those listed after a slash; in many cases they comprise the overstory.

Biome Vegetation Type	Succession Stage Early	Mid	Late	Very Late
Desertshrub				
Wyoming Big Sagebrush	grass-forb	grass/shrub	shrub/grass	juniper/shrub/grass
Black Sagebrush	grass	grass/shrub	shrub/grass	--
Spiny Hopsage	grass-forb	grass/shrub	shrub/grass	--
Winterfat	grass	grass/shrub	shrub/grass	--
Squirreltail	barren	--	grass	--
Salt Desert Shrub	grass	grass/shrub	shrub/grass	--
Black Greasewood	grass	grass/shrub	shrub/grass	--
Shrub-grassland				
Low Sagebrush	forb-grass	forb-grass/shrub	shrub/grass-forb	juniper/shrub/grass
Mountain Big Sagebrush	grass-forb	grass/shrub	shrub/grass	juniper/shrub/grass
Big Sagebrush-bitterbrush	grass-forb	grass/shrub	shrub/grass	juniper/shrub/grass
Fescue	grass-forb	--	grass/shrub	--
Wheatgrass	grass-forb	--	grass/shrub	juniper/grass/shrub
Basin Big Sagebrush	grass-forb	grass/shrub	shrub/grass	--
Montane Shrub				
Mountain Shrub	grass-forb	grass/shrub	shrub/grass	juniper/shrub/grass
Mountain Mahogany	grass/shrub	shrub/grass/young tree	mature tree	old-growth tree
Conifer Woodland				
Western Juniper	grass/shrub	shrub/grass/young tree	mature tree	old-growth tree
Montane Conifer Forest				
Ponderosa Pine	grass/shrub	shrub/grass/young tree	mature tree	old-growth tree
White Fir	grass/shrub	shrub/grass/young tree	mature tree	old-growth tree
Terrestrial Non-vegetated				
Terrestrial Non-vegetated	Non-vegetated	--	--	--

Vegetation Succession is the tendency of plant species occurring in an area to change through time. Succession goes through a number of predictable stages. The following description pertains to shrubland habitats on the Refuge. The very earliest stage of succession happens right after a disturbance (e.g., fire, sagebrush chaining) that eliminates most, if not all, of the above ground parts of plants in the area. Grasses and forbs many times are the most common plants after a disturbance. In this early stage of vegetation succession, the area looks like a grassland. Shortly after this, shrubs such as sagebrush begin to grow (mid succession). When the shrubs become mature and are common on the site, the area is in late succession. Grasses and forbs are still common at this stage, but grow between and under the canopy of shrubs. In some areas, western juniper begins to increase in abundance if juniper are not controlled through burning or other means (very late stage of succession).

types on the Refuge (Maps 1-3 and 1-4). Names given to upland vegetation types identify the dominant plant species in the overstory when the plant community is in a late stage of vegetative succession (Table 3-1). Appendix B provides a basis for the vegetation type-classification system and how it was developed.

Names given to wetland vegetation types identify the dominant plant species in the overstory when the plant community is in a very late stage of site progression, or late stage if a very late stage is not represented (Table 3-2). The term site progression (progression) is used to describe the process of change in wetland vegetation as water supply changes (Leonard et al. 1991). Different vegetation characterizes different stages of site progression. During an early stage of progression, water is limited. In a very late stage of progression, sufficient water is available to support the vegetation depicted by the name of the vegetation type. For example, sedges, rushes, and bluegrass characterize the sedge-rush-bluegrass vegetation type when there is sufficient water to support these plants (Figure 3-1a). In an early stage of progression in the sedge-rush-bluegrass type, sagebrush or rabbitbrush dominate the plant community because sufficient water is not

Table 3-2. Dominant plants of progression stages of wetland vegetation types of Hart Mountain NAR, Oregon. Plants separated by a dash (-) are co-dominants. Plants listed before a slash (/) are dominant over those listed after a slash; in many cases they comprise the overstory.

Biome Vegetation Type	Progression Stage Early	 Mid	 Late	 Very Late
Deciduous Forest				
Aspen	shrub/grass-forb	grass-forb	grass-forb/aspen	aspen/sedge-rush-forb
Riparian Shrub				
Mixed Deciduous Shrub	shrub/grass-forb	grass-forb	grass-forb/dec. shrub	dec. shrub/sedge-forb
Willow	shrub/grass-forb	grass-forb	grass-forb/willow	willow/sedge-rush-forb
Interior Marshland				
Bluegrass-ryegrass	shrub/barren	shrub/grass	grass/shrub	grass
Sedge-rush-bluegrass	shrub/grass	grass/shrub	grass	sedge-rush-grass
Silver Sagebrush	shrub/barren	shrub/grass	shrub/grass-forb	sedge-rush-forb/shrub
Poverty Weed-primrose	barren	--	poverty weed-primrose	--
Rush-spikerush-arnica	barren	poverty weed-primrose	rush-spikerush-arnica	--
Cattail-bulrush	barren	rush-spikerush-arnica	cattail-bulrush	--
Saltgrass	greasewood	grass/greasewood	grass	--
Submerged Aquatic				
Pondweed	barren or grass	rush-spikerush-arnica	pondweed	--
Aquatic Non-vegetated				
Aquatic Non-vegetated	non-vegetated	--	--	--

a)

b)

Figure 3-1. Examples of the sedge-rush-bluegrass vegetation type on Hart Mountain NAR, Oregon. A sedge-dominated plant community (a) indicates a high water table and healthy conditions (this is in a very late stage of site progression). A rabbitbrush-dominated plant community (b) indicates a lowered water table and degraded conditions (this is in an early stage of site progression).

available to support sedges and rushes (Figure 3-1b). Differences in vegetation between Figures 3-1a and 3-1b stem from differences in water table levels. Appendix B presents the basis for using site progression.

Water supply in riparian areas (wetlands associated with streams) is influenced mainly by the degree to which stream channels have been eroded. Eroded stream channels cause water tables to decline. This impacts riparian vegetation along the stream channel as well as the full width of floodplains. A diminished water table is the primary reason why rabbitbrush dominates the meadow illustrated in Figure 3-1b. The sedge community illustrated in Figure 3-1a flourishes because the water table is near ground level.

Vegetation in basin wetlands responds similarly to water levels, except that water levels are influenced more by year to year fluctuations in precipitation. Higher levels of precipitation result in more water flowing into basins.

The remainder of the Habitat section describes general conditions of major groupings of vegetation types.

1. <u>Desert shrub and Shrub-grassland Biomes</u>

Upland desert shrub and shrub-grassland habitats comprise about 90 percent of the Refuge. The four major vegetation types that are included in this category are Wyoming big sagebrush, low sagebrush, mountain big sagebrush, and big sagebrush-bitterbrush (Map 1-3). They comprise about 93 percent of shrubland and grassland habitat on the Refuge.

The primary limitations of these vegetation types in providing quality habitat for all native wildlife species are that excessive shrub cover (Figure 3-2) prevails over the

<u>Vegetation Cover</u> is the amount of area taken up by plants. Vegetation cover is commonly divided into cover of different kinds of plants such as grasses, forbs and shrubs. The reason for describing the vegetation of an area in terms of cover is because the amount of area taken up by different kinds of plants can reveal much about the area. In the example to the right, <u>shrub cover</u> is 20%, <u>grass cover</u> is 10%, and <u>forb cover</u> is 5%. Total vegetation cover is therefore 35%, and 65% is non-vegetated (bare ground, rocks, dead plant parts, etc.).

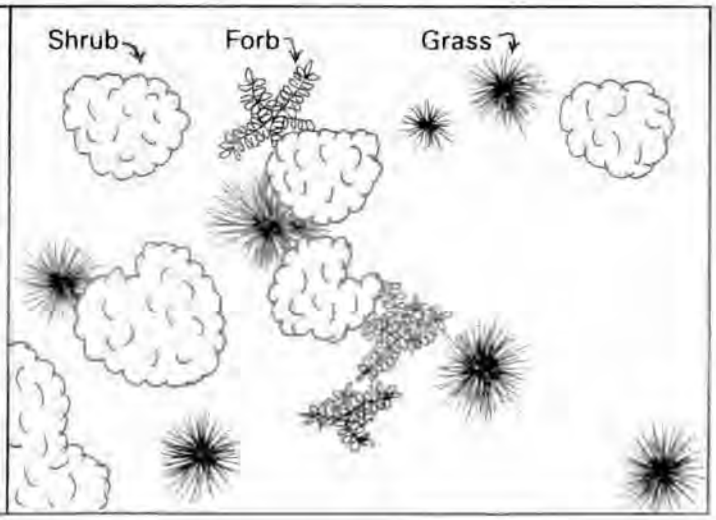


Figure 3-2. Definition and illustration of vegetation cover.

landscape. In some areas, western juniper cover is excessive. Excessive shrub or juniper cover over the landscape can adversely affect habitat diversity, herbaceous vegetation cover, and watershed values. These factors are described in more detail below.

a) **Habitat Diversity**

The Refuge currently provides an abundance of habitat for wildlife species that use late succession stages of Wyoming big sagebrush, low sagebrush, mountain big sagebrush, and big sagebrush-bitterbrush (Table 3-3). It also provides an abundance of western juniper habitat compared to conditions that existed before Euro-American settlement.

Habitat diversity refers to the variety and interspersion of habitat types in a particular area (geographic area or vegetation type). Figure 3-3 illustrates what is meant by habitat diversity. "E-M-L" depicts an area of a vegetation type with relatively high habitat diversity, whereas "L" depicts the same area if patches of

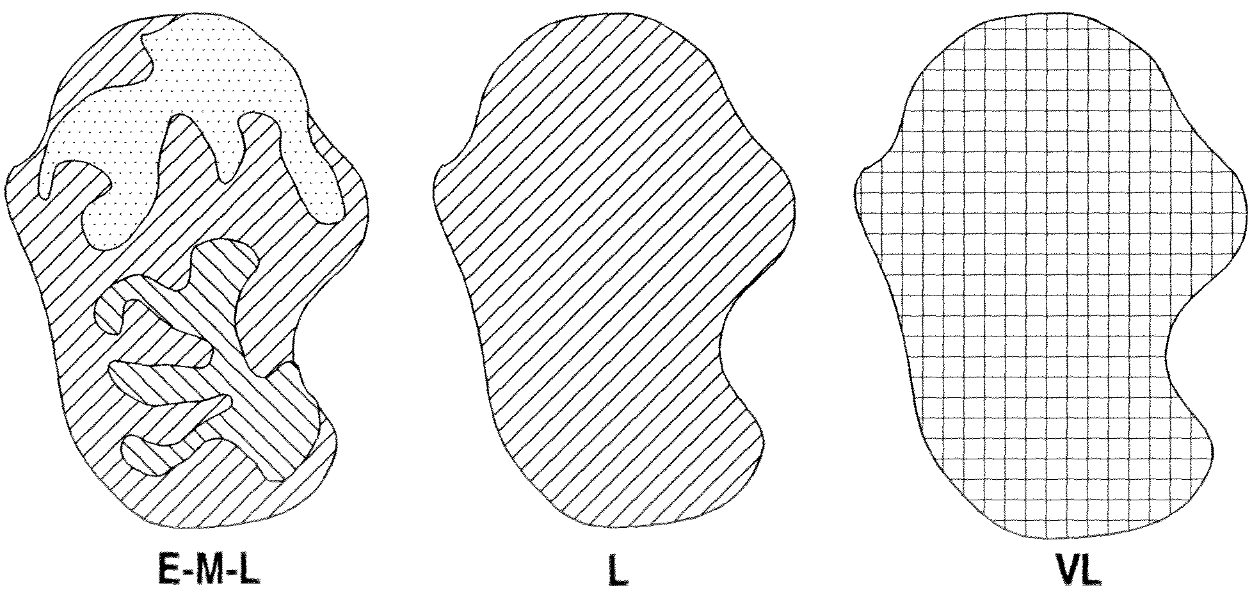


Figure 3-3. Three possible outcomes of vegetation management on habitat diversity. For example, in mountain big sagebrush, periodic burning will produce a mosaic of succession stages (E-M-L). Fire suppression over a period of years will allow all of the vegetation type to advance into late succession (L), or in some areas, and over a longer period of time, very late succession (VL). Very late succession in sagebrush is characterized by juniper woodland. Vast areas of late succession (L) characterizes the existing condition of much of the Refuge.

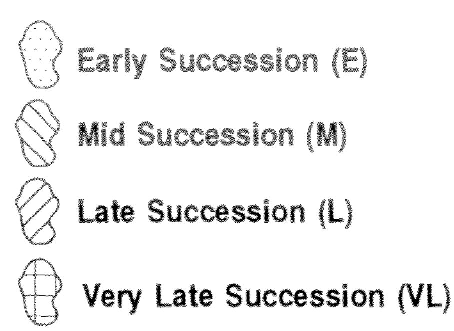


Table 3-3. Acres of existing succession stages of upland vegetation types, Hart Mountain NAR, Oregon (1993).

Biome Vegetation type	Early	Mid	Late	Very Late	Total
Desert Shrub					
Wyoming big sagebrush	1,489	0	88,087	1,552	91,128
Salt desert shrub	0	0	1,546	--	1,546
Winterfat	0	0	1,199	--	1,199
Black greasewood	0	0	701	--	701
Black sagebrush	0	0	648	--	648
Spiny hopsage	0	0	374	--	374
Squirreltail	0	--	163	--	163
Shrub-grassland					
Low sagebrush	6,900	1,182	89,328	7,466	105,506
Mountain big sagebrush	528	1,857	19,003	2,475	23,863
Big sagebrush-bitterbrush	2,430	1,748	3,486	3,242	10,096
Wheatgrass	0	--	2,800	1,330	4,130
Basin big sagebrush	0	0	3,168	--	3,168
Fescue	0	--	149	--	149
Montane Shrub					
Mountain shrub	87	40	2,194	629	2,950
Mountain mahogany	0	0	0	1,449	1,449
Conifer Woodland					
Western Juniper	0	0	0	4,890	4,890
Conifer Forest					
Ponderosa Pine	0	0	69	0	69
White Pine	0	0	0	13	13
Terrestrial Non-vegetated					
Terrestrial Non-vegetated	5,366	0	0	0	5,366
TOTAL	11,434	5,457	218,281	23,046	258,218

early succession had not been created through periodic shrub removal -- habitat diversity is low. A mixture of early, mid, and late succession stages is desirable; the more different types of habitats there are in an area, the higher the diversity. Vast areas of the Refuge are in a late stage of succession (Table 3-3).

Consequently, there is very little variety in habitat (habitat diversity) over much of the Refuge. Figure 3-4 illustrates the relative amount of habitat diversity (bar on the left) for different regions of the Refuge (Map 2-9). The bar on the right indicates the approximate number of acres encompassed by each region. Habitat diversity is highest on Hart Mountain and the Intermediate Hills, and lowest on the extensive tableland area. There are two main sources of diversity: (1) interspersion of vegetation types, and (2) interspersion of succession stages within a vegetation type. The first type is more-or-less permanent, whereas the second can be manipulated. At present, most habitat diversity on the Refuge stems from the first (Appendix F).

The Refuge provides very little habitat for wildlife species that depend on grassland-like habitat (early-mid succession stages; Table 3-3) (Figure 3-5). Only about seven percent of

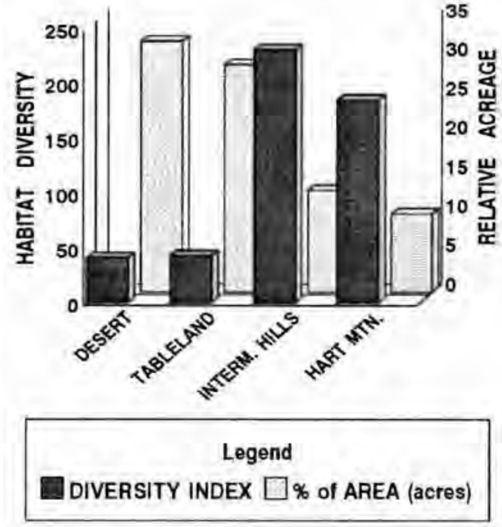


Figure 3-4. Relative habitat diversity by geographic region of Hart Mountain NAR, Oregon. Diversity is based on the amount of edge between different vegetation types and succession stages.

Figure 3-5. An early stage of vegetation succession in an area within the low sagebrush vegetation type.

upland habitats are in an early or mid stage of succession. The vast, unbroken tracts of late succession habitat on the Refuge primarily are a consequence of fire suppression. Heavy livestock grazing also played a part by reducing grasses and forbs that are important in carrying fires through shrub stands. Historically, fires burned shrubland on a periodic basis which produced large grassland habitats free of shrubs (Gruell 1986). Deming (1961b) characterized the shift away from grassland habitat on the Refuge as a "change from dominant bunchgrass range to a sagebrush forest" based on observations of people living in the local area.

b) **Shrub Cover**

Not only has the land encompassed by the Refuge experienced an increase in the amount of land in late succession, shrub cover in late succession stands has increased over historic levels. Refuge staff have noted increased sagebrush cover since Refuge establishment (Deming 1961b).

Shrub cover, mainly sagebrush, is unnaturally high in the major upland vegetation types on the Refuge based on data collected during 1989-1992 (Table 3-4). Shrub cover is considered unnaturally high because it currently restricts cover of grasses and forbs (Winward 1991).

Conditions in the eastern one-third of the Refuge provide a good example. Wyoming big sagebrush is the most common shrub throughout this area. Shrub cover in this habitat averages 27 percent, and ranges from 13 to 43 percent. Shrub cover in healthy stands of Wyoming big sagebrush generally is less than 15

Table 3-4. Summary of vegetation characteristics[a] of late successional stands of major upland vegetation types of Hart Mountain NAR, Oregon; data collected 1989-1992.

Vegetation Type	Percent Shrub Cover[b] (average)	Percent Grass Cover (average)	Percent Forb Cover (average)	Sample Size
Wyoming Big Sagebrush	27	5	5	68
Low Sagebrush	21	11	9	117
Mountain Big Sagebrush	33	13	11	90
Big Sagebrush-Bitterbrush	38	17	7	51

[a] Data collected by the Game Bird Research Program of Oregon State University (Department of Fisheries and Wildlife), and the U.S. Fish and Wildlife Service using methods described by Crawford et al. (1992).

[b] Desired shrub cover: Wyoming big sagebrush = 15% or less, mountain big sagebrush = 20% or less (Winward 1991), low sagebrush = 20% or less, big sagebrush-bitterbrush = 30% or less.

a)

b)

Figure 3-6. Examples of the Wyoming big sagebrush vegetation type on Hart Mountain NAR, Oregon. Excessive shrub cover (a) limits establishment of herbaceous vegetation. Although shrub cover in the lower photograph (b) is high, it is low enough to allow growth of herbaceous vegetation.

percent (Winward 1991). As shrub cover increases over 15 percent, grass and forb cover decreases. Figure 3-6 illustrates a Wyoming big sagebrush stand that has very little understory (photo a) and one that has less shrub cover and higher herbaceous cover (photo b). Shrub cover is higher and herbaceous cover is lower than what can potentially occur at the site where the second photograph was taken. In the mountain big sagebrush vegetation type, shrub cover in the 30 to 40 percent category restricts herbaceous production (Winward 1991). Healthy stands generally have less than 20 percent shrub cover. Shrub cover in mountain big sagebrush on the Refuge averages a little over 30 percent (Table 3-4).

Shrub cover does not seem to have changed substantially in late succession stands since 1968 (Table 3-5). According to recent research, change would not be expected without reducing or eliminating shrub cover (Sneva et al. 1984, Laycock 1991, Winward 1991). See also see Appendix C. Changes in livestock grazing management generally do not result in significant reductions in shrub cover.

Unnaturally high shrub cover is a consequence of heavy livestock grazing during the latter half of the 1800s and early 1900s and fire suppression which has continued under current management of the Refuge (Pyle 1991a). Heavy livestock grazing contributed to high shrub cover by reducing grass and forb cover. Once shrubs became larger and more abundant, less space, water and nutrients remained available for grass and forb establishment and growth.

c) **Western Juniper Expansion**

Only about 20 percent of the current distribution of western juniper on the Refuge is classified as western juniper vegetation type. The remaining 80 percent of its distribution consists of areas where juniper has expanded its range. It has expanded into Wyoming big sagebrush, low sagebrush, mountain big sagebrush, big sagebrush-bitterbrush, wheatgrass, and mountain shrub. Historically, periodic fires limited the spread of western juniper into these habitats (Kauffman 1990).

Juniper invasion has expanded into nearly one-third of the big sagebrush-bitterbrush and wheatgrass vegetation types (Table 3-3). Although it has only invaded about seven percent of the low sagebrush vegetation type, juniper has invaded significant amounts of productive habitat, especially on Poker Jim Ridge.

Juniper expansion into the big sagebrush-bitterbrush type limits the productivity of bitterbrush stands (Adams 1975, Dealy et al. 1978). Invasion in the wheatgrass type has reduced the quality of habitat for bighorn sheep and other wildlife dependent on grassland habitat. On the other hand, habitat for woodland-dependent birds has increased.

According to work done by Miller et al. (1986) increased juniper cover has reduced the amount of water available to herbaceous vegetation and lowered discharge from springs and streams.

Table 3-5. Shrub, grass and forb cover of four vegetation types[a] (in late succession) on Hart Mountain NAR, Oregon in 1968[b] and 1992[c].

	Percent Shrub Cover		Percent Grass Cover		Percent Forb Cover		Sample Size[b,c]	
Vegetation Type	1968	1992	1968	1992	1968	1992	1968	1992
Wyoming Big Sagebrush	25	23	10	5	2	2	7	38
Low Sagebrush	24	25	9	11	10	8	8	37
Mountain Big Sagebrush	31	31	43	18	13	11	4	9
Sagebrush-bitterbrush	45	40	28	15	10	3	4	4

[a] Percent cover figures may differ from those presented in Table 3-2 because only data collected from some range sites (only those that were sampled in 1968, 1979, 1987 and in 1992) were used. Range sites are subdivisions of vegetation types. Appendix C presents data by range site, and includes data collected in 1979 and 1987.

[b] Sampling procedures are unknown for data collected in 1968. Data were collected by the Soil Conservation Service, USDA (Anderson and Franzen 1979).

[c] Each vegetation sample in 1992 consisted of measuring shrub cover along two 32-foot tapes, and estimating grass and forb cover within 10 subplots measuring 0.7 x 1.6 feet (Crawford et al. 1992). Data were collected by Department of Fisheries and Wildlife, Oregon State University, and the U.S. Fish and Wildlife Service.

d) **Herbaceous Cover and Height**

Cover of grasses and forbs currently is restricted throughout much of the Refuge because of unnaturally high shrub cover and an increase in the density and distribution of western juniper. Although data presented in Table 3-5 seems to indicate a reduction in grass and forb cover since 1968, some of the difference may be due to differences in precipitation, timing of data collection, and sampling techniques. Height of grasses and forbs in some areas is directly affected by cattle and horse grazing.

Plant-species composition is substantially different from its natural potential (50 to 100 percent different) in a about 85 percent of areas in a late stage of succession, assuming that conditions in late succession stands have not changed substantially since 1968 when the range site and condition inventory was conducted by SCS (Appendix C). At present, nearly 90 percent of the desert shrub and shrub-grassland biomes (which comprise about 94 percent of Refuge uplands) are in a late stage of succession (and about 85 percent of this is in relatively low ecological condition). This means that ecological conditions are seriously degraded throughout most of the Refuges uplands.

The amount of residual grass cover, which is grass left standing over the winter into the next growing season, is a function of grass cover and height. It is at a low level on the Refuge mainly because of excessive shrub cover, but also because of cattle and horse grazing in some parts of the Refuge. Residual grass cover is important to a number of wildlife species.

Grazing by large mammals played a limited role in shaping habitat in the northern Great Basin before the introduction of domestic livestock (Mack and Thompson 1982, Young et al. 1976). As such, grasses in this region are less resistant to grazing than grasses that evolved under heavier grazing pressure (Mack and Thompson 1982).

e) **Soils and Watershed**

Excessive shrub cover, expansion of juniper distribution, and relatively low herbaceous cover likely has reduced water infiltration and increased water runoff throughout much of the Refuge, based on work done elsewhere by Sturges (1993) and others. Increased water flow over the surface of the land increases soil erosion and increases the amount of sediments (fine soil particles) in streams and lakes. Reduced infiltration of water results in lesser amounts of moisture available to plants, and diminishes percolation into groundwater sources, which in some areas are important sources of water for springs and streams (DeBano and Schmidt 1989).

Litter, which is the accumulation of dead plant material on the ground, also is important for increasing penetration of water into soil and protecting soil from erosion (Blaisdell et al. 1982). Litter seems to have increased in some areas of the Refuge during the period 1979 through 1987 (Anderson and Franzen 1988), possibly due to reduced pressure from livestock. It may have had more to do with high vegetation production associated with several years of high precipitation.

The following discussion of soils and precipitation levels addresses the most prominent vegetation types of the desert shrub and shrub-grassland biome on the Refuge. Information was obtained from Anderson (1978).

Soils of the Wyoming big sagebrush vegetation type in the northeastern corner of the Refuge (Map 3-1) generally are gravelly and loamy near the surface with a hardpan at a depth of about 18 inches. Subsoils generally are loamy to moderately fine textured. Along the eastern border of the Refuge, soils in the Wyoming big sagebrush vegetation type are moderately fine textured; a shallow hardpan is present. At the base of the mountain (western border), soils are deep, and can be very rocky on slopes. Wyoming big sagebrush receives the lowest level of precipitation (8-11 inches on average per year) of the major vegetation types.

Soils of the low sagebrush vegetation type throughout the tableland of the Refuge (large, wide strip of low sagebrush running through the center of the Refuge; Map 3-1) are generally very stony at the surface and very shallow. A shallow hardpan or dense clay subsoil (at a depth of about 12 inches) exists in most areas that limits root-growth. Surface soils are loamy and stony. Small pockets of somewhat deeper soils exist within the low sagebrush tableland. Hardpans in these areas are about 15-18 inches below the surface, and soils are of a gravelly loamy nature. Terrain of tableland low sagebrush is gently sloping and precipitation generally is about 10-12 inches on average per year.

The soils of the mountain big sagebrush vegetation type on top of the mountain and Intermediate Hills where the terrain is rolling or sloping, are gravelly, loamy and deep. On steep south facing slopes along the western face of Hart Mountain, and in association with talus slopes, soils are moderately course to medium textured, and are very stony at the surface. On north facing slopes along the western face of the mountain where terrain is moderate to steep, soils are medium textured at the surface and are moderately deep. Precipitation generally is above 7-12 inches per year on south facing slopes to more than 15 inches per year on top of the mountain. At higher elevations where soils on top of ridges are shallow (12-16 inches) and gravelly, pockets of the low sagebrush vegetation type are found within the mountain big sagebrush vegetation type.

The big sagebrush-bitterbrush vegetation occurs on lower slopes of the Intermediate Hills, the eastern footslope of Hart Mountain and adjacent tableland. Soils are moderately rocky and deep, and are medium textured at the surface. The amount of gravel and stone increases with depth. Terrain is rolling to sloping and precipitation averages about 11-15 inches per year on average.

2. Montane Shrub Biome

The mountain shrub vegetation type includes stands of mountain balm, gland ocean spray, bittercherry, and currants. It occurs on north slopes where snowdrifts form during winter. Many mountain balm thickets were severely impacted by frost during the winter of 1990-1991 when snow drifts did not insulate the vegetation. Recovery of these areas seems to be taking place based on the prevalence of re-sprouting shrubs. Livestock grazing may have impacted some mountain shrub thickets in the Intermediate Hills. A number of mountain shrub stands are being invaded by juniper (Table 3-3).

The mountain mahogany vegetation type occurs mainly on rocky ridges and other areas that provide protection from fire. Although mountain mahogany has expanded into other vegetation types because of fire suppression in those areas, range expansion of this species has not been as extensive as that of western juniper.

The mountain shrub vegetation type is interspersed within the mountain big sagebrush vegetation type at higher elevations on north slopes where snow drifts occur. Soils are deep, gravelly and loamy throughout (Anderson 1978). Although precipitation is about 12-15 inches per year, snow drifts that form in the winter contribute to additional moisture. Where mountain mahogany occur, basalt bedrock underlies soils that are shallow to moderately deep and rocky.

3. Conifer Woodland and Forest Biomes

Currently, about eight percent of the Refuge is wooded (Table 3-3). Most of this (about 6 percent of the Refuge) consists of western juniper that has invaded other vegetation types. There are three types of woodland and forest habitats: western juniper (approximately 16,700 acres, including acres invaded by juniper), ponderosa pine (69 acres), and white fir (13 acres).

The western juniper vegetation type (4890 acres) supports old-growth juniper, and occurs on rocky ridges and other areas that provide protection from fire. The present distribution of juniper includes another 11,800 acres that has invaded other vegetation types, and generally is less than 100 years old. Juniper that has invaded other vegetation types was described previously.

Soils in the western juniper vegetation type generally are medium textured at the surface and are moderately fine to fine textured in subsoils, and are stony. Soils are shallow to moderately deep, and areas of basalt rubble and outcrops are common. Precipitation is 9-12 inches per year on average.

4. Terrestrial Non-vegetated Biome

The cliff and talus habitat running the length of the Refuges' western boundary comprise the bulk of the terrestrial non-vegetated vegetation type (Map 1-3). Talus slopes on the east side of Hart Mountain comprise most of the remainder. The terrestrial non-vegetated type comprises about two percent of the Refuge. Houses and other structures made by people are included in this category because they provide nesting habitat for some species of birds such as cliff swallows and robins (Maser et al. 1979b).

5. Deciduous Forest and Riparian Shrub Biomes

These habitats comprise less than one percent of the Refuge. The main riparian vegetation types are quaking aspen (1,465 acres), mixed deciduous shrub, (212 acres), and willow (355 acres) (Table 3-6). Most of these habitats are found along streams, aside from quaking aspen. Although quaking aspen grows along many Refuge streams in headwater areas, much of it occurs in snowpockets.

About twenty percent of the area occupied by these vegetation types is characterized as having healthy stands of deciduous trees or shrubs and an understory of sedges, rushes, grasses, and a large variety of forbs. Vegetation diversity in these stands is high. These characteristics represent the potential of the aspen, willow, and mixed deciduous shrub vegetation types.

Soils in the aspen vegetation type generally are deep, loamy, and gravelly (Anderson 1978). Precipitation is about 12-15 inches per year on average. About thirty percent of the aspen, willow, and mixed deciduous shrub types retain an overstory of the characteristic vegetation, but have lost much of their understory (late stage of progression; Table 3-6). The aspen stand shown in Figure 3-7 has an overstory of mature aspen, but has a limited amount of young trees. Structural diversity is lower than what the stand can potentially produce.

About half of the aspen, willow, and mixed deciduous shrub types have lost much or all of their original riparian vegetation; much of the riparian vegetation has been replaced by upland grasses and other plants such as sagebrush and juniper (early-mid stages of progression; Table 3-6). Values to wildlife that use, or depend on, these vegetation types in healthy condition are reduced considerably.

Fire suppression, in conjunction with intensive use by livestock, mule deer, and/or beaver has not allowed sufficient survival of young aspen to replace mature trees that have died or have been felled by beaver. Some stands on the Refuge have completely died out (Figure 3-8). Historically, fire was a critical process that rejuvenated aspen stands by instigating sucker sprouting (Brown 1985, Mueggler 1988, Kauffman 1990). Suckers are new shoots that grow from roots of mature trees. Without fire, aspen stands in semi-arid areas, such as Hart Mountain, will eventually be replaced by sagebrush or juniper (Kauffman 1990). It is not uncommon for aspen stands to contain only one "individual" plant with all trees growing from the same root system. Some aspen stands may be thousands of years old (Mueggler 1988). Establishment from seed is uncommon (Schier 1975), and occurs mainly where mineral soil is exposed by fire or other scouring process (G. E. Gruell, personal communication). Consequently, reestablishment of sites where a stand has gone extinct would likely not occur for many years.

Table 3-6. Acres of wetland vegetation types within biomes and progression stages of wetland vegetation types within biomes, Hart Mountain NAR (1993).

Biome Vegetation type	All stages	Progression stages[a] Early	Mid	Late	Very late
Montane deciduous forest					
Quaking aspen	1465	622	124	456	263
Total	1465	622	122	456	263
Riparian shrub					
Willow	355	134	128	57	36
Mixed deciduous shrub	212	10	24	88	90
Total	567	144	152	145	126
Interior marshlands					
Sedge-rush-bluegrass	3745	383	791	2286	285
Silver sagebrush	2552	0	126	2320	106
Poverty weed-primrose	2408	14	--[b]	2394	--
Rush-spikerush-arnica	1919	0	0	1919	--
Bluegrass-ryegrass	953	0	648	223	82
Cattail-bulrush	469	0	454	15	--
Saltgrass	19	0	0	19	--
Total	12065	397	2019	9176	473
Submergent aquatic					
Pondweed	747	615	--	132	--
Total	747	615	--	132	--
Aquatic non-vegetated					
Aquatic non-vegetated	234	234	--	--	--
Total	234	234	--	--	--

[a] Progression is defined as the change in structure of wetland vegetation types associated with a change in water availability to plants.

[b] dashed lines (--) indicates that the progression state is not represented in the vegetation type.

Figure 3-7. A quaking aspen stand in a late stage of progression. The stand has an overstory of mature aspen, but the understory is depleted (Hart Mountain NAR, Oregon).

Figure 3-8. A small quaking aspen stand that has gone extinct (Hart Mountain NAR, Oregon).

6. Marsh Biome

a) **Meadow Habitats**

Meadow habitat comprises nearly two percent of the Refuge. Sedge-rush-bluegrass (3,745 acres), and bluegrass-ryegrass (953 acres) are the two vegetation types that compose meadow habitat (Table 3-6). Most meadow habitat is associated with stream floodplains. Meadows also occur in basin bottoms, such as Big Flat. Sedge-rush-bluegrass produces wet meadow habitat (Figure 3-1a) along the stream corridor and dry meadow habitat along the edges of floodplains under natural conditions. Bluegrass-ryegrass naturally supports dry meadow habitat.

Only about eight percent of the 3,745 acres that can potentially support wet and dry meadow habitat, actually supports this habitat (very late stage of progression; Table 3-6). Wet meadow habitat produces mainly sedges and rushes, making it valuable wetland habitat. Another 60 percent has characteristics that are more similar to the bluegrass-ryegrass meadow habitat (primarily dry meadow) because of lowered water tables caused by eroded stream channels (late stage of progression). Even lower water tables have resulted in another one-third of the type being invaded by sagebrush and upland grass species (early-mid stages; Figure 3-1b). Vegetation throughout much of the sedge-rush-bluegrass type is maintained at a relatively low height during periods of livestock grazing. Values to wildlife that use, or depend on, wet meadow habitat and residual cover of herbaceous plants have been very limited.

Of the 953 acres that can potentially support dry meadow habitat, only nine percent actually do (very late stage of progression; Table 3-6). Another quarter is being invaded by sagebrush (late stage), and the remaining two-thirds is dominated by sagebrush and upland grass species (early-mid stages).

In the case of the sedge-rush-bluegrass vegetation type, the main factor that maintains current habitat conditions is lowered water tables. Water tables will remain low as long as stream channels are downcut and streambanks remain unstable. Livestock grazing has been the primary factor that has limited restoration of streambanks. Wet meadow habitat on Big Flat and at the Shirk Ranch is influenced mainly by irrigation (Shirk Ranch), precipitation levels, juniper invasion in watersheds, eroded stream channels, and other upstream watershed factors.

Quality of the bluegrass-ryegrass type is limited by high sagebrush cover, suppression of fires, and lowered water tables. High shrub cover in some areas restricts grass and forb cover. Until shrub cover is reduced, these areas will remain of low value to wildlife that use dry meadows.

Downcut and widened stream channels primarily are a consequence of historic heavy to severe livestock grazing during the latter half of the 1800s and early

1900s. Severe grazing along streams adversely impacted the deep-rooted sedges and rushes that held banks in place. Unstable streambanks ultimately led to erosion, downcut stream channels, and lowered water tables.

Changes in livestock management since Refuge establishment, and especially since the 1970 Plan was developed, appear to have reduced the degradation of low-gradient portions of streams. However, livestock grazing along streams under baseline management (1971-1990) limits recovery of these and other systems.

Soils of riparian meadows are deep, and are medium to moderately textured at the surface. Subsoils generally are moderately course to moderately fine textured (Anderson 1978). Precipitation ranges from 8-12 inches. However, in healthy riparian systems, sub-irrigation provides additional moisture to vegetation.

b. **Lakebed Habitats**

Playas, or lakebeds, occupy about three percent of the Refuge, and nearly half of wetland habitats. They are scattered throughout the extensive tableland of the Refuge (Map 1-4). Playas support three vegetation types depending on the amount of moisture that drains into basins, and the distribution of moisture over the playa. In general, drier sites support the silver sagebrush type, and wetter sites support the rush-spikerush-arnica type. Intermediate areas support poverty weed-primrose. Although moisture level is the main factor that influences vegetation on lakebeds, grazing by cattle and horses can have an effect also.

Soils are deep with a thin surface layer that is loamy to clayey. Subsoils are clay. Precipitation averages 8-12 inches per year.

7. Aquatic Biomes (Open Water of Lakes and Streams)

Aquatic habitats on the Refuge consist of pondweed and aquatic non-vegetated vegetation types. The pondweed type occurs on open water portions of Big Flat and the Shirk Ranch area (during wet periods), and Jacob's Reservoir. The aquatic non-vegetated type occurs on Poker Jim Lake, Petroglyph Lake, and in streams.

a) Lakes and Reservoirs

Petroglyph Lake and Reservoir Lake typically retain water throughout the year. Jacob's Reservoir rarely goes dry and Poker Jim Lake goes dry in most years. Presence of water in seasonally flooded areas of Shirk Ranch and Big Flat fluctuates year to year. Precipitation levels, timing of precipitation, and the health of the watershed of uplands influence water levels. Specific to Jacob's Reservoir, conditions can be substantially influenced by management of the water level.

b) Streams

There are over 150 miles of streams on the Refuge. Of these, about 70 miles are inhabited by fish during years when adequate water is available. During average drought periods, less than 12 miles of stream habitat has adequate water to sustain fish.

Although stream habitat likely has improved since Refuge establishment, it still is below its potential. In fact, only about 13 percent of stream-miles were characterized as being at potential in a recent survey of Refuge streams (Table 3-7). This assessment is consistent with results of a stream habitat inventory conducted by ODFW (Table 3-8). Based on these results, Jones (1993) concluded that habitat condition of Rock Creek, one of the two major streams of the Refuge, generally is poor to fair.

Streams in very high resource condition are characterized by (1) very limited, if any, scouring or downcutting; (2) stable or nearly stable streambanks; (3) sedges, rushes, and/or woody-riparian vegetation growing on streambanks; and (4) high water tables. Streams passing through meadows have an additional characteristic of having a high degree of meandering.

Another thirteen percent of stream-miles have similar characteristics, but some erosion of stream channels and banks has occurred and riparian vegetation is not as abundant (high resource condition). Figure 3-9a illustrates a stream that is in moderate to high resource condition. The stream channel is downcut, about 2-3 times wider than it should be, and grasses, instead of sedges, occupy the banks.

About three-quarters of Refuge stream-miles are in low to moderate resource condition (Table 3-7). These streams are characterized as having eroded stream channels, unstable streambanks, and a deficiency of deep-rooted riparian vegetation growing on streambanks (Figure 3-9b). Figure 3-9b illustrates a stream in low resource condition. Extent of meandering in meadows is much reduced from potential levels. Approximately 64 percent of streambank-miles along one surveyed section of Rock Creek (Flook Meadow to Hot Springs Campground) are considered stable (Table 3-8, reaches 1-9). Streambank stability should be at least 90 percent (Jones 1993).

Loss of streamside vegetation reduces streambank stability, which ultimately leads to eroded stream channels. Where streams travel through meadows, erosion causes stream channels to widen which can reduce considerably the amount and quality of trout habitat.

The headwater portions of Rock and Guano creeks are the most critical habitat for trout because they provide spawning and nursery habitat, and they currently provide the only permanent water in drought years. Shading in these areas is marginal; shading above 50 percent is considered acceptable (Table 3-8) (ODFW

Table 3-7. Summary of resource condition[a] of Hart Mountain NAR streams, by gradient. Rows add up to 100 percent; 106 miles of stream were surveyed.

	Resource Condition (% Stream Miles)			
Stream Type[b]	Low	Moderate	High	Very High[c]
High Gradient (>4%)	26	24	15	35
Moderate Gradient (2-4%)	36	36	21	7
Low Gradient (<2%)	64	24	10	2
Totals (%)	49	25	13	13

[a] Resource condition was determined based on channel stability, streambank erosion, streambank stability, water table status, and woody-riparian status.
[b] Corresponds to Rosgen stream-types (Collins et al. 1992): Low (C, E, F), Moderate (B, G), and High (A).
[c] Very high resource condition corresponds to expected natural condition.

Table 3-8. Stream characteristics of Rock Creek, Hart Mountain NAR, Oregon (ODFW Aquatic Inventories Project, Refuge files). Information is presented by stream reach.

Reach	Percent Stream Slope	Sinuosity	Width: Depth Ratio	Percent Bank Stability	Pool: Riffle Ratio	Percent Shading
1	0.2	1.5	12.6	64	1.1	22
2	0.3	1.2	14.8	62	1.8	21
3	0.5	1.2	16.9	63	1.0	25
4	1.6	1.0	-	56	1.3	28
5	0.6	1.7	12.9	54	1.0	33
6	0.5	1.5	9.4	63	1.6	20
7	1.2	1.6	11.4	72	0.5	43
8	0.7	1.2	14.4	81	0.6	45
9	0.9	1.5	12.2	78	1.1	33
10	1.2	1.6	12.9	-a	1.1	29
11	1.5	1.6	13.8	-	0.6	53
12	3.1	1.2	19.4	-	0.3	63
13	3.2	1.5	11.7	-	0.7	53

[a] Not evaluated.

a)

b)

Figure 3-9. Examples of streams in moderate to high resource condition (a) and low resource condition (b). The stream channel shown in the top photo is 2-3 times wider than it should be, and grasses occupy the bank, not deep-rooted sedges. Downcutting and widening are much more apparent in the lower photograph (Rock Creek, Hart Mountain NAR, Oregon).

Aquatic Inventories Project, Refuge files). Daily (1979) noted that many areas, especially heavily grazed meadows, lack sufficient shading. The pool to riffle ratio is in an acceptable range. Siltation can be high at times, possibly impacting reproduction (Daily 1979), though it was not excessively high when Rock Creek was surveyed in 1991 (ODFW Aquatic Inventories Project, Refuge files).

Daytime temperatures recorded during habitat sampling in late July of 1991 did not exceed 61 °F in the upper reaches of Rock Creek (ODFW Aquatic Inventories Project, Refuge files). However, temperatures from Lyons meadow up to Hot Springs Campground commonly exceeded 70 °F during mid-day (up to 77 °F). Daily's (1979) report shows a similar for 1979. During his habitat sampling on Rock Creek during the latter half of July, temperatures did not exceed 61 °F above the Hot Springs Campground, but below the campground to Lyons Meadow, temperatures approached 79 °F. Biederbeck and Daily (1980) show similar patterns on Guano Creek. As pointed out by Bowers et al. (1979), temperatures should not exceed 70 °F in trout streams of southeastern Oregon. Certain strains of native trout, however, can withstand water temperatures of 80 °F for short periods during the day (Bowers et al. 1979). Data from Guano Creek show substantial differences in maximum stream temperatures between differences in vegetation cover over short distances (ODFW Aquatic Inventories Project, Refuge files).

During 2 years of sampling maximum and minimum temperatures on Rock Creek during late-July and August (1991 and 1992), maximum recorded temperatures were 81 °F and 73 °F at Headquarters and below the Hot Springs Campground, respectively. Minimum recorded temperatures at these areas were 48 °F and 50 °F, respectively. Below Post Meadow of Guano Creek, temperatures ranged from 43 °F to 77 °F during the period 19 July to 16 August (minimum and maximum temperatures).

G. FIRE

Fire historically was an important component of northwest rangelands (Kauffman 1990), of which the Hart Mountain area is a part. Fire periodically swept across the landscape, converting habitat from shrubland to grassland and limiting the spread of western juniper (Kauffman 1990). While doing so, fire maintained a variety of habitats. It also maintained shrub cover at lower levels than currently exist (Gruell 1986, Winward 1991). As previously described, suppression of fires has resulted in substantial changes in habitat conditions since prior to Euro-American settlement.

Available information suggests that fire frequency in the Hart Mountain area generally ranged from approximately 30 to 50 years above 6,000 feet elevation to more than 100 years in the drier tableland areas (Pyle 1991b for review). Some areas may have been burned as frequently as every 10 to 30 years (Kauffman

1990). Based on Kauffman (1990) and Miller et al. (1990), we can infer that the fire interval for Wyoming big sagebrush areas was likely over 40 years. It may have been over 100 years on average (Pyle 1993b for review). Based on Wright et al. (1979), Kauffman (1990), Miller et al. (1990), the fire return interval for mountain big sagebrush may have ranged from 20 to 50 or more years. Fire return intervals in small habitat patches (e.g., aspen stands, snow pockets, meadows) probably approximated fire return intervals of surrounding uplands. Fire return intervals in the Western juniper vegetation type were likely 250 years or more (Kauffman 1990).

Vegetation conditions have changed markedly since the time when fires regularly occurred. Fuel composition in shrubland/grassland vegetation types is comprised of a much higher proportion of shrubs and juniper (i.e., woody fuels) and lower proportion of grasses and forbs (i.e., fine fuels). Other substantial changes are the presence of cheatgrass in the Wyoming big sagebrush and big sagebrush-bitterbrush areas, and scarcity of seeds of native herbaceous plants in the Wyoming big sagebrush vegetation type. Future fire management on the Refuge must account for these complicating factors.

H. NOXIOUS WEEDS

There are three noxious weed species known to exist on the Refuge: Canada thistle, Mediterranean sage, and white top. These species have been identified as being noxious by the Oregon Department of Agriculture and the U.S. Department of Agriculture Soil Conservation Service (Refuge files). On Hart Mountain NAR, these three species occur in small patches around headquarters, along roads, in meadows, and around old homesteads. Canada thistle, Mediterranean sage, and white top are very aggressive and have the capability to dominate entire plant communities if left unmanaged.

II. **WILDLIFE**

INTRODUCTION

One of the principal goals of resource planning at Hart Mountain NAR is to provide a systematic framework for wildlife management, defined as the objective-based art and science of managing factors that affect the productivity and survival of wildlife (Patton 1992). Development of objectives for wildlife management determines (1) which wildlife will be emphasized, (2) what, how, where, and when actions will be prescribed to influence wildlife populations and wildlife habitat over time and space, and (3) what cultural and ecological benefits and impacts will be produced by management actions. Consequently, planners, biologists, and resource managers have the means to systematically describe, document, and account for the influence of management actions on wildlife.

The planning framework for wildlife management was based on (1) review and interpretation of legal standards established by the Executive Order for Hart Mountain NAR, policies developed for management of the National Wildlife Refuge System, and federal laws such as the Endangered Species Act; (2) review of Refuge records of wildlife and the wildlife-science literature; and (3) capability for practical application given differences in values, uses, and knowledge of species and their relationships to habitat. Based on these considerations, we determined that featured species (e.g., pronghorn) and species richness (e.g,. other native wildlife species) were the resources of concern described by the Executive Order. Species richness refers to the number of native wildlife species in a particular area. Featured species and species richness were evaluated for planning purposes based on principles and procedures described by Maser and Thomas (1983), Maser et al. (1984a), Patton (1992:238), and Scott et al. (1993).

A. FEATURED SPECIES

At Hart Mountain NAR, featured species include pronghorn, California bighorn sheep, mule deer, sage grouse, and trout. Featured species were selected based on public interest and intent of the Service to continue monitoring their populations. Additionally, featured species may receive management emphasis in some situations. Conversely, management actions would not be carried out that would have significant long-term detrimental impacts to a featured species' population on the Refuge.

Applied to the Refuge, these principles are broadly consistent between the 1970 Plan and this FEIS. Differences exist, however, between the 1970 plan and the this FEIS. First, trout were added to the list of featured species in recognition of their cultural value and a requirement for special management practices.

Second, the scope of management was increased in the FEIS to include management for species richness (Maser and Thomas 1983). Management for featured species and species richness involves an awareness of how habitat manipulation practices affect both. For example, singular emphasis on pronghorn production may entail extensive reduction of shrubs to create grassland-like habitat in their summer range. Such extensive habitat change could increase other species associated with grassland habitat, but reduce species associated with shrub-dominated habitat.

One of the goals of this FEIS is balanced management of featured species and species richness to maintain and enhance Refuge wildlife. In the following species accounts, status of featured species is summarized and relationships of featured species to habitat is discussed.

1. Pronghorn

An estimated 30 to 40 million pronghorn inhabited North America before Euro-American settlement (Nelson 1925:4). By the early 1900s, an estimated 13,000 pronghorn remained in the United States (Hoover et al. 1959). Populations increased to 30,000 by 1924 and for the next 60 years increased 3,000 percent (Yoakum 1986). In Oregon, an estimated 2,000 pronghorn occurred in southeast Oregon during the 1920s, of which 1,000 were in the vicinity of Hart Mountain NAR (Nelson 1925). Since establishment of the Refuge in 1936, pronghorn populations have fluctuated considerably (Appendix G). In 1937, 1,950 pronghorn were counted on the Refuge during mid-summer (Refuge files). Pronghorn populations fluctuated during the 1940s-1960s and have steadily increased since then. The number of pronghorn seen during yearly mid-summer pronghorn surveys has increased from a late 1960s low to approximately 1,800 during the early 1990s (Table 3-9).

Table 3-9. Number of pronghorn seen during mid-summer aerial surveys of Hart Mountain NAR, 1955-91.

Period	Total Number Seen	Bucks/100 does	Fawns/100 does	Fawns/100 adults
1955-59	347	35	66	49
1960-64	348	37	66	46
1965-69	292	41	33	23
1970-74	316	29	30	15
1975-79	503	19	35	31
1980-84	712	40	23	17
1985-89	816	39	42	30
1990-91	1763	43	23	17

Pronghorn habitat in the shrub-steppe is characterized by low, rolling terrain with low vegetative stature (Kindschy et al. 1982). Vegetation height averaging 10-18 inches is preferred. Vegetation over 25 inches is less preferred and taller than 30 inches is seldom used. Key components of pronghorn habitat include at least 50% cover of living vegetation with a diversity of shrub, grass, and forb species. Furthermore, rangelands supporting a variety of vegetation types are preferred over monotypic vegetative communities (Yoakum 1980). At Hart Mountain NAR, low sagebrush is the principal vegetation type used by pronghorn throughout the year (Refuge files, Herrig 1974). However, grasslands (burned areas) and wetlands (silver sagebrush, lakebeds, and meadows) are also important habitats, particularly during summer and fall (Figure 3-10).

Pronghorn feed on forbs, grasses, and shrubs. Forbs are especially important, particularly during spring through fall (Yoakum 1990). Shrubs are important forage during winter when forbs are not readily available (Smith et al. 1965, O'Gara and Greer 1970, O'Gara and Yoakum 1992). Grasses are least preferred, but are important in late winter and early spring (Smith et al. 1965). Competition for forage between pronghorn and domestic cattle does not appear to be a problem on rangelands in good ecological condition (O'Gara and Yoakum 1992). However, vegetation types used by pronghorn (low sagebrush) at the Refuge are in low ecological condition (i.e., low species diversity). Furthermore, cattle may compete directly with pronghorn for forbs on lakebeds.

Predation of pronghorn fawns may be a factor limiting populations on marginal pronghorn rangelands or in areas where numbers of predators are high in relation to pronghorn numbers (O'Gara and Yoakum 1992). Fences also can increase the rate of predation of pronghorn fawns (McNay and O'Gara 1982). At Hart Mountain NAR, predation is known to occur on pronghorn fawns (Einarsen 1948, Yoakum 1957). Predator/prey relationship studies on adjacent rangelands report similar findings (McNay 1980, Trainer et al. 1983). However, none of these reports provide sufficient information to substantiate that predation on fawns is the limiting factor controlling pronghorn populations. A predator control program on the Refuge during the 1950s and 1960s resulted in increased fawn survival (McNay 1980, Refuge files). However, only slight increases in pronghorn

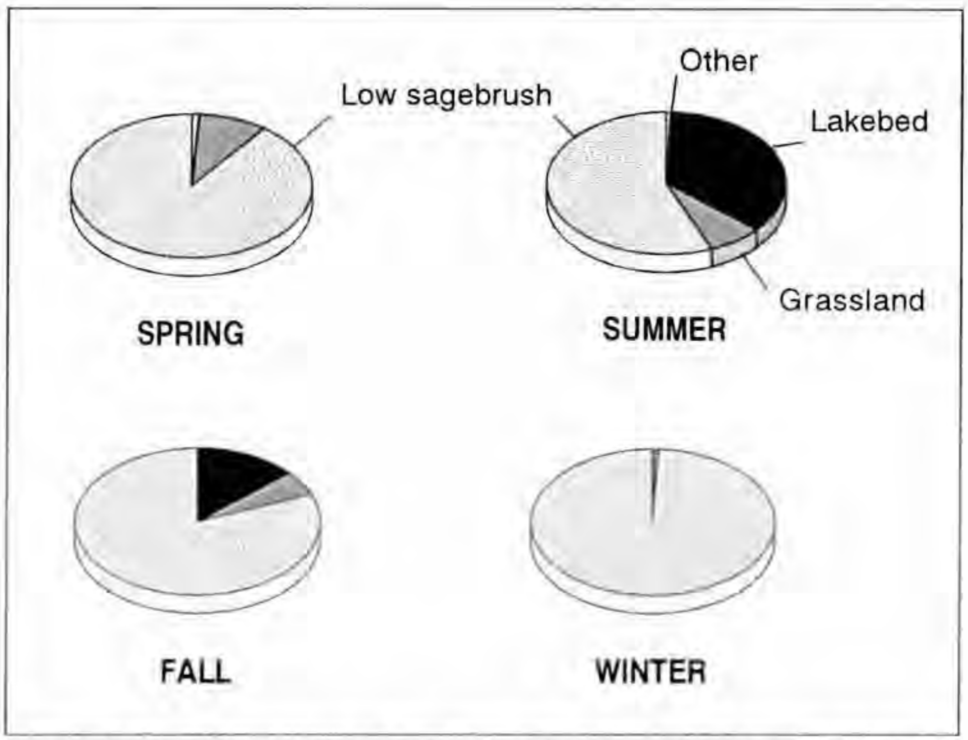


Figure 3-10. Pronghorn use of vegetation types by season on Hart Mountain NAR, Oregon (1990-1992). Grassland includes early succession stages of several vegetation types.

populations were noted between 1955 and 1969 (Refuge files). Apparently, fawns that survived because of predator control died of other causes. Udy (1953) investigated the results of predator control on pronghorn fawns and concluded that rangeland conditions affected pronghorn populations more than predation in the Great Basin of Utah. The cumulative effects of predation ultimately appears regulated by habitat quality (Beale and Smith 1973, Yoakum 1980, O'Gara and Yoakum 1992).

Productivity of pronghorn, and ultimately population size, are related to availability of quality forage. Beale and Smith (1969) reported that forage condition during late summer and fall, which is dependant on precipitation, may influence breeding activity, successful gestation of does, and size of fawn crop. Furthermore, Ellis (1970) reported that fawn survival is dependent on availability of quality forage, primarily forbs, during spring and summer.

Hunting of pronghorn has been allowed on the Refuge since 1968. A limited number of permits are issued each year and emphasis is on high quality hunts (Appendix G). The number of pronghorn taken by hunters is far below harvest levels that the population could sustain (L. Conn, ODFW, personal communication).

2. California Bighorn Sheep

California bighorn sheep are native to southeastern Oregon and northern Nevada. Parasites and disease introduced by domestic livestock, competition with livestock for forage, overhunting, and human encroachment contributed to their extirpation in Oregon by 1915 (Van Dyke et al. 1983). The last record of a bighorn on the Refuge was in 1912 (Polenz 1985). An attempt to reintroduce bighorns to Hart Mountain NAR in 1939 was unsuccessful. In 1954, 20 bighorns from British Columbia were successfully transplanted (Deming 1961a) and the population has steadily increased (Table 3-10). The current population is estimated at 500 animals (L. Conn, ODFW, personal communication). The Refuge population also is the source of bighorn sheep used to establish populations in historic ranges of Oregon and Nevada. Since 1960, 551 bighorn sheep have been translocated from the Refuge (Appendix G). The California bighorn was listed as a candidate for threatened and endangered status in 1985 (Federal Register 50:37963).

Bighorn sheep habitat is characterized by remote, steep, rugged terrain (Van Dyke et al. 1983). Habitat requirements include forage, water, thermal protection, escape cover, and areas for rutting and lambing (Van Dyke et al. 1983). Open areas with good visibility and adequate forage close to escape terrain also are important (Van Dyke 1978 and Hansen 1982). Although bighorns primarily consume grass, a variety of forbs and shrubs are used depending on season and availability (Hansen 1982 and Van Dyke et al. 1983).

Table 3-10. Number of California bighorn sheep counted on Hart Mountain NAR, 1955-92 (total number counted, and age and sex ratios).

Period	Total Number Counted	Rams/100 ewes	Lambs/100 ewes
1955-59	46	52	54
1960-64	71	67	64
1965-69	93	65	45
1970-74	79	116	44
1975-79	155	70	51
1980-84	339	65	34
1985-89	328	74	46
1990-92	363	71	42

Hart Mountain and Poker Jim Ridge comprise the majority of the bighorn sheep habitat on the Refuge. The distribution of bighorn during summer is dependent on water availability (Payer 1992). Bighorn range over a larger area during dry years and a smaller area during wet years. Primary vegetation types used include mountain big sagebrush, low sagebrush, and terrestrial non-vegetated (e.g., cliff, talus, etc.) (Payer 1992).

Factors that can potentially limit bighorn populations and distribution on the Refuge include competition for forage, habitat change associated with fire suppression and excessive livestock grazing, and human disturbance. Domestic cattle can compete for forage directly by grazing during spring green-up and indirectly by grazing bighorn winter range during summer (Van Dyke et al 1983). Cattle also compete with bighorn for riparian habitat during summer and fall (D. Payer, Oregon State University, personal communication). Fire suppression and historical heavy grazing have resulted in encroachment of dense shrubs and trees onto bighorn ranges and have precluded use by bighorns (Graf 1980 and Wehausen 1983).

Human disturbance (hiking, backpacking, etc.) has caused bighorns to reduce or terminate use of prime habitat and stop migration (Dunaway 1971, Hansen 1982, Van Dyke 1978, Van Dyke et al. 1983). Human disturbance does not appear to be a problem on the Refuge. However, the potential for conflict exists at Petroglyph Lake, which is an important water source for bighorn during late summer and is accessible to the public at that time (Payer 1992).

Hunting for bighorn sheep has been allowed on the Refuge since 1965 (Appendix G). Bighorn seasons are designed to emphasize quality and yearly tag numbers are based on total population size, proportion of rams in the population, and lamb recruitment rates (ODFW 1993a). Ram harvest rarely exceeds 5 percent of the total population.

3. Mule Deer

Mule deer populations greatly increased throughout the Intermountain West between the early 1930s and mid 1960s (Longhurst et al. 1983, Gruell 1986). However, during the late 1960s and particularly the early 1970s, mule deer populations and distribution declined dramatically (Longhurst et al. 1983). Although data are limited, a similar trend in deer populations is evident for Hart Mountain NAR. An estimated 2000-3000 deer were present on the Refuge during the late 1930s and early 1940s (Refuge files). Populations remained high until the mid 1960s and declined during the late 1960s and 1970s. The current population of mule deer on the Refuge during summer is estimated between 800 and 1000 animals (Refuge files).

Habitat requirements of mule deer include cover from weather and predators, forage, water, and fawning and fawn-rearing habitat (Leckenby et al. 1982). Deer consumption of forage varies with the seasons of the year; grasses and forbs are heavily eaten during spring and summer, forbs and shrubs are predominantly used during the fall and winter (Leach 1956, Vavra and Sneva 1978, Tueller 1979, Spalinger 1980, Hansen 1986, and Woodis 1989). Shrubs are important as the major survival forage during winters; however, grasses and forbs are needed during the gestation and lactation period (Tueller and Monroe 1975). The value of forbs was reported as the primary factor resulting in thrifty deer herds in two summer rangelands that were compared in Utah (Peterson 1970). Hansen's (1986) research on deer diet studies of the Sheldon NWR indicated deer ate almost as much forbs as shrubs on a year-long basis. Spalinger (1980) indicated that deer in the Great Basin may have forage strategies that closely follow an energy maximization scheme; consequently, it would be highly important to have an available mixture of grass-forb-shrub communities to support thrifty viable populations.

There is reason to believe that changes in vegetative succession on deer winter ranges brought about by the livestock industry in the first half of the twentieth century, greatly stimulated the increase in numbers of deer in the Great Basin (Urness 1976, Longhurst et al. 1982, 1983). However, heavy livestock grazing in deer habitats during the mid-twentieth century, led to deterioration of preferred deer forage which in turn contributed to the decline of deer herds in the latter half of the century (Dasmann 1949, Peterson 1970, Tueller and Monroe 1975, Spalinger 1980, Longhurst et al. 1983). In addition, livestock have other impacts on deer such as negative social interactions (Rule 1989, Loft et al. 1991), and changes in deer foraging behavior (Kie et al. 1991). Furthermore, cattle grazing in aspen and meadow habitats can reduce food availability and fawn hiding cover (Loft et al. 1987, Kie et al. 1991).

According to Longhurst et al. (1982), fire affected post-Pleistocene deer habitats for the longest period. Fire incidence and spread in the shrub-steppes was initially reduced when livestock reduced the density of native bunchgrasses. Another consequence of lowered fire incidence on some Great Basin rangelands, has been the increase in density of juniper (Urness 1976). Juniper stands provide valuable escape and thermal cover for deer, but when stands become excessively dense, palatable shrubs and forbs are crowded and shaded (Tueller and Monroe 1975, Urness 1976). Juniper does provide forage for deer but it is not a preferred species. Then too, when deer are forced to rely heavily on plants that are low in palatability and contain some secondary compounds which depress or inhibit rumen microbes (such as sagebrush and juniper), digestibility of forage is lowered and passage of food through the rumen slows (Dietz and Nagy 1976).

There are numerous reports substantiating that predators are a regulating influence on mule deer in the Great Basin (Robinette et al. 1977, Austin et al. 1977, Trainer et al. 1978, Lemos et al. 1978). However, Connolly (1981) in the many mule deer/predator cases he evaluated, concluded that "In no case has predation by coyotes or mountain lion been documented as the principal cause of mule deer population decline." Connolly further stated "Mule deer numbers ultimately are limited by quality and quantity of habitat."

Deer hunting on the Refuge has been allowed since 1943 (Refuge files). Seasons were unrestricted for muzzleloader until 1977 and archery until 1986. A rifle season has not been permitted since 1968. Since 1987, a limited number of muzzleloader and archery permits have been issued each year, and emphasis is on quality trophy hunts.

4. Sage Grouse

Sage grouse were once abundant in the area around Hart Mountain and other non-forested habitats of eastern Oregon (Gabrielson and Jewett 1940). Hunted by native Americans at leks and watering areas in spring and summer, sage grouse were the principal upland bird used for subsistence; harvest surpluses were stored for future consumption (Kelly 1932). Within the area now encompassed by the Refuge, large populations were noted between the 1870s and 1920s by Henshaw (1880), Streator (1896), Goldman (1916), and Prill (1922).

Although populations on the Refuge fluctuated considerably during the past 60 years, the population trend of sage grouse has been downward. Population peaks were estimated at 8750 in the 1940s, 6,000 in the 1950s, 5,200 in the 1960s, 2,500 in the 1970s, and 2,000 in the 1980s (Refuge files, J. A. Crawford, Oregon State University, personal communication). Reduced abundance of sage grouse observed at Hart Mountain has also been reported for sage grouse populations throughout southeastern Oregon (Crawford and Lutz 1985). Furthermore, sage grouse populations have been extirpated from British Columbia (Hamerstrom and Hamerstrom 1961) and greatly reduced in Washington (Yocom 1956). As a consequence, the western sage grouse was listed as a candidate for threatened and endangered status in 1985 (Federal Register 50:37963).

Sage grouse use a diversity of habitats and require specific habitat conditions within vegetation types for successful reproduction (Crawford et al. 1992). Mountain and Wyoming big sagebrush habitats with tall (greater than 7 inches) residual grass cover are critical for successful nesting (Gregg et al. 1994). Meadows, lakebeds, and big and low sagebrush stands with a diversity of native forbs are crucial sage grouse habitats during spring and summer (Crawford et al. 1992). Although sage grouse forage primarily on sagebrush during winter, forbs are a critical component of the diet of pre-laying hens during early spring (Barnett 1993), and forb and insects are critical components of chick diets during summer (Drut 1993, Pyle 1993a).

The decline of sage grouse populations at Hart Mountain NAR is attributed to reduced productivity (Crawford and Lutz 1985) (Table 3-11). Reduced abundance and impaired productivity may result from several factors including hunting, climatic changes, predation, food availability, or habitat alterations (Call and Maser 1985). An analysis of long-term data revealed no relationship between the decline in abundance of sage grouse and hunting harvest (Crawford 1982). Furthermore, no evidence exists of long-term climatic changes in southeastern Oregon the past 60 years (Refuge files, Taylor 1992).

Batterson and Morse (1948) and Nelson (1955) identified predation as the primary factor directly influencing sage grouse productivity in Oregon. Although predators are the direct cause of nest and chick losses, productivity of sage grouse is largely a function of habitat characteristics available to hens for nesting and brood-rearing (Klebenow 1969, Blake 1970, Autenrieth 1981). This is supported by sage grouse research conducted on the Refuge (DeLong 1993b, Barnett and Crawford 1994, Drut et al. 1994, Gregg et al. 1994).

Table 3-11. Productivity of sage grouse by decade, Hart Mountain NAR, 1950-1992.

	Measure		
Period	% hens with broods	Chicks/hen	Chicks/brood
1950-59	60	3.2	4.8
1960-69	43	1.8	4.3
1970-79	66	2.3	3.4
1980-89	60	2.2	3.2
1990-92	18	0.6	3.1

Research at Hart Mountain NAR indicates a relationship between sage grouse nest success and amount of residual grass cover at nest sites (Gregg et al. 1994). Successful nests had greater cover of shrubs and tall residual grasses within a three foot radius around the nest than unsuccessful nests. Parallel results were obtained in a study making use of artificial nests to study the relationship between vegetative structure and nest predation on the Refuge (DeLong 1993a). Although sagebrush is critical to nesting sage grouse, the high cover of shrubs on the Refuge currently limits the grass and forb understory (discussed earlier in this chapter), which are critical to sage grouse production (DeLong 1993b, Barnett and Crawford 1994, Drut et al. 1994, Gregg et al. 1994).

Habitat alterations probably have had the greatest effect on sage grouse productivity on the Refuge (Crawford et al. 1992). Fire suppression and long-term overgrazing have resulted in degraded meadows and many upland habitats with excessive shrub cover and little or no herbaceous understory. The result has been a decrease of adequate nesting and brood-rearing habitat that may be limiting sage grouse productivity which ultimately limits sage grouse populations on the Refuge.

5. Trout

Hart Mountain NAR has limited, sustained fisheries in Rock Creek, Guano Creek, and Warner Pond. During late summer and drought years (e.g., 1992), reduced stream flows limit fish habitat to 1 mile of stream in upper reaches of the watersheds. Catlow redband trout is the only native trout species on the Refuge and is a candidate for federal threatened or endangered status (Williams et al. 1989, ONHP 1993). Cutthroat trout and rainbow trout have been introduced. Rock Creek was stocked regularly with rainbow trout between 1963 and 1976 by ODFW, but may have been stocked as early as 1915 (Refuge files). Stocking of rainbow trout in Rock Creek was terminated in 1976 to preserve the genetic integrity of Catlow redband trout. Trout present in Rock Creek showed characteristics of redbands in 1979 (Daily 1979). Guano Creek was stocked with cutthroat and rainbow trout between 1957 and 1979. Warner Pond is regularly stocked with rainbows by ODFW.

Optimum stream conditions for trout include water temperature less than 70^{0} F, Ph between 6.5 and 9.0, stable streambanks with riparian vegetation, instream cover, and areas with riffles (Bowers et al. 1979, Reiser and Bjornn 1979). Streamside vegetation (e.g., trees, shrubs, grasses, and sedges) is critical for maintaining trout habitat (Platts 1985). Riparian vegetation provides shade during summer, prevents erosion during high water periods, and provides terrestrial insects for food (Bowers et al. 1979). Instream cover (e.g., boulders, debris, tree roots, overhanging banks) is of primary importance for resting, protection from predators, and production of food (Bowers et al. 1979). Areas with clean riffles (free of sedimentation) are important for spawning, egg development, and rearing of juveniles.

Small streams (i.e., trout habitat) are intimately associated with riparian zones and are highly responsive to alterations in riparian vegetation. Small streams are easily altered by many activities including road development, wildfire, and recreation. However, the primary factor affecting small streams on the Refuge is grazing of the associated riparian zones by domestic livestock. Research has demonstrated that fish production is greater for streams in ungrazed riparian zones than for streams in grazed riparian zones (Gunderson 1968, Claire and Storch 1977, Marcuson 1983, Stuber 1985). Excessive grazing of riparian zones reduces streambank vegetation, which increases water temperature, reduces streambank stability, and increases erosion and sedimentation. Furthermore, livestock trample streambanks, reduce undercut banks and cover for fish, and compact soils (Platts et al. 1977, Bowers et al. 1979). Ultimately, amount and distribution of water available to fish will be reduced (Van Havereen and Jackson 1986).

Fishing has been allowed on the Refuge since 1955. All Refuge waters were open and under regulations established by the ODFW. However, Rock and Guano creeks were temporarily closed to fishing beginning in 1992 because drought conditions substantially reduced water flows and limited populations.

B. WILDLIFE SPECIES RICHNESS

The purpose of managing for species richness is to "maintain the highest possible number of wildlife species in viable populations" (Maser and Thomas 1983). Consequently, management for species richness requires information on what native wildlife occur on the Refuge, how they are associated with habitat, and how they respond to change in habitat conditions (Maser et al. 1984a). In this section on species richness, procedures are described, composition of the Refuge wildlife is summarized, and results are discussed. Refer to Appendix H for results from analyses of breeding and feeding assemblages, sensitive species, and regional endemic species.

Evaluation of species richness for the FEIS involved development of a wildlife-habitat relationships model based on species-habitats found at Hart Mountain NAR. The model was patterned after work done by Maser et al. (1984a,b) and was modified to include new technical procedures and information (Patton 1992:256). Vertebrate wildlife species were listed, vegetation characteristics were described, a relational database was developed, Refuge records and wildlife-science literature were reviewed, and wildlife-habitat relationships were evaluated. Invertebrate wildlife species were not included in the model although that they are an important component of wildlife communities. Key information used to evaluate species richness included: (1) classification of species by taxonomic category and seasonal occurrence; and (2) classification of the relationship of vegetation types and structural conditions within vegetation types used by wildlife species for primary breeding and feeding purposes (Maser et al. 1984a,b). Refer to Appendix F for a discussion of the relationship between wildlife species and habitat quality within succession and progression stages of vegetation types. Results from analysis of species richness follow.

1. General Composition of Refuge Wildlife

The Refuge supports pronghorn and a wide variety of wildlife species characteristic of habitat conditions of intermediate-sized mountain ranges of the northern Great Basin. Three-hundred and two species of vertebrate wildlife have been recorded on the Refuge; another 32 vertebrate species probably have occurred (e.g., bats), but have not been confirmed. These hypothetical species are listed in Appendix H, but were excluded from analysis of species richness in this FEIS. Although all species contribute to total wildlife diversity of the Refuge, birds and mammals collectively compose 93% of the Refuge vertebrate wildlife (Table 3-12). Wildlife use of the Refuge also differs on a seasonal basis among taxonomic groups of wildlife. Of the total number of recorded species (302), 190 species are classified as breeding on the Refuge, and another 112 species are classified as transients and winter residents and therefore use the area mainly for feeding purposes.

Table 3-12. Number of species in major animal groups, and their residency, Hart Mountain NAR.

	Residency				
Major Animal Groups	Permanent resident	Summer resident	Transient	Winter resident	Total
Fishes	5	0	0	0	5
Amphibians	3	0	0	0	3
Lizards	7	0	0	0	7
Snakes	6	0	0	0	6
Birds	36	92	95	16	239
Mammals	41	0	1	0	42
Total	98	92	96	16	302

2. Wildlife Species Richness in Upland Habitats

Wildlife species richness in a vegetation type is highest when a mixture (i.e., mosaic) of succession stages occur (Table 3-13). For example, in a particular area in the Wyoming big sagebrush vegetation type, we might find about 27 species of wildlife using the area for feeding if the entire area is in a late stage of succession (dominated by shrubs) (Table 3-13). However, if that same area had patches of habitat in early succession (grass-forb community) and patches of habitat in mid succession (grass-shrub community) mixed in with the late succession stand, we might find up to 66 species of wildlife using the area for feeding. This is because some species require grassland-like habitat, while others require grass-shrub or shrub dominated habitat. Still others require more than one stage of succession in a small area.

At present, about 96 percent of the Wyoming big sagebrush vegetation type is in a late stage of succession while only 2 percent is in an early stage of succession (Table 3-14). The remaining 2 percent is in a very late stage of succession, meaning that it is dominated by juniper. Therefore, the vast majority of the

Table 3-13. Number of wildlife species associated with succession stages[a] of upland vegetation types for primary breeding and feeding purposes, Hart Mountain NAR, Oregon.

	Succession stages					
	Breeding			Feeding		
Biome vegetation type	Early, mid, and late	Late	Very late	Early, mid, and late	Late	Very late
Desert shrub						
Wyoming big sagebrush	36	20	17	66	27	40
Spiny hopsage	24	11	--[b]	30	9	--
Salt desert shrub	32	17	--	44	24	--
Winterfat	8	8	--	22	20	--
Squirreltail	7	7	--	11	11	--
Black greasewood	20	9	--	48	22	--
Black sagebrush	3	3	--	19	15	--
Sagebrush-grass						
Low sagebrush	21	16	16	69	55	56
Mountain big sagebrush	33	17	22	79	29	49
Big sagebrush-bitterbrush	30	16	18	52	23	35
Basin big sagebrush	40	23	--	83	41	--
Wheatgrass	6	6	5	35	30	40
Fescue	14	12	--	27	26	--
Montane shrub						
Mountain shrub	27	17	18	61	29	38
Mountain mahogany	44	34	26	90	55	45
Conifer woodland						
Western juniper	53	30	38	122	67	67
Conifer forest						
Ponderosa pine	44	27	52	100	62	63
White fir	39	28	42	83	57	56
Terrestrial non-vegetated						
Terrestrial non-vegetated	53	--	--	33	--	--

[a] Based on single and multiple succession stages: early, mid, late = mosaic of those stages; late = dominated by late stages; and very late = dominated by very late stages.
[b] Indicates succession stage was not represented in vegetation type.

Table 3-14. Acres of succession stages[a] of upland vegetation types, Hart Mountain NAR.

	Succession stage		
Biome Vegetation type	Early, mid, and late	Late	Very late
Desert Shrub			
Wyoming big sagebrush	2,978	86,598	1,552
Salt desert shrub	0	1,546	-
Winterfat	0	1,199	-
Black greasewood	0	701	-
Black sagebrush	0	648	-
Spiny hopsage	0	374	374
Squirreltail	0	163	-
Shrub-grassland			
Low sagebrush	16,164	81,328	7,466
Mountain big sagebrush	4,770	16,618	2,475
Big sagebrush-bitterbrush	7,664	0	3,242
Wheatgrass	0	2,800	1,330
Basin big sagebrush	0	3,168	-
Fescue	0	249	-
Montane Shrub			
Mountain shrub	254	2,067	629
Mountain mahogany	0	0	1,449
Conifer Woodland			
Western juniper	0	0	4,890
Conifer Forest			
Ponderosa pine	0	69	0
White fir	0	0	13
Terrestrial non-vegetated			
Terrestrial non-vegetated	5,366	-[b]	-

[a] Based on single and multiple succession stages: early, mid, late = mosaic of those stages; late = dominated by late stages; and very late = dominated by very late seral stages.

[b] Indicates succession stage was not represented in vegetation type.

Wyoming big sagebrush vegetation type supports a relatively low number of wildlife species. The figures shown in Table 3-13 assume healthy conditions within succession stages. This assumption, however, is not met throughout most of the Refuge uplands because of excessive shrub cover in late succession stands. This means that, for vegetation types such as Wyoming big sagebrush, the number of species shown in the "Late" column actually are higher than what currently exists on the Refuge.

Mosaics of succession stages have the most breeding species in 12 of 18 vegetation types and the most feeding species in 16 of 18 vegetation types. Compared to late succession stages, mosaics average 10 more breeding species and 25 more feeding species. This pattern in species richness also was found by Thomas et al. (1979a,b), who suggested that species richness was related to: (1) the kind, amount, and variety of vegetation types; and (2) the degree of interspersion that exists among vegetation types and succession stages within vegetation types. Consequently, maximum species richness usually is associated with sites where a diversity of vegetation types occur in combination with a diversity of succession stages within vegetation types (Thomas 1979a,b). Table 3-14 presents the existing amount of area (acres) within vegetation types that can be considered a mosaic of early or mid, and late succession stages (see Figure 3-3 on page 98 for reference).

3. Wildlife Species Richness in Wetland Habitats

The pattern of species richness differs between upland and wetland habitats. In wetlands, maximum richness of breeding and feeding species usually is associated with occurrence of late or very late stages of progression (Table 3-15). For example, richness averages 14 breeding species in early-mid stages, 19 in late stages, and 34 in very late stages in riparian wetlands where very late progression stages occur. Increased species richness associated with later stages of progression is attributed to increased biological productivity and habitat complexity in vegetation types comprised of woody-riparian shrubs and trees (Kovalchik 1987, Busse 1989, Schulz and Leninger 1990, Leonard et al. 1992). More species are accommodated in very late stages compared to early stages of progression (Refuge files, Schulz and Leninger 1991, Dobkin and Wilcox 1986).

This is supported by recent work conducted on the Refuge. Bird species that inhabit a wide variety of riparian habitats under a variety of site progression stages comprise the bulk of the riparian bird communities on the Refuge (Dobkin 1992). For instance, American robins, red-winged blackbirds, and house wrens together make up more than one-third of the breeding population in Refuge riparian areas. In contrast, bird species such as MacGillivray's warblers, lazuli buntings, and willow flycatchers are very rare or absent from riparian habitats on the Refuge (Dobkin 1992, 1993). These and other riparian birds of conservation concern (mostly long-distance migrants) are associated with woody-riparian habitats that have been minimally impacted by livestock grazing (Bock et al. 1993). At Hart Mountain NAR, such habitats are the most structurally complex and consist of multi-layered (i.e., uneven-aged) aspen with lush shrub and herbaceous understories, or composed of dense willow or alder thickets (Dobkin 1992, 1993).

Table 3-15. Number of species associated with progression stages[a] of wetland vegetation types for primary breeding and feeding purposes, Hart Mountain NAR, Oregon.

Biome Vegetation type	Progression stages					
	Breeding			Feeding		
	Early-mid	Late	Very late	Early-mid	Late	Very late
Deciduous forest						
Quaking aspen	11	30	55	48	108	101
Riparian shrub						
Mixed deciduous shrub	3	11	35	46	119	132
Willow	18	29	40	68	142	137
Interior marshlands						
Bluegrass-ryegrass	20	23	17	23	62	81
Sedge-rush-bluegrass	29	18	41	61	100	117
Silver sagebrush	4	3	18	22	63	69
Poverty weed-primrose	0	4	--[b]	3	14	--
Rush-spikerush-arnica	3	21	--	19	127	--
Saltgrass	7	2	--	17	19	--
Cattail-bulrush	18	38	--	127	116	--
Aquatic submergent						
Pondweed	39	12	--	127	113	--
Aquatic non-vegetated						
Aquatic non-vegetated	11	--	--	106	--	--

[a] Based on single and multiple progression: early and mid = dominated by both stages; late = dominated by late stages; and very late = dominated by very late stages.
[b] Indicates progression stage was not represented in vegetation type.

The limiting factor for many long-distance migratory birds (i.e., neotropical migrants) is the scarcity of dense understories in mature aspen stands and thick willow stands (Dobkin 1992, 1993).

In riparian meadows, species richness is influenced by habitat structure and occurrence of free water. For example, richness in meadows is greatest in very late progression stages, despite the fact that early-mid stages comprised of sagebrush-grass are more structurally complex. Healthy dry and wet meadow areas are apparently more biologically productive based on increased amount and stability of water supply (Thomas et al. 1979c, Kauffman and Krueger 1984, Kovalchik 1987, Leonard et al. 1992, USSCS 1993). Height of vegetation in meadows can also influence species richness.

Species richness in lake basins differs from riparian areas. Late stages of progression average more breeding and feeding species compared to early stages in poverty weed-primrose and rush-spikerush-arnica. However, early, mid, and late stages of cattail-bulrush and pondweed tend to maintain higher levels of richness compared to the same stages in poverty weed-primrose and rush-spikerush-arnica.

Differences among vegetation types are associated with differences in water regimes and characteristic vegetation of progression stages (Cowardin et al. 1979). Table 3-6 presents the existing acreage of progression stages for wetland vegetation types.

C. FERAL HORSES

The feral horse population on the Refuge fluctuated from a high of 321 in 1980 to a low of 23 in 1988 to the current estimate of 81 animals. During this period, removal by trapping, production of young, and immigration apparently were the primary factors that influenced population size. Reduction in the population coincided with trapping and removal of 247 horses in 1980-81 and 207 in 1987-88. In addition to a high reproduction rate on the Refuge, an increasing Refuge population results from horses moving onto the Refuge from surrounding areas. An annual growth rate of 20% was assumed for the Refuge horse herd based on analysis of population trends reported for herds of the Intermountain region (Garrott et al. 1991). High reproduction and survival of young and adults indicates that populations are maintained at a level substantially below carrying capacity (Garrott et al. 1991).

Since the 1960s, horses have been distributed primarily in the southeastern quarter of the Refuge, ranging from Swede Knoll south to Spanish Lake and east to the eastern boundary. Within this region, use of habitats occurs on a year-round basis; distribution changes correspond mainly to changes in availability of food and water (Refuge files, Meeker 1979). Horse use is distributed among 3 habitats: low sagebrush, playa wetlands, and Wyoming big sagebrush (Table 2). Analysis of horse distribution by habitat and season indicated that low sagebrush was the primary vegetation type used year-round. Other types were seasonally important. Distribution of horses has not changed substantially in the past 20 years despite continuing availability of suitable habitats adjacent to the current use area.

Feral horse diets are comprised 80-95% of annual and perennial grasses, 5-9% forbs, and 1-12% shrubs on a year-round basis (Vavra and Sneva 1978, Hanley and Hanley 1982). Principal grasses in diets included wheatgrass, bluegrass, squirreltail, and needlegrass. Peak use of forbs occurs during spring and summer; Meeker (1979) found that forbs comprised 23% of feral horse diets on low sagebrush range of the Sheldon NWR during summer.

Because composition of horse diets overlaps most with domestic cattle and least with pronghorn, potential for competition for food is greatest between horses and cattle (Vavra and Sneva 1978, Hanley and Hanley 1982). Horses and pronghorn may not compete on rangelands maintained in good condition where a balance of shrub, grass, and forb cover exists. This statement assumes that environmental conditions remain constant and that populations of both species are maintained below carrying capacity (Meeker 1979, Yoakum and O'Gara 1990). However, horses and pronghorn may compete for forage in poor vegetation conditions, especially during drought (Yoakum and O'Gara 1990).

At Hart Mountain NAR, two factors increase the potential for competition between feral horses and pronghorn. First, horse and pronghorn distribution and habitat use overlap substantially. Low sagebrush is the primary habitat used by both horses and pronghorn within this region. Second, habitat conditions in low sagebrush are less than ideal for late succession (i.e., shrub cover is excessive), and consequently, the potential for forb and grass competition is increased despite differences in diet selection among species (Yoakum and O'Gara 1990).

Other factors which may cause competition between horses and pronghorn include horse-induced disturbance to pronghorn does during fawning and early fawn-rearing and use of water during drought (Refuge files, Yoakum and O'Gara 1990). Under current habitat conditions, the level of horse-pronghorn competition is related to the size of horse populations on the Refuge; the larger the horse population, the greater the potential for competition. Management guidelines developed by Salwasser (1980) suggested that horses either be removed or kept at low densities to avoid competition with pronghorn on principal winter and spring ranges.

Horses also may compete indirectly with sage grouse. The area occupied by horses is one of the primary use areas of sage grouse between fall and spring (seven leks occur there). Sage grouse hens use late succession stands of Wyoming big sagebrush and low sagebrush habitats for nesting, and amount and height of residual grass cover is related to nesting success (Gregg et al. 1994). Condition of nesting habitat is sub-optimal in late succession stands because of excessive shrub cover and shrub-grass competition. Competition for grass between nesting grouse and foraging horses is consequently related to the size of horse populations and range conditions.

III. SPECIAL MANAGEMENT AREAS

A. WILDERNESS

In compliance with the Wilderness Act of 1964, the Service completed a wilderness study on Hart Mountain NAR in 1967. Based on his review of the study, the Secretary of the Interior approved the Service proposal to recommend designation of two units, Poker Jim Ridge (17,464 acres) and Fort Warner (32,743 acres) as wilderness. The President sent the recommendation to Congress in 1969.

The Hart Mountain proposal was introduced in legislation in 1969. Response was generally favorable, but objections expressed at hearings and by letter caused it to be deleted from the bill. The Hart Mountain proposal was introduced in Congress again in 1971, but continued opposition caused it to be deleted again.

The Service re-evaluated the proposal and withdrew the Fort Warner unit pending further study and acquisition of private inholdings. A revised proposal was submitted to Congress in 1972, reducing the size of Poker Jim Ridge to 16,462 acres to delete a tract of private land. Congress has not considered either the original or revised proposal since that time.

The Service continues to review units of the NWRS, including new acquisitions and expansions, for lands and waters that qualify for wilderness study. These periodic reviews will occur through the comprehensive management planning process as required by FWM 602 and FWM 610 (USFWS 1992).

Given the changes on the Refuge during the past 20 years (i.e. road closures and acquisitions) the Service will be reevaluating Hart Mountain NAR for potential Wilderness Study Areas. The Refuge will be evaluated in order to determine areas that potentially meet the criteria for Wilderness Study Areas. This involves assessing road status, degree of naturalness, opportunities for solitude and/or primitive type of recreation, area sizes, and any other features of scientific, educational, scenic, or historical value. For areas that qualify as Wilderness Study Areas, Wilderness Study Reports will be written, and recommendations sent to Congress.

The purpose of the Wilderness Act, passed in September of 1964, is:

> "2(a) ...to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness."

B. RESEARCH NATURAL AREAS (RNAs)

The Poker Jim RNA was established on November 30, 1972. RNAs are tracts of land administratively designated for research and education purposes. Each area constitutes a site where natural features are preserved for scientific purposes, and natural processes are allowed to dominate. The Poker Jim Ridge RNA is preserved as an example of a western juniper savanna vegetative community. The main purposes of RNAs are to provide baseline areas against which the effects of human activities can be measured, sites for study of natural processes in undisturbed ecosystems, and gene pool preserves for all types of organisms. During the planning process, Refuge lands need to be reviewed for potential research natural area designations.

SECTION TWO - SOCIO-ECONOMIC COMPONENTS

I. PUBLIC USE AND FACILITIES

A. OPPORTUNITIES

1. Recreation

Hart Mountain NAR offers a wide variety of wildlife oriented recreation. Although located far from any population centers, visitation on the Refuge is increasing. Approximately 17,200 visitors came to Hart Mountain in 1992. An estimate of visitor origins taken from the visitor register (past 3 years) suggests that approximately 75% of Refuge visitors came from Oregon, with 7% from local areas (Lakeview to Burns), and 25% from out-of-state and other countries (Table 3-16). In 1991 visitors came from 35 states and 16 countries. The visitors from local areas may be underestimated because many local visitors do not sign the register. To many of the visitors, Hart Mountain constitutes a final destination location, and to others it is an intended stop on route to or from Frenchglen and the Steens Mountain.

Hart Mountain's unique geologic features and abundance of wildlife make sightseeing and wildlife observation popular activities. Riparian areas are preferred places for hiking, camping, and visiting. These areas are also critical wildlife habitat areas and need to be managed carefully. The steep, rugged canyons on Hart Mountain's west face are also popular places for hiking and observing wildlife.

Table 3-16. Estimated number of visitors to Hart Mountain NAR, Oregon in 1992, by home residence.

Home Residence	Number of Visitors
Lake or Harney County	1,170
Other Oregon	11,696
California	1,840
Washington	998
Nevada	138
Other U.S.	963
Foreign Countries	395
Total visitors	17,200

In 1992, enjoying nature and wildlife appeared in the visitor register more often than other activities. All big game hunting programs on Hart Mountain are run as limited, quality hunts (Table 3-17). Camping, hunting, hot springs bathing, photography, and hiking and backpacking were all popular activities to visitors who signed the register. Other recreation activities offered on the Refuge include fishing, horseback riding, rock hounding, and mountain bike riding.

Table 3-17. Number of hunting tags issued on Hart Mountain NAR, Oregon, 1988-1992.

	Pronghorn		**Mule Deer**		**Bighorn Sheep**	
Year	Archery	Rifle	Archery	Musket		Total
1988	20	20	100	100	12	252
1989	20	20	150	100	12	302
1990	20	20	150	100	14	304
1991	20	20	150	100	15	305
1992	20	20	100	50	14	204

Recreational opportunities available in various areas on the Refuge can be described in terms of settings that exist within those areas. A recreational setting is made up of three kinds of settings--physical, social, and managerial:

- the **physical** setting is defined by its size, the presence and extent of environmental changes caused by human activity, and the presence or absence of human sights and sounds,
- the **social** setting is defined by the amount and type of contact occurring between individuals and groups using an area, and
- an area's **managerial** setting refers to the number and kind of regulations used by an agency to manage recreational use in that area.

The Recreation Opportunity Spectrum (ROS) provides a standardized means of classifying recreational settings (Clark and Stanke 1979). ROS is a way of letting visitors know what to expect in recreational areas, such as access, facilities, social encounters, and remoteness. It is also a system to help managers classify recreational lands and plan for future use. ROS can assist managers in identifying and mitigating conflict through identifying appropriate uses within different recreation settings.

ROS can help answer questions concerning the allocation and management of opportunities for recreation. It focuses on the setting where recreation occurs. The ROS framework defines a recreation opportunity setting as:

"the combination of physical, biological, social, and managerial conditions that give value to a place. Thus, an opportunity includes qualities provided by nature (vegetation, landscape, topography, scenery), qualities associated with recreational use (levels and types of use), and conditions provided by management (developments, roads, regulations). By combining variation of these qualities and conditions, management can provide a variety of opportunities for recreationists." (Clark and Stanke 1979)

The Spectrum consists of six major classes. These are Urban (U), Rural (R), Roaded Natural (RN), Semi-Primitive Motorized (SPM), Semi-Primitive Non-motorized (SPNM), and Primitive (P). ROS was designed to be flexible and can be divided into subclasses as the needs arise. New classes may also be developed to address specific settings. Currently, Hart Mountain NAR offers recreational settings in the SPM, SPNM, and RN categories.

RN areas on Hart Mountain are mostly natural in appearance with few structures, though they are the main routes of travel. The level of visitor use along these areas is the highest on the Refuge. The SPM areas contain primitive jeep trails, and use is considerably lower in these areas than the RN areas. SPM areas offer a greater chance for solitude and a high degree of contact with the natural environment. The SPNM areas contain no open roads, and offer a great degree of solitude for visitors. Because all use is limited to foot and horseback travel, the opportunities to get away from the sights and sounds of others are abundant.

The key to providing a variety of opportunities is in the setting and how we manage it. As land managers, we can facilitate (or hamper) many desired experiences by the way we manage such setting indicators as access, remoteness, naturalness, facilities, social encounters, visitor impacts, and visitors.

Data collected by the State of Oregon show the actual distribution of major recreation activities, by type of ROS setting, and compares that with the setting that Oregon recreators report they would prefer. The data presented in Table 3-18 represents Region 11, which consists of Lake, Harney, and Malheur Counties.

2. <u>High Desert Discovery</u>

The Oregon High Desert Discovery program is an interagency plan between the Service and the BLM to improve visitor facilities, signing, and interpretive needs between the Warner Wetlands, Hart Mountain NAR, Steens Mountain, Diamond Craters, and Malheur NWR. The main objective of the program is to enhance communication between the agencies and the public. As part of the High Desert Discovery, a few interpretive stops are planned on the Refuge -- the Warner Valley Overlook, Flook Knoll, Lookout Point, South Lookout, and Blue Sky. A cooperative visitor center between the BLM and the Service is planned at the base of the mountain within the next ten years (USBLM and USFWS 1992).

Table 3-18. Comparison of actual and preferred outdoor recreation settings in region 11: Lake, Harney, and Malheur Counties[a].

Activity	Used/ Preferred	Primitive/ Semi-Primitive	Roaded Natural	Roaded Modified	Rural/ Urban
Sightseeing	USED	7.6	47.2	34.0	11.3
	PREFERRED	17.3	38.5	36.5	7.7
Hiking	USED	26.5	20.8	30.2	22.6
	PREFERRED	44.0	22.0	24.0	10.0
Nature Activities	USED	13.9	19.4	55.6	11.1
	PREFERRED	45.5	18.2	36.4	0.0
Non-Mot. Riding	USED	16.1	16.1	41.9	25.8
	PREFERRED	25.8	19.4	35.5	19.4
Camping	USED	24.2	27.6	41.4	6.9
	PREFERRED	50.0	11.5	30.8	7.7
Fishing	USED	17.0	29.8	44.7	8.5
	PREFERRED	46.5	27.9	23.3	2.3
Hunting/ Shooting	USED	37.3	14.0	48.8	0.0
	PREFERRED	58.2	9.3	32.6	0.0

[a] Source: Oregon State Parks & Recreation Division (1988), p I-8.

3. Back Country Byway

The Lakeview BLM manages the Lakeview to Steens Back Country Byway. This is a scenic route from Lakeview through Plush, the Warner Wetlands, Hart Mountain NAR, and on to the Steens Mountain. The only planned site on the Refuge is an overlook about 1/2 way up the grade road. This will be a short, accessible trail leading to an interpretive overlook of the Warner Wetlands.

Plans are underway by the BLM to provide camping and hiking areas in the Warner Wetlands at the base of Hart Mountain. Campgrounds would provide a needed resource for both areas, particularly for RV camping.

B. FACILITIES

1. Roads

There are approximately 360 miles of roads on the Refuge, 243 miles of which are currently open to vehicle traffic. Various roads are permanently closed, while several are seasonally closed due to wildlife or weather conditions. In winter, attempts are made to keep the main road open. All other open roads are accessible depending on weather conditions.

2. Campgrounds

Hart Mountain NAR offers two camping areas, the Hot Springs Campground (open year-round) and the Guano Creek camping area (open during hunting season). Drinking water is not available in the campgrounds. Fire rings are not available, nor is firewood. Pit toilets are available. The Hot Springs Campground has a hot springs bathhouse located in the middle of the campground. Most camping occurs along spur roads, and in a large meadow. Camping is unregulated, so people camp throughout the area.

3. Outhouses

Seven outhouses are available at the Hot Springs Campground and five others are available elsewhere on the Refuge, at Robinson Draw, Deer Creek, and Guano Creek. None of these are currently accessible for disabled visitors.

4. Hot Springs

The Hot Springs is a warm, 99 degree Fahrenheit spring enclosed by a 24 x 16 foot, pale green cement block bathhouse with walls over 7 feet tall. The bathhouse is located in the middle of the camping area. It is open 24 hours per day. The only regulations are no dogs, no soap, and a 20 minute use limit when busy. The immediate area around the bathhouse is limited to day use only.

5. Visitor Room

A visitor room is located in the office building adjacent to the main road. A public rest room is located in the same building. Currently, the garage is used for occasional slide shows and meetings. Brochures, regulations, maps, and various information are available in the visitor room. Refuge personnel currently do not staff the visitor room.

II. **LIVESTOCK GRAZING PROGRAM**

A. HISTORY OF LIVESTOCK GRAZING

The first ranches were established in the vicinity of the Refuge during the early 1870s. By 1900, the number of ranches increased and range condition began to decline because of overuse. Cattle were grazed throughout the year with no control over numbers or distribution. Furthermore, domestic sheep were introduced to the area around 1900. Because there was no regulation of use on public domain, the Refuge and vicinity was heavily grazed by migrant bands of domestic sheep, and domestic sheep and cattle of the established ranches. By the 1920s, excessive grazing had resulted in depletion of vegetative cover and erosion of topsoil.

With the passage of the Taylor Grazing Act in 1934 and establishment of the Refuge in 1936, the migrant bands of domestic sheep were eliminated and efforts were begun to reduce AUMs of other livestock. Because of financial difficulties during the Great Depression, many ranches went bankrupt, which resulted in a substantial reduction in numbers of livestock grazing the Refuge and surrounding lands. Grazing by domestic sheep was eliminated on the Refuge by 1960.

B. BASELINE MANAGEMENT

During the period 1971-1990, 43 grazing units and 10 non-use areas were used for the livestock grazing program. Most livestock grazing has occurred on a seasonal basis (April-October) and is conducted primarily to manage vegetation for wildlife. Total AUMs ranged from 10,406 to 17,228 during most years. Livestock have not grazed Refuge lands since 1990.

III. **ECONOMIC CONDITIONS**

Hart Mountain NAR is located in east-central Lake County adjacent to Harney County. The largest population center is Lakeview, which has a population of 2,526 (1990 census). Lake County has a population of 7,186, and encompasses approximately 5,292,800 acres, of which slightly over 75 percent is in public ownership (Riggs 1991). Lake County is sparsely populated.

Wood-products manufacturing, farming (including ranching), and federal, state and local government are the largest employers in Lake County (Appendix L). The largest government employers are the Fremont National Forest and BLM District office in Lakeview. Per capita income has not kept up with inflation, and stood at $14,443 in 1989, compared to $16,003 for the State of Oregon. Ranches in Lake County are large compared to the average ranch size in Oregon (Appendix L). Ranches are almost entirely focused on cattle, while farm acreage produces significant quantities of hay and grain. Unemployment in Lake County has fluctuated between 8.4 percent and 10.6 percent during the 1986-1990 period (Oregon Department of Human Resources 1992:24).

The largest population center of Harney County is the incorporated area of Burns and Hines. Harney County has a population of 7,060 (U.S. Bureau of the Census 1992). Harney County is sparsely populated. Employment in Harney County is dominated by wood products manufacturing and government. Cattle ranching is the primary industry in rural areas. As with Lake County, ranches in Harney County are large compared to the average ranch size in Oregon. Ranches are almost entirely focused on cattle, while farm acreage produces significant quantities of hay and grain.

IV. CULTURAL RESOURCES

A. SHIRK RANCH, POINDEXTER PLACE, FLOOK RANCH, AND OTHER HOMESTEADS

Because Hart Mountain has only been a Refuge since 1936, there are many remnants of the land's previous owners. Poindexter place is a one room stone structure quite near the middle of nowhere (Map 2-4). Flook Ranch has several buildings, though not well kept. There are cabin remains in several other places on the Refuge, such as Deer Creek, Stockade Creek, and near the Hot Springs Campground.

The Shirk Ranch was one of the earliest ranches established in the vicinity of Hart Mountain (USFWS 1985:57). The ranch was homesteaded in the early 1880's. The Shirk Ranch with all of its structures (two story house, corrals, a barn, animal sheds, a workshop, an outhouse, a water tower, a root cellar, and a "boot hill" type grave marker) is potentially eligible for inclusion into the National Register of Historic Places.

B. CCC BUILDINGS

In 1985 the Headquarters buildings (created by the Civilian Conservation Corps--CCC) were determined to be potentially eligible for inclusion in the National Register of Historic Places (USFWS 1985:75).

When Hart Mountain was established, the Nation was in a situation of economic collapse due to the drought in the nation's agricultural areas. The Emergency Conservation Work bill was passed, which authorized the President to create a civilian conservation corps from the ranks of the unemployed "to relieve the acute condition of widespread distress and unemployment existing in the United States, provide for restoration of the country's depleted natural resources, and advance an orderly program of useful public work". The creation of the CCC represents an important federal response to the Great Depression, and therefore properties associated with the CCC may be interpreted to be of exceptional importance to the history of the nation (USFWS 1985:71).

C. NATIVE AMERICANS

The Hart Mountain National Wildlife Refuge lies within the Norther Great Basin Cultural area. The prehistoric and historic Native American occupants of the area were Hunters and Gathers. they used a subsistence strategy which used the natural products of the land which could be hunted, fished, or collected. No animal husbandry or farming were practiced by persons living in the area. Subsistence was based on the yearly seasonal rounds during which different places within the environment were occupied and exploited as plants or animals became available. Historically, at the time of euroamerican contact, the area of Hart Mountain was occupied by members of the Surprise Valley Band of the Northern Paiute. Hart Mountain was used by this group for hunting, collecting of medicinal and food plants, gathering stone tool material, and for religious purposes. Some Paiute mythology deals with Hart Mountain and its place in the oral history of the Surprise Valley Band of the Northern Paiutes.

Besides the recent occupation of the Hart Mountain area by the Northern Paiute, evidence exists to indicate that the Mountain has been a focal point of use for at least 10,000 years. This time period can be broken down into four general time periods. During this time, which falls between 10,000 to 8,000 years before the present (BP), large game was hunted using large stemmed points. Projectiles were propelled through the air with an atlatl or spearthrower. the bow and arrow would be introduced at a much latter date. Because of this, projectile points from this time period are properly referred to as "dart points" rather than arrowheads. Occupation was often at small lakes, along streams and playas. Sites from this time period, besides having large stemmed points, often have crescent shaped flaked tools, steep edged scrapers and few ground stone tools which would have been used for plant processing.

The next period of occupation is referred to as the Archaic Period. It falls between the period of 8,000 to 1500 BP. During this time period, a wide variety of projectile point forms were used. Game which was hunted included many kinds of animals such as deer, elk, antelope, rabbits, ground squirrels, waterfowl and sage hens. The abundance of tools for grinding plant foods which are found in the sites from this period indicates a heavy reliance on vegetal foods, more than was seen in the previous period.

The next period of occupation is referred to as the Late Archaic Period. It falls between the period of 1500 BP to about 500 BP. The practices of hunting and gathering as seen in the previous period continued. The major change is seen in the introduction of the bow and arrow which replaces the atlatl or spearthrower which was used to propel small spears or darts during the earlier period. Gathering of vegetal foods as an important economic pursuit is again indicated in the large number of tools for processing vegetal foods.

The Northern Paiute Period begins about 500 BP. Northern Paiute oral history indicates that the Surprise Valley people were created here and that they have always lived in the region. Sites throughout the Warner Valley area are important locations within the history of the people. Archeological evidence indicated the presence of the Northern Paiute approximately 500 years ago. Where these people came from, whether the area was abandoned by other groups at that time or whether the Northern Paiute displaced or assimilated other groups is not presently known. The Northern Paiute followed the same liveway as the earlier periods of hunting and gathering. Changes are again seen in the form of the projectiles points, basketry and houses used by the occupants. Use of the area by the Northern Paiute continues today.

1. <u>Site Types</u>

a. **Lithic Scatters**

Lithic scatters are areas where evidence of the production, refinishing and using of stone tools is present. They are indicated by the presence of large amounts of stone flakes produced in the use, refitting and production of stone tools. Usually these sites will not have features such as houses, hunting blinds, stone rings, etc.. They seldom contain finished stone tools. Often, exactly what type of activity took place and when cannot be determined for these sites.

b. **Quarry/Workshop Sites**

These are sites where the procurement of stone for the manufacture of stone tools and the production of stone tools took place. They are found in areas where the required type of stone was located. Cobbles of obsidian, basalt, or cryptocystaline stone were taken from the ground, broken into smaller pieces and then cores for the removal of flakes were made. Flakes or blades removed from these cores were further worked down into semi-finished or finished tools. Evidence of a quarry workshop site include the presence of tool stone, broken cobbles, cores, waste flakes, hammerstones and discarded broken tools which failed in manufacture.

c. **Occupation Sites**

These are sites where evidence indicates that the people were living on a daily basis. These could include areas of winter villages, summer villages, small temporary campsites, temporary work-sites, and special use areas. They may be indicated by the presence of a wide variety of tools, housepits, stone house rings, plant processing areas, etc.. They can range in size from less than one acre to sites which cover 40 acres.

d. **Burial Sites**

These are areas where the remains of deceased persons were placed.

e. **Rock Art Sites**

Rock art sites are abundant on the Hart Mountain Refuge. They can range in size from an area of less than one square foot on a rock surface where a single petroglyph was placed, up to sites which cover many acres where thousands of glyphs are present. Both petroglyphs (carvings on stone) and pictographs (painting on the stone) exist on Hart Mountain. Evidence exists that some of these sites may be as much as 7,000 years old. The function of these sites is unknown. However, they are most often associated with the root gathering sites and the summer occupation sites associated with the plants. It is probable that the rock art served some function to preserve the social solidarity within the group living at the upland camps.

f. **Hunting Sites**

These sites often contain stone blinds behind which the hunter waited to ambush game. Often they contain broken projectile points and evidence of the butchering of animals.

g. **Rockshelters and Caves**

Often the rockshelters and caves in the region were used for various purposes including storage, living and burial. Perishable items such as basketry, nets, and matting can be found in such sites. However, due to the extreme amount of artifact collecting in the area, no sites which have not been destroyed by collectors are presently known on Hart Mountain. Some sites will still contain rock art which was frequently made in these locations.

Chapter 4
ENVIRONMENTAL CONSEQUENCES

Chapter 4
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter identifies and compares the potential impacts that the alternatives described in Chapter 2 may have on the natural and human environment detailed in Chapter 3. This chapter summarizes and compares the environmental consequences predicted to occur as a result of implementing each of the five alternatives. Section One presents environmental impacts of the alternatives, and Section Two presents additional detail on the impacts of the Proposed Action. Assessments were based on information provided in Appendices I, J, and L as well as from information obtained during meetings and other communications with natural resource professionals. Extensive referencing of scientific literature was not used in Chapter 4 to enhance readability -- for information on the basis of statements made in this chapter, Appendices I and J should be consulted.

The following assumptions have been made in the analysis presented in this chapter:

- Funding and personnel would be sufficient to implement any alternative selected;

- Monitoring programs would be implemented and maintained as indicated, and adjustments or revisions would be made as indicated by evaluations;

- Standard operating procedures would be followed; and

- The Comprehensive Management Plan/EIS would remain in effect for 15 years.

Relatively few improvements to habitats can realistically be accomplished in 15 years, considering all the changes that are needed to restore habitats to their expected natural condition, even with an intensive restoration program. Restoration must be an ongoing process well into the 21st century. Some habitats may not fully recover even within that span. In many areas of the Refuge, reducing shrub and juniper cover will not immediately restore those areas. It will take time to increase soil productivity and restore native plant communities.

Impacts are discussed in relation to short-term and long-term time-frames. Short-term effects cover those that would be apparent within 15 years of implementation of an alternative. Long-term effects are those that would not be expected to occur for 30-50 years or up to several hundred years, depending on vegetation type and processes involved. Baseline Management (Alternative A) provides a benchmark for comparisons.

For upland habitats, refer to Table 4-1 for the projected number of acres of early-mid succession that could be obtained in 15 years of treatment at treatment levels of each alternative. It also presents projected acres that could be maintained in early-mid succession over the long-term. Table 4-2 presents the projected amount of area (acres) that could be restored and maintained over the long-term. The amount of time required to restore habitat depends on vegetation type and treatment. Wyoming big sagebrush would take the longest to totally restore, likely on the order of several centuries.

Achieving vegetative stability of meadow streambanks does not necessarily mean that the stream and meadow have recovered. The stream channel may still meander within the confines of a gully. Maintaining stable stream banks will, however, allow floodplains to restore through time. This will take decades in many areas.

Assumptions that were used in the evaluation of species richness with respect to consequences of management include: (1) response of species richness would differ among alternatives as a consequence of variation in type, intensity, and scope of habitat management practices; and (2) response of richness would differ among alternatives based on differences in acres of vegetation types and their relative importance as sources of species richness. Furthermore, this evaluation focuses on a limited number of vegetation types (18 of 31), which would be subject to major changes in habitat condition as a result of management actions prescribed in the alternatives. Consequently, it was assumed that management actions prescribed under each alternative would not affect the status of the following vegetation types: salt desert shrub, winterfat, squirreltail, black greasewood, black sagebrush, fescue, white fir, western juniper, terrestrial non-vegetated, and saltgrass.

Tables 4-3, 4-4, 4-5, and 4-6 were developed specifically to be used in assessing relative differences between alternatives in terms of habitat diversity. Acreage figures presented in Tables 4-3 and 4-4 are based on the number of acres that would be treated under each alternative (Table 2-2). They are approximate and assume a 50:50 ratio of treated to untreated patches. For example, using the first row of Table 4-3 as an example, the 3,400 acres in the "early, mid, and late" succession category (first column), represents 1,700 acres in early or mid succession of Wyoming big sagebrush and 1,700 acres in late succession (refer to Figure 3-3 for illustration). As such, habitat within the 3,400 acres would be available for species using early, mid, or late succession Wyoming big sagebrush. A total of 86,176 acres would be available for wildlife that use late succession Wyoming big sagebrush. The 1,700 acres of late succession in the "early, mid, and late" succession category are repeated in the "late" succession category because this habitat also would be available for species using late succession.

Therefore, the total number of acres in each succession stage, or stages, do not necessarily add up to the total number for the vegetation type. These tables can be used in conjunction with Tables 3-11 and 3-13 to get an idea as to the potential effects of the alternatives on wildlife richness.

Tables 4-5 and 4-6 present the relative amount of change in riparian habitats that would be expected under each alternative (15-years and long-term). Refer to tables 3-11 and 3-13 for information on species richness for each structural stage of vegetation types.

Given limited information, no attempt was made to predict the number of acres that could burn by natural fires under each alternative. As such, the number of acres that could be converted to, and maintained in, early succession was not calculated. Therefore, in-depth analysis of the effects of implementing the alternatives on wildlife and socio-economic conditions does not reflect the influence of natural fires even though occurrence of fire is likely in the 15 years following implementation and over the long-term.

Table 4-1. Existing, objective and projected percents of early and mid succession stages of vegetation types. Projected percents reflect the percent of vegetation types that would be in early-mid succession at the end of 15 years of treatment under each alternative, and the percent of each vegetation type that could be maintained in early-mid succession over the long-term under each alternative. These figures are based on figures presented in Table 2-2.

Vegetation Type	Total Acres	Existing	Long-range Objective	Alternatives A	B	C	D	E
<u>15 Years</u>								
Wyo. Big Sagebrush	91,128	2	20-30	2	4	4	12	2
Low Sagebrush	105,506	8	20-30	8	10	12	19	8
Mtn. Big Sagebrush	23,863	10	25-35	14	20	32	33	10
Big Sagebrush-Bitterbrush	10,906	39	25-35	39	40	42	45	38
Wheatgrass	4,130	0	25-50	0	0	4	25	0
<u>Long-term</u>								
Wyo. Big Sagebrush	91,128	2	20-30	1	9	9	30	0
Low Sagebrush	105,506	8	20-30	2	5	10	30	0
Mtn. Big Sagebrush	23,863	10	25-35	7	17	37	37	0
Big Sagebrush-Bitterbrush	10,906	38	25-35	0	6	9	16	0
Wheatgrass	4,130	0	25-50	0	0	6	38	0

Table 4-2. Predicted percent of each vegetation type that could be restored and maintained over the long-term under each alternative[a].

Vegetation Type	Alternatives A	B	C	D	E
Wyo. Big Sagebrush	<6	29-44	29-40	>80	0
Low Sagebrush	6-9	11-17	23-34	>61	0
Mtn. Big Sagebrush	18-27	45-67	>95	>95	0
Mtn. Big Sagebrush-Bitterbrush	0	15-22	22-33	37-59	0
Wheatgrass	0	0	12	>95	0
TOTAL	7-10	24-38	27-51	70-84	0

[a] Figures are based on information provided in Table 2-2; a treated to untreated ratio of 50:50; and treatment return intervals (reflective of historic fire return intervals) of 100 years for Wyoming big sagebrush, 60 years for low sagebrush and big sagebrush-bitterbrush, 40 years for mountain big sagebrush, and 50 years for wheatgrass.

Table 4-3. Predicted acreages of management-induced succession stages and mosaics[a] of succession stages of vegetation types on Hart Mountain NAR, Oregon after 15 years of treatment under each alternative.

Alternative Vegetation Type	Succession Stages[b] Early, mid, and late	Late	Very Late	Total
A - Baseline Management				
Wyoming Big Sagebrush	3,400	86,176	1,552	91,128
Low Sagebrush	19,400	78,640	7,466	105,506
Mountain Big Sagebrush	6,800	14,600	2,475	23,863
Mtn. Big Sagebrush-Bitterbrush	7,664	0	3,242	10,906
Wheatgrass	0	2,800	1,330	4,130
Mountain Shrub	127	2,067	629	2,950
B - Featured Species Management				
Wyoming Big Sagebrush	8,000	81,576	1,552	91,128
Low Sagebrush	21,100	76,940	7,466	105,506
Mountain Big Sagebrush	9,800	11,600	2,475	23,863
Mtn. Big Sagebrush-Bitterbrush	7,956	0	2,950	10,906
Wheatgrass	0	2,800	1,330	4,130
Mountain Shrub	254	2,067	629	2,950
C - Habitat Restoration				
Wyoming Big Sagebrush	7,700	81,876	1,552	91,128
Low Sagebrush	24,900	74,256	6,350	105,506
Mountain Big Sagebrush	15,300	6,100	2,475	23,863
Mtn. Big Sagebrush-Bitterbrush	8,056	0	2,850	10,906
Wheatgrass	300	2,650	1,180	4,130
Mountain Shrub	254	2,067	629	2,950
D - Native Community Restoration				
Wyoming Big Sagebrush	21,000	68,576	1,552	91,128
Low Sagebrush	40,400	59,086	6,020	105,506
Mountain Big Sagebrush	15,300	6,400	2,125	23,863
Mtn. Big Sagebrush-Bitterbrush	8,356	0	2,550	10,906
Wheatgrass	2,100	975	1,055	4,130
Mountain Shrub	1,300	1,335	315	2,950
E - Custodial Maintenance				
Wyoming Big Sagebrush	2,978	86,598	1,552	91,128
Low Sagebrush	17,424	80,616	7,466	105,506
Mountain Big Sagebrush	4,770	16,600	2,475	23,863
Mtn. Big Sagebrush-Bitterbrush	7,664	0	3,242	10,906
Wheatgrass	0	2,800	1,330	4,130
Mountain Shrub	254	2,067	629	2,950

[a] Figure 3-5 provides an illustration and description of "mosaics of succession stages"
[b] early, mid, and late = acreage is comprised of a mosaic of those stages;
late = acreage dominated by late stages; very late = acreage dominated by very late stages.

e) **Cattail-bulrush**

Cattail-bulrush habitat on Shirk Ranch would improve considerably. Elimination of livestock grazing would allow residual vegetation cover to increase. Thus, quality of waterfowl nesting habitat would increase. Cattail-bulrush habitat in Big Flat would continue to be impacted by lack of water during dry periods, and by annual cattle grazing. Development of deep-water areas on the Shirk Ranch would increase establishment of bulrush and cattail.

8. <u>Aquatic Habitats</u>

a) **Pondweed**

Very little change would be expected in lakes of the Refuge.

b) **Aquatic Non-vegetated**

<u>Lakes</u> Very little change would be expected in non-vegetated lakes.

<u>Streams</u> Aquatic habitat of streams generally would improve over existing conditions, though at a slower rate than would occur under alternatives C - E. Streambank stability and shading should improve somewhat in high gradient portions of streams as riparian aspen stands rejuvenate, and in Lyons, Flook and other non-grazed meadows. Water temperatures would be cooler as a result in these areas. Bank stability and shading in other riparian meadows would improve over existing conditions, but concentrations of livestock along stream corridors would maintain instability in some areas. There is no indication that cattle grazing along streambanks would increase shading of stream channels. Willow plantings would increase shading.

Herbicides could reach stream habitats but negative impacts to stream ecosystems are expected to be minimal because herbicide concentrations would be very low. Mitigation measures that would reduce the potential of herbicide reaching stream habitats would include relatively low herbicide application rates, ground application of herbicides, 100 foot buffer zones surrounding stream habitats (for shrub reduction applications), limited amount of treatment areas, maximum of one herbicide application per site and avoidance of herbicide application prior to heavy precipitation. The use of wicking and wiping techniques for applying herbicides for noxious weed control would minimize the potential for herbicides entering stream-water.

II. **EFFECTS ON WILDLIFE**

A. FEATURED SPECIES

Descriptions of the effects on pronghorn, bighorn sheep and mule deer were adopted from an assessment completed by Yoakum (1993) in conjunction with information obtained during several meetings with other natural resource professionals and information presented in Appendices I and J.

1. Pronghorn

This alternative would allow for a slow increase in pronghorn numbers, potentially over that of Alternative A. To the extent that shrub cover is reduced through prescribed burning and use of herbicides, pronghorn would benefit. Effects of livestock grazing on pronghorn would be much the same as they would be under Alternative A, except that impacts would be reduced. Direct competition for forage would continue in some areas. Avoiding livestock grazing in many pronghorn fawning areas prior to July 1 would minimize negative impacts to pronghorn does and fawns.

Preconditioning of forage for pronghorn throughout most of their range would not be possible because cattle would graze vegetation in units after the growing season. For those areas where cattle would be removed before mid-growing season, there is no indication that forage used by pronghorn during fall and winter would be preconditioned or that preconditioning forage would have substantial benefits to pronghorn (Appendix I). However, based on Ellis (1970) and McNay and O'Gara (1982), impacts to fawning pronghorn could occur. In general, cattle grazing during the period 1 April through 1 August in pronghorn fawning areas (units that encompass low sagebrush) could negatively impact pronghorn does and fawns. This means that early season cattle grazing aimed at preconditioning forage for pronghorn could adversely impact pregnant pronghorn does. Cattle grazing in some meadows, if cattle are taken off while sufficient moisture remains in the soil, would delay development of forbs and increase their availability. Although this would have limited benefits to the pronghorn population, cattle grazing in meadows, under this alternative, is not expected to adversely impact pronghorn. However, additional fencing around riparian areas, especially meadows, would adversely affect pronghorn. Maintenance of fences throughout the distribution of pronghorn would continue to have adverse impacts to pronghorn.

Continued maintenance of waterholes would be an asset to pronghorn. The increased number of hunting tags would not adversely affect the pronghorn population. A predator control program may benefit pronghorn in the short-term. Opening the Blue Sky Road and the South Boundary Road year-round, weather permitting, may result in limited disturbance to pronghorn. Closing all spur roads off Blue Sky Road and South Boundary Road during the first half of the pronghorn fawning season would lessen the amount of disturbance to pronghorn does and fawns. Opening the Black Canyon Road to camping would have limited adverse impacts to pronghorn using the area. Opening the road between Post Meadow and Big Flat would increase use of the area by people, which would have adverse effects on pronghorn using the Big Flat area. However, camping along these roads would likely be low.

2. Bighorn Sheep

The bighorn sheep population would increase slightly under this alternative. The high amount of prescribed burning that would occur on South Mountain, and the non-use of this grazing unit by livestock would benefit bighorn populations. Livestock would compete directly with bighorn for forage (in bighorn sheep feeding areas). Because livestock are carriers of bluetongue and leptospirosis, they could potentially negatively impact the bighorn population. Transplanting operations would not adversely affect the bighorn population. Likewise, hunting of bighorn under this alternative would not change population status.

3. Mule Deer

Mule deer populations likely would not increase to any great extent under this alternative, during the short or long-term. The livestock grazing program and prescribed burning program would be coordinated to provide favorable conditions for deer in some areas, but overall effects on the population are unclear. Within the first 15 years of the program, however, conditions may decline somewhat for mule deer.

There is no indication that cattle could enhance forage quality of herbaceous plants in areas occupied by mule deer in the fall and winter (Appendix I). Removal of accumulated dead plant material may have some benefits to mule deer where late season cattle distribution overlaps with spring mule deer distribution. Direct competition for forage would occur in areas where cattle graze in late succession stages areas of big sagebrush-bitterbrush habitat during the growing season. Grazing by cattle in early-mid succession stages would enhance growth of bitterbrush seedlings.

Improved condition in aspen stands would benefit mule deer by providing higher quality fawning areas and cover and forage for adult deer. On the other hand, increased fencing in these areas would have adverse impacts on mule deer. Livestock grazing in meadows and willow habitat can reduce hiding cover for fawns. Willow planting would provide additional cover and forage for mule deer.

Hunting of mule deer at present levels would not affect populations. Implementation of a predator control program would likely benefit mule deer populations in the short-term. An effective predator control program could maintain artificially high deer populations if habitat conditions allow increased populations. Restricted use of the Barnhardi Road during the fawning season would continue to lessen disturbance to mule deer does and fawns. Establishment of a camping area near Stockade Creek would have minimal impacts to mule deer because the area is not heavily used by deer. Development of a camping area near Stockade Creek, replacing the one in Guano Creek, would mitigate adverse effects currently taking place in Guano Creek.

4. Sage Grouse

Sage grouse populations would increase over the short-term and remain static over the long-term under this alternative. Sage grouse populations would not increase to the extent they would under alternatives C and D. For the most part, livestock grazing would not have a detrimental impact on sage grouse. Detrimental impacts in uplands and riparian habitats could occur in areas of heavy livestock use or high livestock concentration. Generally, residual cover for nesting would not be reduced in upland areas lightly grazed or ungrazed by livestock. Condition of meadows and riparian areas, which are important for brood-rearing, would gradually improve where grazing was eliminated or reduced. Cattle grazing in meadows would enhance availability of forbs. It also would prolong the existence of succulent growth of forbs when moisture is available for regrowth. Whether these short-term benefits outweigh long-term consequences of cattle grazing in riparian meadows is a consideration that was brought up by Evans (1986).

Predator control (primarily coyotes and ravens) would allow for increased nest success over the short-term. However, excessive shrub cover appears to be the primary factor limiting sage grouse populations on the Refuge. The reason that excessive shrub cover is the primary limiting factor is that it restricts cover of grasses and forbs throughout most of the Refuge. Grass cover has been found to be important for sage grouse nesting on the Refuge (DeLong 1993b, Gregg et al. 1994). Forbs are critical for pre-laying hens (Barnett and Crawford 1994) and for chicks (Drut et al. 1994) on the Refuge. With lower cover of shrubs in late succession stands of sagebrush, higher cover of herbaceous plants would be expected (Winward 1991). Readers should note that sagebrush is absolutely critical to sage grouse, but at present, the excessively high cover of sagebrush is limiting other components of their habitat that are important.

Under this alternative only limited treatment of vegetation (e.g., fire) would occur and livestock grazing would not reduce excessive shrub cover. Therefore, sage grouse habitat would only be enhanced in isolated areas. Ecological status of sage grouse habitat would remain low on a large scale and sage grouse populations would not increase over the long-term. Sage grouse would be adversely impacted to a limited degree by developing camping areas at the edges of Post and Flook meadows. Use of the dry meadow in the vicinity of camping areas would be reduced; impacts would not have adverse impacts to the population.

5. Trout

Trout would benefit from the reduction of livestock grazing in riparian areas, and elimination of livestock grazing in Lyons Meadow and Eagle Peak grazing units. Stream habitat would continue to be impacted in some areas, and stream recovery would be impaired due to continued cattle grazing. There is no reason to believe that livestock grazing along streambanks would increase shading of streams.

B. WILDLIFE DIVERSITY

Richness of wildlife species would not change in the short-term and increase only slightly in the long-term under this alternative. Species richness would increase to the extent that interspersion of early and mid succession stages were increased in uplands, very late progression stages were restored in riparian areas, and residual supplies of herbaceous cover were maintained in uplands and emergent wetlands.

Although livestock grazing would occur less extensively than Alternative A, it would not directly or indirectly increase richness of wildlife species associated with an interspersion of early and mid succession stages in upland habitats. Furthermore, livestock grazing would not increase cover of herbaceous plants available to wildlife dependent on cover of sagebrush and herbaceous plants in late succession stands because grazing would not reduce excessive cover of sagebrush.

As prescribed in Alternative B, fire would increase interspersion of succession stages in uplands to a greater extent than Alternative A. The actual influence of burning would be limited to treated areas. Total area where fire had increased interspersion and richness would be small over the long-term compared to the total area not influenced by burning, especially in Wyoming big sagebrush and low sagebrush habitats. Consequently, sagebrush competition would limit cover of herbaceous plants and species richness in most Wyoming big sagebrush and low sagebrush habitats. Because of increased control of young juniper in Alternative C, amount available to juniper-associated wildlife would remain near current levels. Because of the relatively low application rate, small acreage of proposed treatment, and one time application, effect of herbicides on wildlife diversity are expected to have minimal impacts.

Prescribed burning and haying on the Shirk Ranch would increase their use by foraging cranes and geese during the breeding season. Haying operations on the Shirk Ranch would result in short-term, localized disturbances to wildlife; haying operations would occur infrequently and would not occur during the breeding season.

Species richness in riparian areas would increase as late and very late progression stages became more abundant over the long-term. No response of species richness would occur over the short-term because of the slow rate of recovery of riparian vegetation associated with the systematic restoration of channel-form in streams of the Refuge. Riparian areas and species richness will recover the fastest in sites not subjected to livestock use. Riparian areas and species richness will recover the slowest in sites subject to light-moderate livestock use. In riparian areas, any livestock use likely would reduce vegetation on streambanks, decrease roughness and sediment trapping by streambank vegetation, and diminish stability of streambanks. In emergent wetlands, wildlife richness would be impacted by regular removal of cover of residual herbaceous plants by livestock.

Wildlife associated with willow and aspen would increase, over the long-term, to the extent that mature stands would be 1) restored due to rested from grazing, 2) were planted to willow, and 3) burned to regenerate willow and aspen. Predator control would affect species richness in proportion to the number of species involved, the total area affected, and the duration of control. Based on these considerations, Alternative B results in more benefits to more wildlife species than Alternative A, but less than C, D, and E.

III. <u>EFFECTS ON SPECIAL AREA MANAGEMENT</u>

Refuge lands would not be evaluated as potential study areas for wilderness. The Poker Jim Ridge Wilderness Study Area is pending Congressional action. Poker Jim Ridge RNA would continue to be managed as a RNA.

IV. <u>EFFECTS ON RECREATION OPPORTUNITIES</u>

A. <u>RECREATION OPPORTUNITY SPECTRUM</u>

This alternative provides 63% of the Refuge in a SPM setting, providing the most opportunities for motorized recreation of all the alternatives. It would have the least amount of non-motorized recreation. People looking for opportunities for solitude and primitive types of recreation would have fewer places to recreate. Only 26% of the Refuge would be in a SPNM setting.

B. <u>CAMPING OPPORTUNITIES</u>

This alternative provides the most camping opportunities of any alternative. By providing many more camping opportunities and more direction in the Hot Springs Campground, this alternative would provide the most benefits to campers. More direction to campers would also be provided at the Guano Creek camping area.

By locating camping areas in more places on the Refuge, however, this alternative would have the greatest negative impact on other recreation uses. Visitors wanting to go sightseeing, hiking, and observing wildlife may be distracted by others camping in some areas.

The Hot Springs bathhouse would be redesigned to blend with the surrounding environment, and would be more visually appealing to visitors. Use would not be expected to change.

C. ROAD ACCESS

Opportunities for motorized recreation are most abundant in this alternative. All roads would either be open year-round or seasonally (363 miles of open roads), so visitors would have motorized access to most areas on the Refuge. Due to the rough nature of these roads, use may not increase dramatically.

D. INTERPRETATION

This alternative would provide for more signs and literature than baseline management. This would provide visitors with many more opportunities to learn of the Refuge and surrounding environment.

E. HIKING OPPORTUNITIES

This alternative would provide the most opportunities for those seeking developed hiking areas. However, due to the low amount of SPNM areas and the opening of all roads, opportunities for backcountry hiking would be limited.

F. HUNTING AND FISHING OPPORTUNITIES

By providing additional pronghorn and bighorn hunting tags as compared to baseline management, more hunters would have the opportunity to hunt these species on the Refuge. Although this would benefit hunters that otherwise would not have had the opportunity to hunt on the Refuge, it may detract from the experience of other hunters by increasing the encounter rate between hunters. This is the only alternative in which pronghorn hunting is increased, and would have a minor negative effect on those who do not like to visit during hunting season. Fishing would not change under this alternative, therefore would have no effect on recreation.

G. WILDLIFE VIEWING OPPORTUNITIES

Alternative B would have more habitat treated and restored than would Alternative A, but changes in wildlife populations due to this would be minimal. Thus, wildlife viewing opportunities would increase to a limited degree relative to existing conditions. There should not be any negative effects on wildlife viewing, compared to baseline management.

H. AESTHETICS

More prescribed burning would occur than in Alternative A. The degree to which this would affect recreation is very small, due to the small amount of acres treated. The limited amount of herbicide treatment prescribed by this alternative may create some negative short-term impacts on recreation and visuals. However, long-term effects would be positive, increasing opportunities for wildlife observation, and improving visual quality.

This alternative would provide livestock grazing on most management units of the Refuge, but would be approximately two-thirds less than Alternative A. Grazing would occur on the units only one out of every two years, so the effects to recreation would be less than Alternative A. However, grazing would occur on Big Flat in most, if not every, year. This would have some negative effect on recreation, for Big Flat is a popular wildlife viewing area. More fencing in riparian areas could diminish recreation experiences for people seeking natural areas.

V. EFFECTS ON THE LIVESTOCK GRAZING PROGRAM

This alternative would reduce the number of available AUMs to 3,900-4,300 each year (a two-thirds reduction from current levels). Livestock grazing would not be permitted during severe droughts. Shirk Ranch would not be available for livestock grazing.

VI. SOCIO-ECONOMIC IMPACTS

This alternative maximizes recreational use, with related annual benefits exceeding those from Alternative A by between $600,000 and $700,000. This alternative also is the least adverse for the business of cattle ranching (after Alternative A). Annual losses, using Alternative A as a baseline, between $3,000 and $95,000 are estimated, depending on whether or not ranchers could find alternative grazing pastures in the local area. The maximum figure would reflect losses if alternative pastures are not available and ranchers reduce production.

By year 15, increased business revenue associated with recreation/tourism would exceed adverse impacts on agriculture. By 50 years, this beneficial affect would have increased to $604,000 to $697,000, depending on assumptions used.

VII. EFFECTS ON CULTURAL RESOURCES

Camping areas in dispersed locations would have to be evaluated for cultural resources prior to development. The opening of all roads on the Refuge would allow access to most areas and would increase the chance of people finding artifacts. Escaped prescribed burns have the potential of damaging cultural resources. Possibilities of an escaped prescribed burn would be minimal because precautions would be undertaken when burning near historic and other structures. Livestock have the potential to damage artifacts on the soil surface by trampling; overall impacts would be slight in this alternative.

VIII. <u>EFFECTS ON SURROUNDING LANDS</u>

Changes to the livestock grazing program under this alternative could result in scheduling or other changes to livestock management on other lands, including BLM grazing allotments (please see comment 187, Appendix O) and private pasture. Any changes made on BLM allotments to better accommodate livestock operators that hold permits on the Refuge could have an influence on rangeland conditions to allotments in which changes are made. This may also hold for private pasture. Socio-economic impacts are discussed in a previous section.

Improvements to pronghorn habitat and increased numbers of bighorn sheep on the Refuge may result in higher use of surrounding lands, as these species move back and forth over the Refuge border. Increased camping opportunities would offset, at least in part, the potential increase in camping pressure on surrounding BLM lands as visitor use of the Refuge increases.

ALTERNATIVE C - HABITAT RESTORATION

Note: Assessments of this alternative's impacts on the natural and social environment were based on information summarized in Appendices I, J, and L as well as from information obtained during meetings and other communications with natural resource professionals.

I. EFFECTS ON HABITAT

A. SOILS

In general, soil erosion would decrease on a small scale in upland areas where shrub cover is removed and herbaceous cover has increased (up to 5 percent of Refuge uplands in the next 15 years). Litter cover would increase in other, untreated areas, which would help to decrease erosion. However, low herbaceous vegetation cover throughout most of the Refuge and continued use of roads in upland habitats would maintain near current soil erosion rates.

Streambank stability would improve considerably, though somewhat less than under Alternative D. In riparian areas where cattle grazing would be discontinued, bank erosion would decrease to a greater extent than in other riparian areas. Soil compaction would lessen considerably, though it may continue as a problem on a limited basis.

Direct heating of soil during fires would be mitigated by timing prescribed burns to minimize their intensity and severity. Exposure of the soil surface after burning may allow accelerated run-off, especially in areas of steeper slopes. However, after 2-3 years, grass and forb cover should be higher than before burns took place, which would result in a net reduction in soil erosion.

B. WATER QUALITY

Water quality would improve to a moderate degree over the next 15 years. However, maintenance of dense plant cover in riparian areas would trap sediment entering from uplands which would significantly reduce the amount actually entering stream water. Erosion of stream channels would lessen considerably. Over the long-term, water quality would improve substantially over current conditions, higher than under any other alternative except Alternative D.

Impacts of fire on water would largely be secondary, resulting from fire's influence on vegetation. Increased soil erosion would be expected for 1 to 3 years after burning. Riparian vegetation would catch some of the sediment. Over the long-term, water quality would improve over current conditions in many areas.

C. AIR QUALITY

No significant impacts to air quality would be expected, based on the air quality analysis presented in Appendix J. Prescribed burning would occur during approximately 5-10 days out of the year. Prescribed burning would not be carried out some years.

D. VEGETATION AND WATERSHED VALUES

Habitat conditions would improve more than they would under alternatives A and B, though they would remain relatively low for the next 15 years. Habitat diversity, watershed values, and nutrient cycling, would improve on a limited basis. In the long-term, habitat condition would improve substantially on up to half the Refuge. Riparian area conditions would improve considerably in the next 15 years. Refer to tables 4-1 through 4-6 for projected effects on structural stages of vegetation.

1. Desert Shrub Habitats

a) **Wyoming Big Sagebrush**

Habitat condition would improve slightly in the next 15 years; extent of improvement would be limited to about percent of the vegetation type (Table 4-1). Over the long-term, up to 40 percent of Wyoming big sagebrush could be restored and maintained under this alternative's treatment program (Table 4-2). A lower level of shrub cover in late succession stands would be maintained, thus allowing for higher grass and forb cover.

Soil disturbance resulting from mechanical treatment would increase the risk of cheatgrass invasion. However, seeding with native grasses and forbs should reduce the potential of cheatgrass gaining dominance over plant communities. Slopes generally are gentle in Wyoming big sagebrush areas, and thus erosion hazards would be limited. Through time, increased herbaceous cover and accumulation of litter gradually would increase soil-organic matter in the soil, increasing its productivity. Correspondingly, water infiltration would improve, and water runoff and soil erosion would decline.

Removing livestock from grazing units encompassing Wyoming big sagebrush would result in very few changes in this habitat, primarily because cattle have not been the factor that keeps cover of herbaceous vegetation at low levels. Additionally, cattle did not use most of the Wyoming big sagebrush area under baseline management. Residual height and cover of grass cover may increase near water sources. Removal of feral horses from the Refuge would improve habitat conditions in areas where horses are distributed. Feral horses occupy the southeastern portion of the Refuge year-round, and given current habitat conditions have a significant impact on plant communities.

Development of a campground near Flook Lake in the Wyoming big sagebrush vegetation type would result in increased soil erosion during the construction process. Adverse impacts would be minimized, however, by locating sites on level terrain and establishing native herbaceous vegetation in the vicinity of the camping area. Adverse impacts to vegetation would be minimal because of the relatively poor ecological condition of the site at present.

2. <u>Shrub-grassland Habitats</u>

a) **Low Sagebrush**

Habitat conditions would improve slightly in tableland areas and substantially in higher elevations in the next 15 years. Habitat diversity would increase substantially in higher elevations.

Over the long-term, about ten percent of the vegetation type could be maintained in early-mid succession at the treatment rate prescribed by this alternative (Table 4-1). Up to one-third of the vegetation type could be restored and maintained (Table 4-2). Shrub cover of late succession stands would be maintained at a much lower level than presently exists, thus allowing higher grass and forb cover. Watershed values would improve to the extent that shrub cover is reduced. The shallow hardpan characteristic of the low sagebrush type would prevent a substantial increase in water infiltration.

As with Wyoming big sagebrush, removing livestock from the low sagebrush type would not result in substantial changes, except in areas near water sources that previously were subjected to cattle and feral horse grazing. In these areas, there would be an increased amount of residual grass cover.

b) **Mountain Big Sagebrush**

Considerable improvement in habitat conditions would be achieved during the next 15 years. Up to 30 percent of the vegetation type would be in an early-mid stage of succession, and this level could be maintained over the long-term under this alternative. The most beneficial improvements would be the larger amount of grassland habitat and resulting increase in habitat diversity. Over the long-term, shrub cover in late succession stands would be maintained at a lower level, thus allowing higher grass and forb cover compared to current levels ("maintained" does not imply actively managed). Consequently, water infiltration would improve, and water runoff and soil erosion would decline. Nearly all of this vegetation type could be restored and maintained under this alternative over the long-term.

Elimination of juniper from key areas would allow grass and forb cover to increase which would enhance water infiltration and percolation. This would enhance water flow in some drainages.

Sharp reductions in livestock grazing levels, elimination in many areas, and permitting grazing at most once out of every three years in remaining areas would allow residual herbaceous cover and litter to increase in some areas; however, cover of herbaceous cover would continue to be limited by high shrub cover. Changes in livestock grazing management would not affect mountain big sagebrush on steep slopes.

c) **Big Sagebrush-bitterbrush**

Habitat conditions of this vegetation type would be improved somewhat over the next 15 years. The most significant improvements would be made by removing western juniper from productive bitterbrush areas. Very little of the existing mature stands (late succession) would be burned in the next 15 years.

A slight increase in early-mid succession areas would result from juniper control in the next 15 years. Over the long-term, the amount of land in early-mid succession would decline from its present level of 38 percent to about 9 percent. Up to one-third of the big sagebrush-bitterbrush type could be restored and maintained under this alternative over the long-term (Table 4-2).

Elimination of juniper in these bitterbrush areas would allow bitterbrush and mountain big sagebrush to once again dominate these areas. In the event that bitterbrush does not reestablish, seedlings would be planted. Following shrub and juniper reduction efforts, grass and forb cover would increase which would retard water runoff, increase infiltration, and reduce soil loss. Increased water infiltration and reduced water being used by junipers would increase the amount of water that reaches underground water sources, and may increase the amount of water that flows out of springs and into streams. Seedlings planted in the spring of 1993 would increase in cover.

Elimination of livestock grazing, except on a limited or prescription basis, would allow residual herbaceous cover and litter to increase somewhat, thus positively influencing watershed values. Cover of herbaceous cover, however, would continue to be limited by high shrub cover. Moderate to heavy grazing pressure would occur only on a limited basis. Any impacts due to livestock grazing would be minimal because use would be closely monitored, and use would occur at most every third year. This would permit higher seed production in late succession stands. Bitterbrush seed production requires two complete growing seasons to mature.

Development of a camping area at Barry Spring, just east of Blue Sky, would adversely impact soil and vegetation of the immediate vicinity of the proposed area. The site would be located in the big sagebrush-bitterbrush vegetation type, although bitterbrush currently is uncommon in the area. During construction, soil erosion would increase. However, adverse impacts would be mitigated by re-establishing native vegetation soon after project completion. A more thorough assessment would be completed by resource professional prior to development of the site.

d) **Wheatgrass**

In the next 15 years, some improvement would be made on habitat condition in wheatgrass as a result of prescribed burning of shrub dominated stands, and cutting and burning juniper that has invaded. Over the long-term, about 12 percent of the wheatgrass type could be maintained under this alternative's prescribe burning program. Treated areas would be maintained in a grassland state. Converting sites from juniper dominated stands to grassland areas would vastly improve watershed qualities. Water infiltration would increase, and water runoff and soil erosion would correspondingly decrease.

Habitat would become more favorable for grassland inhabiting wildlife species and less favorable for species that depend on juniper. Additional feeding areas would become available to bighorn sheep.

3. Montane Shrub Habitats

a) **Mountain Shrub**

Habitat conditions in mountain shrub and mountain mahogany stands over the next 15 years would remain much as they are at present. Though snowpockets generally would be avoided during prescribe burning operations, some snowpocket mountain shrub stands may be burned in the process. Mountain balm generally responds favorably to burning, and thus fire would improve the health of some stands.

4. Conifer Forest Habitats

a) **Ponderosa Pine and White Fir**

Cover of western juniper would be reduced in and adjacent to pine and fir stands, which would reduce risk of a wildfire eliminating stands. Discontinuing cattle grazing would increase fine fuels in and adjacent to pine stands, which would facilitate underburning efforts.

5. Deciduous Forest Habitats

a) **Quaking Aspen**

Recovery of aspen habitat would be substantially higher during the next 15 years under this alternative as compared to Alternative B. Burning 100-200 acres of aspen habitat would stimulate resprouting of stands which would hasten their recovery. Burning would temporarily reduce habitat diversity, but the resulting mature aspen stands would have much higher diversity than they presently have. Mule deer would continue to suppress aspen regeneration in some areas.

Effects of cattle would be mitigated by fencing some aspen stands and by monitoring cattle distribution and use of vegetation closely. Cattle in units encompassing unfenced aspen stands may occasionally make their way into these stands; impacts would be minimal. Increased fencing would pose additional hazards to mule deer.

Restoring areas presently at an early or mid stage of progression to their potential, would greatly increase the number of wildlife species that would use these areas.

6. Riparian Shrub Habitats

a) **Mixed Deciduous Shrub**

Effects would be similar to those of the aspen vegetation type. Most mixed deciduous shrub exists in grazing units which would not be available to livestock grazing. Development of a camping area at Barry Spring would have limited impacts to the stand of mixed deciduous shrub located nearby. The stand is dense, making penetration by people difficult. Impacts would be mitigated by developing the camping area at least 50 meters away from the riparian area.

b) **Willow**

Substantial recovery of willow would occur under this alternative due to (1) willow plantings, (2) reduction of cattle grazing pressure in grazing units encompassing willow habitat, (3) the sharp reduction in livestock numbers, and (4) rest periods of two years or more. Willow habitat would recover at a faster rate than it would under alternatives A and B. Streambanks would once again become stabilized by willow, and shading would increase in areas presently in early or mid progression. Over the long-term, water tables would reach their former level. Willows and sedges would replace sagebrush and upland grasses that presently dominate valley bottoms.

7. Marsh Habitats

a) **Bluegrass-ryegrass**

Recovery of bluegrass-ryegrass meadows would be increased over alternatives A and B. Nearly all bluegrass-ryegrass meadows would be permitted to restore without any impacts from livestock grazing because most of the area comprised by this vegetation type is within non-use areas prescribed by this alternative. Streams travelling through these meadows are seasonal, and in some years may not receive water. Consequently, recovery of these meadows may take decades.

Prescribe burning meadows that have been invaded by basin big sagebrush would allow these areas to recover more rapidly than if they were not burned. Reestablishment of grasses and elimination of cattle grazing would maintain competitive advantage to grass species.

b) **Sedge-rush-bluegrass**

Habitat conditions would improve over existing conditions, and to some extent over conditions resulting from Alternative B, though not as much as would occur under alternatives D and E. Strategically located check dams would provide additional recovery. Sedge-rush-bluegrass meadows would be the most intensively grazed habitat under this alternative. However, grazing pressure would be much reduced compared to Alternative B.

The restrictive livestock grazing program would limit damage to streams and riparian habitat. However, complete control would not be obtained. Therefore, some overuse would occur and streambanks would be impacted on a limited basis. Impacts of heavy grazing in some areas would be mitigated by allowing two or more years of rest between grazing periods. Soil compaction that has occurred through past use would lessen under this alternative.

Few sedge-rush-bluegrass meadows would reach potential within the next 15 years. Over the long-term, most of this vegetation type could reach potential, though it would take longer than under Alternative D. Periodic burning would not reduce time to full recovery.

One of the most significant effects that this alternative would have on wildlife as compared to baseline management and Alternative B would be the maintenance of residual vegetation cover. Nesting cover for waterfowl, wading birds, marsh-birds, and shorebirds would be greatly improved.

Improvements made to the Hot Springs Campground would reduce soil compaction, reduce soil erosion, and reduce impacts to vegetation. Developing camping areas at the edge of Post Meadow would have limited adverse impacts to dry meadow plant communities of these meadows. Impacts would be mitigated by providing parking areas in the adjacent uplands, minimizing the development of camping areas in dry meadow habitat, and limiting the total area available for camping. Soil compaction would result from use of the area by campers, and soil erosion would likely increase. Adverse impacts to wet meadow plant communities would be minimal because camping areas would be restricted to dry meadow habitat. A more thorough assessment would be completed by resource professionals prior to development of the site.

c) **Silver Sagebrush**

Habitat conditions in silver sagebrush would not change appreciably over the next 15 years under this alternative. Maintenance of residual vegetation cover may benefit some species of wildlife.

d) **Poverty Weed-primrose and Rush-spikerush-arnica**

Aside from sustaining greater forb cover on playas, elimination of livestock grazing in the southeast portion of the Refuge would result in few changes.

e) **Cattail-bulrush**

Cattail-bulrush habitat on Big Flat and Shirk Ranch would improve considerably. Reduction in cattle grazing pressure on Big Flat and elimination on the Shirk Ranch would allow residual vegetation cover to increase. Thus, quality of waterfowl nesting habitat would increase. Cattail-bulrush habitat in Big Flat would continue to be grazed by cattle, but no more than once out of every three years. Big Flat would continue to be impacted by low water supply during dry periods. Development of deep-water areas on the Shirk Ranch would increase establishment of bulrush and cattail.

8. Aquatic Habitats

a) **Pondweed**

Habitat conditions would remain similar to current conditions.

b) **Aquatic Non-vegetated**

Lakes Very little would change in non-vegetated lakes.

Streams Aquatic habitat of streams generally would recover at a faster rate than would happen under alternatives A and B. Assuming adherence to the maximum 30-percent use of streamside vegetation, recovery of many areas may approach the same rate as under alternatives D and E. However, some heavy use and damage to streambanks would most likely occur in some areas. Overall damage to the system would be limited.

Changes in instream habitat could be considerable in some meadows and streams bordered by willows. Although recovery of the water tables will take substantially longer, stabilization of streambanks would allow stream channels to narrow and deepen in the short-term. Adhering to the 30-percent maximum use of streamside vegetation by livestock, and minimum two-year rest periods would greatly increase shading in some meadows. Willow plantings would hasten recovery of stream sections where willows were planted, and would improve shading. Stream temperatures would drop correspondingly, improving conditions for trout. Over the long-term, restoration of up to half of upland habitats would reduce sedimentation.

Stream length in meadows (a function of the amount of meandering) and water storage capabilities would not increase to any great extent in the near future. Over the long-term, however, stream length in meadows would increase as more meanders formed in streams. This would increase the amount of habitat available to redband and Lahontan cutthroat trout.

II. EFFECTS ON WILDLIFE

A. FEATURED SPECIES

Descriptions of the effects on pronghorn, bighorn sheep, and mule deer were adopted from an assessment completed by Yoakum (1993), in conjunction with information obtained during several meetings with other natural resource professionals and information presented in Appendices I and J.

1. Pronghorn

A moderate increase in pronghorn would be expected under this alternative, though it may take 30 years to see a significant increase in population. Reducing shrub cover, and increasing acreage of early-mid succession stands would benefit pronghorn. Livestock grazing under this alternative would have minor effects on pronghorn populations.

Cattle grazing at Big Flat on a periodic basis may increase the availability of forbs. Additional fencing around riparian areas, especially meadows, would adversely affect pronghorn.

Continued maintenance of waterholes would be an asset to pronghorn. Hunting at the level proposed by this alternative (same as baseline management) would not adversely affect the pronghorn population. Vehicle traffic into fawning habitat during fawning season would adversely affect populations.

Development of the Flook Lake camping area may have some adverse impacts on pronghorn that use the lakebed. However, the camping area would be nearly a mile from the lakebed and use of the camping area is expected to be limited.

2. Bighorn Sheep

The bighorn sheep population would increase moderately under this alternative. The high amount of prescribed burning that would occur on Hart Mountain and Poker Jim Ridge, and non-use by livestock would benefit bighorn populations.

Transplanting operations and hunting would not adversely affect the bighorn population.

3. Mule Deer

Overall, mule deer populations are not expected to increase in response to management actions proposed by this alternative, though they would not be adversely affected. This applies to both the short-term and long-term. Some actions would benefit deer, however. Willow planting and natural restoration would provide additional cover and forage for mule deer. Recovery of aspen stands would increase fawn-rearing habitat, cover and forage available for fawns and adults. Creating mosaics of different succession stages would have some benefits to mule deer also. Increased fencing in some riparian areas would have adverse impacts on mule deer.

Hunting of mule deer at present levels would not adversely affect populations. Restricted use of the Barnhardi Road during the fawning season would continue to lessen disturbance to mule deer does and fawns. Closing of the Guano Creek Campground would lessen disturbance to deer in this important summer range of deer. Establishment of a camping area at Barry Spring would have minimal impacts to mule deer because the area is not heavily used by deer. Development of a camping area at Barry Spring and Flook Lake, replacing the one in Guano Creek, would mitigate adverse effects currently taking place in Guano Creek.

4. Sage Grouse

Sage grouse populations would remain static over the short-term and increase over the long-term under this alternative. Restricted cattle grazing would not be detrimental to sage grouse populations. Residual cover for nesting would not be reduced in upland areas. Increased treatment of vegetation types compared to alternatives A and B would allow for greater vegetation type diversity. Brood-rearing habitat would be improved over the short and long-term because of increased forb production in treated areas. Although increased treatment of vegetation types would eliminate sage grouse nesting habitat in the short-term, quality of nesting habitat would improve over the long-term because of greater amounts of residual grass cover in late succession sagebrush stands. Furthermore, condition of meadows and riparian areas would also improve over the long-term. Sage grouse populations would increase over the long-term because of reduced shrub cover and increased herbaceous understory in uplands and improved condition of riparian areas.

Sage grouse would be negatively impacted to a limited degree by developing two camping areas near Post Meadow. The campground for horseback riders would be located at the edge of the meadow. Because use of this site by campers would be limited (only people with horses can use the site), negative impacts to sage grouse would be restricted to a few days out of the year. Adverse impacts of the proposed Barry Spring Campground would be mitigated by locating the camping area behind a screen of riparian shrubs and trees.

5. Trout

Trout would benefit from the sharp reduction in livestock grazing, and elimination of livestock in Lyons Meadow and Eagle Peak grazing units. Restoration of stream habitat would approach that which would occur in Alternative D, except cattle would continue to impact streams in some areas. Consequences of this would be minor.

B. WILDLIFE DIVERSITY

Species richness would increase more in this alternative than alternatives A, B, and E, but less than D. As with other alternatives, wildlife habitats would be influenced by a variety of management practices. Changes in species richness initially would be limited to sites where practices are applied. However, richness would increase moderately over the long-term as habitat manipulations collectively influenced conditions and processes of the landscape.

In uplands, long-term increase in species richness would occur to the extent that succession was controlled to improve habitat interspersion and increase cover of herbaceous vegetation. Because livestock grazing cannot be used to reduce shrub cover, it would not increase richness of wildlife species associated with an interspersion of early and mid succession stages in upland habitats. Furthermore, livestock grazing would not increase the amount of residual cover of herbaceous plants available to wildlife because it would not reduce cover of sagebrush. However, impacts of livestock use would be more limited in Alternative C compared to alternatives A and B.

Prescribed burning would be conducted on a more extensive basis in Alternative C compared with alternatives A and B. Prescribed burning in Alternative C would increase species richness in uplands over the long-term. Richness would increase because: (1) sagebrush cover would decline; (2) cover of herbaceous plants would increase; (3) interspersion of early, mid, and late stages of succession would increase; and (4) all principle upland habitats would be involved in the restoration program (Tables 4-3 and 4-4). Additionally, Alternative C would reduce the amount of young juniper and therefore increase richness of wildlife associated with productive early, mid, and late stages of succession in sagebrush stands of Hart Mountain and Poker Jim Ridge. Development of a campground near Flook Lake in the Wyoming big sagebrush vegetation type would have minimal impacts to wildlife diversity. To the extent that shrub cover is reduced and herbaceous cover is established, wildlife diversity in the immediate area may increase -- use of the camping area by people, however, would offset these benefits.

Restoration of upland habitats also would influence restoration of wetland habitats. As a consequence of prescribed burning and mechanical control of sagebrush and juniper in uplands, improved soil-water infiltration would increase streamflow, which would increase the rate of riparian habitat recovery, and, consequently, increase richness of wetland-dependent wildlife. Although livestock grazing would not restore riparian areas, its effect on rate of recovery would be less in Alternative C compared to alternatives A and B. In Alternative C, some aspen and willow stands would recover as areas are rested from livestock grazing, planted to willow, and burned for willow and aspen regeneration. Alternative C would, in conclusion, moderately increase species richness in uplands and wetlands over the long-term.

Establishment of campgrounds at Barry Spring and Post Meadow (horse camp only) would negatively impact wildlife using adjacent habitat. However, there would be a net gain in values to wildlife compared to present management because Guano Creek Campground would be closed. Impacts to wildlife would be mitigated by locating camp sites of the Post Meadow camping area at the edge of the meadow, and the Barry Spring site would be located in an upland area. Use of the Post Meadow site is expected to be low.

III. EFFECTS ON SPECIAL AREA MANAGEMENT

No foreseeable changes would occur in management of special management areas within the next 15 years. Poker Jim Ridge RNA would continue to be managed as a Research Natural Area. There currently are no other special management areas on the Refuge.

Three areas would be studied to assess their potential as RNAs. The Poker Jim Ridge Wilderness Study Area is pending Congressional action. Two SPNM areas on the Refuge would be recommended for study to assess their wilderness potential. Determinations as to whether or not RNAs or wilderness areas would be added to Hart Mountain NAR cannot be made at this time.

IV. EFFECTS ON RECREATION OPPORTUNITIES

A. RECREATION OPPORTUNITY SPECTRUM

Thirty-two percent of the Refuge would be maintained in a SPNM setting offering chances for solitude and primitive types of recreation. This is not very different than baseline management as far as the percentage of non-motorized area, but the locations of the areas are different.

B. CAMPING OPPORTUNITIES

Campground management in this alternative would provide additional sites, as well as designing the Hot Springs Campground to accommodate different user groups. By providing more camping opportunities and more direction in the campground, this alternative would offer more areas to camp, fewer people at each area, and a decrease in user conflicts.

Having camping at more places on the Refuge may have some negative effects on other Refuge visitors, although not as great as Alternative B. Closing the Guano Creek camping area would have some negative effect on hunters who prefer to camp there, but would improve wildlife viewing and hiking opportunities. Mitigation for closing this area would be opening other dispersed camping areas for longer periods of time.

The Bathhouse would be redesigned to blend with the surrounding environment. This would make it more visually appealing to visitors, but use would not be expected to change.

C. ROAD ACCESS

This alternative would provide less open roads than would Alternative A (Baseline Management); however, 57% of the Refuge would still fall under the SPM setting. This will still offer many opportunities for motorized recreation. Approximately 200 miles of roads would remain open for public access, 161 miles would be closed to public access (34 miles of this would be administrative roads).

D. INTERPRETATION

A few additional signs and literature would be provided, offering recreationists more opportunities to learn of the Refuge and surrounding environment.

E. HIKING AND HORSEBACK RIDING OPPORTUNITIES

In this alternative, a few additional opportunities for hiking along closed roads would be available due to road closures, but most of these roads are redundant or dead end roads. Administrative use of North and South Hart Mountain would be much more restrictive, creating a larger roadless area in one the most popular hiking areas on the Refuge. No developed trails would be constructed.

Horseback riding opportunities would be decreased because riding would be restricted to open roads only. Due to the low amount of horse use on the Refuge, this should not have a large negative affect on recreation in general.

F. HUNTING AND FISHING OPPORTUNITIES

Hunting and fishing opportunities would not change from baseline management. Continuing hunting on the Refuge would still affect some recreationists by maintaining the relatively high number of people on the Refuge during hunting season, and those who do not like to visit during hunting season.

G. WILDLIFE VIEWING OPPORTUNITIES

This alternative contains the second highest change in habitat diversity of all the alternatives, and should increase wildlife diversity as well. This increase should have a positive impact on wildlife viewing opportunities.

H. AESTHETICS

Considerable acreage would be treated through prescribed burning, which would have some negative short-term effects on aesthetics in treated areas. The long-term should show positive effects on recreation and visuals in that area based on improvements in wildlife, spring richness, and landscape diversity.

The effects to recreation from cattle grazing should be very limited in this alternative due to the limited scope of grazing. Livestock grazing would occur in the central portion of the Refuge once out of every three years. This alternative would necessitate more fencing around riparian areas to control cattle use, which would have a negative impact on recreationists seeking a natural environment.

V. EFFECTS ON THE LIVESTOCK GRAZING PROGRAM

This alternative would reduce the number of available AUMs by about 95 percent. Livestock grazing would be permitted no more than once out of every three years, and no more than 2,500 AUMs would be accommodated during the year in which grazing is permitted (these can be viewed as baseline constraints). Taking into account additional constraints on livestock grazing (such as the requirement for the five-year average precipitation level being greater than the 30 year average), grazing would likely occur no more than once out of every four years on average. Approximately 20 percent of Refuge lands would be available to livestock grazing. Shirk Ranch would not be available.

VI. SOCIO-ECONOMIC IMPACTS

This alternative is more moderate with respect to permitted levels of recreation/tourism use, and provides for a small amount of cattle grazing. At the same time, it incorporates a more extensive vegetation recovery and maintenance program -- considered beneficial by non-consumptive visitors to the Refuge. When the amount of land in early-mid succession is maximized (50 years), it would generate between $157,000 and $383,000 more annually to the local economy than would Alternative A.

This alternative would have adverse impacts on revenue gained from cattle grazing. Using Alternative A as a baseline, annual losses between $8,000 and $234,000 are estimated, depending on whether or not ranchers could find alternative grazing pastures in the local area. The maximum figure would reflect losses if alternative pastures are not available, and ranchers reduce production.

VII. <u>EFFECTS ON CULTURAL RESOURCES</u>

The extremely limited livestock grazing in this alternative may damage some surface resources. The increased amount of prescribed burning would increase the chance of fires escaping and damaging cultural resources. However, possibilities of an escaped prescribed burn would be minimal because precautions would be undertaken when burning near historic and other structures. Camping areas in dispersed locations would have to be evaluated for cultural resources prior to development.

VIII. <u>EFFECTS ON SURROUNDING LANDS</u>

A sharp cut in the amount of livestock grazing on the Refuge under this alternative could result in adjusted schedules or other changes to livestock management on other lands, including BLM grazing allotments (please see comment 187, Appendix O) and private pasture. Changes have already been made on one allotment (AMP #0216) due to the absence of grazing on the Refuge during 1991-1993 (Refuge files). Changes on other allotments have not been requested. Any changes made on BLM allotments to better accommodate livestock operators that have held permits on the Refuge could have an influence on rangeland conditions to allotments in which changes are made. This may also hold for private pasture. Four livestock operators currently hold livestock grazing permits on the Refuge. Socio-economic impacts are discussed in a previous section.

Improvements to pronghorn habitat and increased numbers of bighorn sheep on the Refuge may result in higher use of surrounding lands, as these species move back and forth over the Refuge border. Restrictions on the number of camping parties per campground on the Refuge may increase camping pressure on surrounding BLM lands as visitation of the Refuge increases. This could potentially affect lands on which off-Refuge campgrounds are located, although significant adverse impacts are not anticipated.

ALTERNATIVE D - NATIVE COMMUNITY RESTORATION

Note: Assessments of this alternative's impacts on the natural and social environment were based on information summarized in Appendices I, J, and L as well as from information obtained during meetings and other communications with natural resource professionals.

I. EFFECTS TO HABITAT

A. SOILS

Considerable headway would be made in reducing soil erosion on the Refuge in the next 15 years on nearly 15 percent of upland habitats. Litter cover would increase in other, untreated areas, which would help reduce erosion. Road closures and natural re-vegetation of these roads would reduce soil erosion and gullying. Low cover of herbaceous vegetation throughout most of the Refuge would maintain near current soil erosion rates in uplands.

Positive effects would be most prominent in riparian areas. Streambank stability would improve considerably; this alternative would result in the highest streambank stability of any alternative. Even at the recovery rate expected under this alternative, some streambanks may not stabilize for decades. Soil compaction would not be a problem under this alternative.

Direct heating of soil during fires would be mitigated by timing prescribed burns to minimize their intensity and severity. Exposure of the soil surface after burning may allow accelerated run-off, especially in areas of steeper slopes. However, after 2-3 years, grass and forb cover should be higher than before burns took place, which would result in a net reduction in soil erosion. This alternative has the highest potential of adversely impacting soils in the short term through prescribed burning.

B. WATER QUALITY

Water quality would improve to a moderate degree over the next 15 years (more than any other alternative). Restoring and maintaining dense plant cover in riparian areas would trap sediment entering from uplands which would significantly reduce the amount actually entering stream water. Erosion of stream channels would lessen considerably. Impacts of fire on water would largely be secondary, resulting from fire's influence on vegetation. Increased soil erosion would be expected for 1 to 3 years after burning. Riparian vegetation would catch some of the sediment. Over the long-term, water quality would improve over current conditions, higher than under any other alternative.

Herbicides could negatively impact water quality by contaminating surface and/or groundwater. Herbicides may reach waterbodies through drift of herbicide, or post-treatment through surface or subsurface runoff. Proposed mitigation measures including ground application, 100-foot buffer zones (200-foot if aerially applied) around riparian areas (for shrub reduction applications), and avoidance of application prior to heavy precipitation would reduce the potential for herbicides impacting water quality. Effects of herbicides on water quality would be minimal because of the relatively few acres proposed for treatment, low dose of herbicide application rates, and one time herbicide application per site. Negative impacts to water quality as a result of herbicide application would be less likely with Alternative D compared to Alternatives B, because Alternative D proposes less acreage to be treated with herbicides.

C. AIR QUALITY

No significant impacts to air quality would be expected, based on the air quality analysis presented in Appendix J. Prescribed burning would occur on approximately 5-15 days out of any given year, but would not be carried out in some years.

D. VEGETATION AND WATERSHED VALUES

Habitat conditions would increase more than they would under any other alternative. Habitat diversity, watershed values, and nutrient cycling, could be improved on about 15 percent of the Refuge. In the long-term, ecological status would improve substantially on up to three-quarters of the Refuge. Riparian area conditions would improve considerably in the next 15 years. Refer to tables 4-1 through 4-6 for projected effects on structural stages of vegetation types.

1. Desert Shrub Habitats

a) **Wyoming Big Sagebrush**

Effects of this alternative on Wyoming big sagebrush would be similar to those of alternative C with the exception of the following: (1) the amount of Wyoming big sagebrush in an early-mid stage of succession would be as high as 15 percent in 15 years, (2) approximately 30 percent of the vegetation type could be maintained in early-mid succession over the long-term, and (3) over 80 percent of the vegetation type could be restored and maintained over the long-term (Table 4-1). Attaining this level of treatment is dependent on finding an effective means to reduce shrub cover. Excessive soil erosion would continue throughout most of this vegetation type during the next 15 years, but over the long-term, soil erosion would be lowered more than under any other alternative.

As pointed out by Krueger et al. (1991), healthy habitat conditions would not be an automatic result of prescribed burns. Because of the prevalence of cheatgrass and scarcity of native perennial grasses and forbs in some areas of this vegetation type, reseeding with native grasses and forbs will be important. A healthy balance of shrubs and native herbaceous vegetation would not be expected in the near future.

Effects of herbicides on Wyoming big sagebrush stands would differ by type of herbicide. Application of 2,4-D would target shrubs and forbs, and plant death would occur within one season of application. Application of tebuthiuron would primarily target shrubs, although forbs may also be affected. Tebuthiuron application would thin sagebrush stands (50-75% sagebrush kill), primarily within a three year period. Grasses are relatively tolerant to both 2,4-D and tebuthiuron. Impacts to forbs would likely be minimal because of the relative low abundance of forbs currently in Wyoming big sagebrush stands.

Elimination of livestock grazing would not affect the Wyoming big sagebrush type to any large degree because livestock under baseline management did not use most of the vegetation type. Additionally, removal of cattle from areas grazed until 1990, in itself, would not result in a substantial increase in herbaceous vegetation because excessive shrub cover would persist. Removal of feral horses from the Refuge would improve habitat conditions to some degree in areas where horses are distributed. Feral horses occupy the southern portion of the Refuge year-round, and given current habitat conditions have substantial impact on plant communities.

Development of a campground near Flook Lake in the Wyoming big sagebrush vegetation type would result in increased soil erosion during the construction process. Adverse impacts would be minimized, however, by locating sites on level terrain and establishing native herbaceous vegetation in and around the camping area. Adverse impacts to vegetation communities would be minimal because of the relatively poor ecological condition of the site at present. Although soil erosion would not significantly decline during the next 15 years with the closure of roads, soil erosion from roads would decline over the long-term as vegetation establishes on the roads. A more thorough assessment would be completed by resource professionals prior to development of the area.

2. Shrub-grassland Habitats

a) **Low Sagebrush**

Effects of this alternative on low sagebrush would be similar to those of Alternative C with the exception of the following: (1) nearly twice as much acreage would be in an early-mid seral stage of succession in 15 years, (2) over twice as much of the vegetation type could be maintained in early-mid succession over the long-term, (3) elimination of livestock would result in more residual cover in areas that would be grazed under Alternative C, and (4) over 60 percent of the vegetation type could be restored and maintained over the long-term (Table 4-2). Reaching this level of treatment is dependent on finding an effective means of burning low sagebrush through prescription.

Effects of herbicides on low sagebrush would be similar to effects described for Wyoming big sagebrush with the possible exception of impacts to forbs. Herbicides may negatively impact forbs to a greater degree than in the Wyoming big sagebrush stands because of their greater relative abundance in low sagebrush stands.

Similar to the Wyoming big sagebrush type, elimination of livestock from low sagebrush would not have substantial effects, except in areas near water sources that previously were subjected to cattle and feral horse grazing. In these areas, there would be an increased amount of residual grass cover. Removal of feral horses from the Refuge would improve habitat conditions in areas where horses are distributed. Feral horses occupy the southern portion of the Refuge year-round, and given current habitat conditions have significant impact on plant communities.

Road closures in low sagebrush areas would reduce soil erosion to a limited degree. Roads that follow along intermittent drainages would improve in condition because many of these areas formerly were dry meadows. Closing roads that access lakebeds would reduce disturbance to wildlife. Development of a road in low sagebrush habitat to replace the road in Guano Creek would increase soil erosion in a localized area. Adverse impacts would be lower than those that currently exist with the road travelling along Guano Creek. Rerouting the road out of Guano Creek would mitigate adverse impacts currently taking place.

b) **Mountain Big Sagebrush**

Effects of this alternative on mountain big sagebrush would be similar to those of Alternative C with the exception of the following: (1) up to 35 percent of the mountain big sagebrush type would be in an early-mid seral stage of succession in 15 years, (2) more residual grass cover would be maintained in areas that would be grazed under Alternative C, and (3) Approximately 37 percent of the vegetation type could be maintained in early-mid succession over the long-term.

Non-use by livestock, compared to very minimal use as proposed in Alternative C, would result in few differences in livestock-related effects between these alternatives. Compared to Alternative A, however, substantial improvements in the amount of residual cover would occur in some areas that has received heavy use in the past. Road closures would reduce soil erosion rates.

c) **Big Sagebrush-bitterbrush**

Effects of this alternative on big sagebrush-bitterbrush would be similar to those of Alternative C with the exception of the following: (1) substantially more juniper would be cut or burned, (2) approximately 16 percent of the vegetation type could be maintained in early-mid succession over the long-term, and (3) up to 59 percent of the vegetation type could be restored and maintained over the long-term.

Non-use by livestock, compared to very minimal use as proposed in Alternative C, would result in few differences in livestock-related effects between these alternatives. Compared to Alternative A, however, substantial improvements in the amount of residual cover would occur in some areas that has received heavy use in the past.

Development of a camping area at Barry Spring, just east of Blue Sky, would adversely impact soil and vegetation of the immediate vicinity of the proposed area. The site would be located in the big sagebrush-bitterbrush vegetation type, although bitterbrush currently is uncommon in the area. During construction, soil erosion would increase. However, adverse impacts would be mitigated by re-establishing native vegetation soon after project completion. A more thorough assessment would be completed by resource professional prior to development of the site.

d) **Wheatgrass**

In the next 15 years, considerable improvement would be made on habitat conditions in the wheatgrass type as a result of prescribed burning of shrub dominated stands, and cutting and/or burning young juniper that has invaded. Over the long-term, most of the wheatgrass type could be maintained under this alternative's prescribe burning program. Wheatgrass habitat would be maintained in a grassland state. Converting sites from juniper dominated stands to grassland areas would improve watershed conditions. Water infiltration would increase, and water runoff and soil erosion would correspondingly decrease.

Habitat would become more favorable for grassland inhabiting wildlife and less favorable for species that use juniper. More feeding areas would become available for bighorn sheep.

3. Montane Shrub Habitats

a) **Mountain Shrub**

Effects of this alternative on these vegetation types would be the same as in Alternative C.

4. Conifer Forest Habitats

a) **Ponderosa Pine and White Fir**

Effects of this alternative on these vegetation types would be similar to those described under Alternative C.

5. <u>Deciduous Forest Habitats</u>

a) **Quaking Aspen**

Recovery rate of aspen habitat would be somewhat higher than under Alternative C because of the larger amount of acres subjected to burning. Total elimination of livestock during the next 15 years would considerably reduce impacts to young aspen, and therefore, increase aspen survival and recruitment. There also would be an increase in structural diversity and hiding cover in understories. Mule deer would continue to impair restoration of small, isolated stands. Rerouting portions of the Barnhardi Road and closing the middle section would enhance watershed qualities and aspen habitat. Soil erosion would decline as the existing road re-vegetated. Rerouting the road from its current location along Guano Creek would increase structural diversity and distribution of riparian vegetation. Disturbance to wildlife during the period 1 August to 1 November (when the road currently is open) would be reduced. Aside from these differences, consequences of alternatives C and D would be very similar.

6. <u>Riparian Shrub Habitats</u>

a) **Mixed Deciduous Shrub**

Effects would be similar to those of the aspen vegetation type. Development of a camping area at Barry Spring would have limited impacts to the stand of mixed deciduous shrub located nearby, assuming that people do not camp in the narrow riparian corridor and do not cut fire wood from the area. The stand is dense, making penetration by people difficult. Impacts would be mitigated by developing the camping area at least 50 meters away from the riparian area, posting regulations, and monitoring activity of the campground.

b) **Willow**

Effects of this alternative on willow habitat would be similar to effects that would occur under Alternative C. Total elimination of livestock would ensure no overuse by livestock, possibly speeding recovery in some areas. Willow planting and burning in some areas would increase the recovery rate over that which would occur under Alternative E.

7. <u>Marsh Habitats</u>

a) **Bluegrass-ryegrass**

Consequences would be very similar to those described under Alternative C for bluegrass-ryegrass, except that additional acreage would be prescribe burned under this alternative.

b) **Sedge-rush-bluegrass**

This alternative would allow for the most rapid recovery of sedge-rush-bluegrass. Strategically located check dams would provide additional recovery over Alternative E. Soil compaction would lessen as riparian soils are restored.

Few sedge-rush-bluegrass meadows would reach potential within the next 15 years, even at the relatively fast recovery rate that would take place under this alternative compared to the others. Over the long-term, most of this vegetation type would reach potential, though it may take many decades in some areas. Periodic burning would not reduce time to full recovery.

Maintenance of residual vegetation cover would greatly improve habitat quality for wildlife that depend on meadow habitat. Burning meadows through prescription (and haying on the Shirk Ranch area) would temporarily reduce nesting and hiding cover of wildlife. Adverse impacts would be mitigated by burning meadows no more than once out of every five years, not burning during nesting season, and leaving large unburned patches. Quality of waterfowl nesting cover would be enhanced in some areas as a result of prescribed burning (or haying). Haying operations on the Shirk Ranch area would not adversely impact meadow soil, relative to compaction, because of the infrequency of applications.

Re-routing roads to minimize the amount of roads in wet meadows and restoring areas once portions of roads are closed would reduce soil erosion and sedimentation to streams and would improve overall quality of the riparian areas for wildlife.

Re-routing of the road that currently runs through the Refuge headquarters initially would negatively impact the vegetation and would potentially impact water quality. Mitigation measures would include rehabilitating the existing road, installing a bridge where the bypass road would cross Rock Creek, and installing a longer bridge to allow floodwaters to pass beneath the bridge. A longer bridge would allow flood waters to disperse to a greater degree than possible with the current bridge. Long-term effects of the rerouted road would be no different than the existing road.

Improvements made to the Hot Springs Campground would reduce soil compaction, reduce soil erosion, and reduce impacts to vegetation. Developing camping areas at the edge of Post Meadow would have limited adverse impacts to dry meadow plant communities of these meadows. Impacts would be mitigated by providing parking areas in the adjacent uplands, minimizing the development of camping areas in dry meadow habitat, limiting the total area available for camping, and limiting the number of campers at any one time. Soil compaction would result from use of the area by campers, and soil erosion would likely increase. Adverse impacts to wet meadow plant communities would be minimal because camping areas would be restricted to dry meadow habitat. A more thorough assessment would be completed by resource professional prior to development of the site.

c) **Silver Sagebrush**

Habitat conditions would improve in burned areas; shrub cover would be reduced allowing grass and forb cover to increase. Sedge and rush cover may also increase if they are present in the area and the water table is sufficiently high. Without grazing pressure from livestock, shrub cover would remain lower than what currently exists. In unburned areas, maintaining residual vegetation would benefit some species of wildlife.

d) **Poverty Weed-primrose and Rush-spikerush-arnica**

Aside from sustaining greater forb cover on lakebeds, elimination of livestock grazing in the southeast portion of the Refuge would result in few changes. Development of the Flook Lake camping area may have some adverse impacts may increase use of the lakebed by Refuge visitors.

e) **Cattail-bulrush**

Cattail-bulrush habitat on Big Flat and Shirk Ranch would improve considerably. Elimination of cattle grazing would allow residual vegetation cover to increase. Thus, quality of marsh habitat would be enhanced during wet periods. Big Flat would continue to be impacted by low water supply during dry periods. Development of deep-water areas on the Shirk Ranch would increase establishment of bulrush and cattail.

8. Aquatic Habitats

a) **Pondweed**

Habitat conditions would remain similar to current conditions.

b) **Aquatic Non-vegetated**

Lakes Very little would change in non-vegetated lakes.

Streams Stream habitat generally would recover at a faster rate than would occur under any other alternative. Total exclusion of livestock, use of fire in aspen stands, and small check dams (as opposed to none in E) would hasten recovery of streams. Stream-side riparian vegetation (e.g., sedges, rushes, willows) would be permitted to recover and provide shading for stream channels. Improved watersheds and rising water tables in meadows would increase baseflow in summer.

Changes in instream habitat would be small over the course of 15 years, but over the long-term, quality of instream habitat would improve substantially. Willow plantings would hasten recovery of stream sections where willows were planted, and would improve shading. Increased shading would result in lowered stream water temperatures, improving conditions for trout inhabiting streams. The pool:riffle ratio would increase, which also would benefit trout. Over the long-term, restoration of upland habitats would substantially reduce sedimentation.

Stream length (function of the amount of meandering) and water storage capabilities would not increase to any great extent in the near future. Over the long-term, stream length in meadows would increase as more meanders formed in streams. This would increase the amount of habitat available to redband and Lahontan cutthroat trout.

Closure of Barnhardi Road would reduce sediment input into Rock and Guano Creeks from the soil erosion occurring on the road. Re-vegetation of the roads should occur fairly rapidly where it travels through aspen stands and other productive areas. Very course soils associated with the proposed Barry Spring camping area would protect the nearby stream.

Herbicides could reach stream habitats but negative impacts to stream ecosystems are expected to be minimal because herbicide concentrations would be very low. Mitigation measures that would reduce the potential of herbicide reaching stream habitats would include relatively low herbicide application rates, ground application of herbicides, 100 foot buffer zones surrounding stream habitats (for shrub reduction applications), limited amount of treatment areas, maximum of one herbicide application per site and avoidance of herbicide application prior to heavy precipitation. The use of wicking and wiping techniques for applying herbicides for noxious weed control would minimize the potential for herbicides entering stream-water.

II EFFECTS ON WILDLIFE

A. FEATURED SPECIES

Descriptions of the effects on pronghorn, bighorn sheep, and mule deer were adopted from an assessment completed by Yoakum (1993), in conjunction with information obtained during several meetings with other natural resource professionals and information presented in Appendices I and J.

1. Pronghorn

This alternative would provide the greatest amount of benefits to pronghorn populations. It prescribes the largest amount of shrub reduction, which would produce a greater amount of area in early succession in low sagebrush. Non-use of the Refuge by livestock grazing for the next 15 years also would benefit pronghorn by eliminating competition for forage. Reduction in fencing would benefit pronghorn.

Continued maintenance of waterholes would be an asset to pronghorn. Hunting at current levels would not adversely affect the pronghorn population. Removal of wild horses would be beneficial to pronghorn. Excluding vehicle traffic into fawning habitat until after the fawning season is nearly over would benefit the population.

Establishment of the Flook Lake camping area may have some adverse impacts on pronghorn that use the lakebed. However, the camping area would be nearly a mile from the lakebed and use of the camping area is expected to be limited. Camping at the Post Meadow camping area also could adversely impact pronghorn use of the meadow while people are camping. Impacts would be related to frequency of use, which is expected to be low.

2. Bighorn Sheep

The bighorn sheep population would increase moderately under this alternative. Bighorn sheep would benefit from the changes in vegetation that would occur after prescribed burning on Hart Mountain and Poker Jim Ridge, and from the non-use of burned areas by livestock. Prescribed burning and cutting of juniper in these areas also would benefit bighorn sheep. Transplanting operations and hunting at proposed levels would not adversely affect the bighorn population.

3. Mule Deer

Overall, mule deer populations are not expected to increase in response to management actions proposed by this alternative. However, they would not be adversely affected because interspersion of upland habitats would be increased and riparian habitat condition would improve. This applies to both the short-term and long-term. Some actions would benefit deer, however. Willow planting and increase in natural establishment would provide additional cover and forage for mule deer. Recovery of aspen stands would increase fawn-rearing habitat, and cover and forage for adults. Creating mosaics of different succession stages in uplands would have some benefits to mule deer by improving forage:cover ratios. Mule deer also would benefit because disturbance from, and competition with, cattle would not occur. Removal of fences associated with riparian areas would benefit mule deer.

Closing of the Guano Creek Campground and closing the Barnhardi Road would considerably reduce disturbance to deer along Guano Creek. Hunting of mule deer at present levels would not affect populations. Establishment of a camping area near Barry Spring would have minimal impacts to mule deer because the area is not heavily used by deer. Development of a camping area at Barry Spring and Flook Lake, replacing the one in Guano Creek, would mitigate adverse effects currently taking place in Guano Creek.

4. Sage Grouse

Sage grouse populations would increase to the greatest extent under this alternative. Over the long-term, quality of sage grouse habitat would increase more than it would under other alternatives. Brood-rearing habitat would be improved over the short and long-term because of increased forb production in treated areas. Reduction of shrub cover (through treatment) would eliminate sage grouse nesting habitat in the short-term. However, all upland habitats would be improved (decreased shrubs and increased grasses and forbs) over the long-term and, therefore, enhance sage grouse nesting and early brood-rearing habitats. Mosaics of succession stages would improve cover:forage ratios. Rest from grazing would allow for the restoration of riparian areas and provide quality late brood-rearing habitat. On the other hand, elimination of late season grazing of meadows on the Refuge may result in forbs not being as readily available to sage grouse during the late summer (meadow vegetation would be taller and denser). Elimination of cattle grazing would not, based on season of use by cattle during the 1971-1990 program, result in reduced nutritional quality of late season forage for sage grouse in meadows. Sage grouse productivity and, ultimately populations, would increase over the long-term.

Sage grouse would be negatively impacted to a limited degree by developing two camping areas near Post Meadow. The campground for horseback riders would be located at the edge of the meadow. Because use of this site by campers would be limited (only people with horses can use the site), negative impacts to sage grouse would be restricted to a few days out of the year. Adverse impacts of the proposed Barry Spring Campground would be mitigated by locating the camping area behind a screen of riparian shrubs and trees.

5. Trout

Trout would benefit considerably from the elimination of cattle grazing during the next 15 years. Restoration of stream habitat would be the highest of any alternative. Shading along stream channels eventually would be restored as riparian vegetation increased in cover and the width of stream channels narrowed over the long-term. Instream habitat would improve. Meandering in low gradient systems would increase, which would increase the length of streams in these areas. In the long-term, the amount of perennial water flow in summer would increase. Trout would benefit from the closure of the Barnhardi Road and removal of the campground along Guano Creek.

B. WILDLIFE DIVERSITY

Implementation of this alternative would increase wildlife richness to a greater extent than other alternatives. Whereas wildlife-richness would increase only slightly over the short-term, it would increase substantially over the long-term. Livestock grazing would not occur and therefore it would not influence short-term and long-term restoration rates, habitat quality, and species richness.

Prescribed burning and mechanical control of sagebrush and juniper would increase species associated with an interspersion of early, mid, and late succession stages. In late succession stands, residual cover of herbaceous plants would increase in treated areas, which would increase habitat quality for species dependent on cover of sagebrush and herbaceous plants during late succession. Extensive reduction of young juniper would adversely affect species associated with young juniper stands. However, reduction of young juniper would increase species associated with productive early, mid, and late succession stands of mountain shrub, mountain big sagebrush, low sagebrush, and Wyoming big sagebrush. Because of the relatively low application rate, small acreage of proposed treatment, and one time application, effect of herbicides on wildlife diversity are expected to have minimal impacts.

Prescribed burning and haying on the Shirk Ranch would increase their use by foraging cranes and geese during the breeding season. Haying operations on the Shirk Ranch would result in short-term, localized disturbances to wildlife; haying operations would occur infrequently and would not occur during the breeding season.

Development of a campground near Flook Lake in the Wyoming big sagebrush vegetation type would have minimal impact to wildlife diversity. To the extent that shrub cover is reduced and herbaceous cover is established, wildlife diversity in the immediate area may increase -- use of the camping area by people, however, would offset these benefits.

In riparian wetlands, passive and active restoration practices would gradually increase richness of species associated with very late stages of progression in aspen, mixed deciduous shrub, willow, and meadow. Conversely, distribution of species associated with early-mid progression stages of riparian wetlands would be reduced to pre-settlement levels. Short and long-term increase in residual herbaceous cover would improve habitat quality for species dependent on food and cover values of late and very late stages of progression in emergent wetlands. Species richness would increase in silver sagebrush as sagebrush is reduced and cover of wetland herbaceous plants increases after burning. Wetland-dependent wildlife would increase in all major watersheds of the Refuge as a result of increased infiltration in uplands, increased amount, duration, and distribution of streamflow, increased input to lake basins, and increased cover of wetland vegetation.

Establishment of campgrounds at Barry Spring and Post Meadow (horse camp only) would negatively impact wildlife using adjacent habitat. However, there would be a net gain in values to wildlife compared to present management because Guano Creek Campground and the Barnhardi Road would be closed to vehicle traffic. Impacts to wildlife would be mitigated by locating camp sites of the Post Meadow camping area at the edge of the meadow, and the Barry Spring site would be located in an upland area. Use of the Post Meadow site is expected to be low.

III. EFFECTS ON SPECIAL AREA MANAGEMENT

No foreseeable changes would occur in management of special management areas within the next 15 years. Poker Jim Ridge RNA would continue to be managed as a Research Natural Area. There currently are no other special management areas on the Refuge.

Three areas would be studied to assess their potential as RNAs, and the Poker Jim RNA would be studied to assess whether the area should be enlarged. The Poker Jim Ridge Wilderness Study Area is pending Congressional action. Two Semi-primitive Non-motorized areas on the Refuge would be recommended for study to assess their wilderness potential. Determinations as to whether or not RNAs or wilderness areas would be added to Hart Mountain NAR cannot be made at this time.

IV. EFFECTS ON RECREATION OPPORTUNITIES

A. RECREATION OPPORTUNITY SPECTRUM

Forty-four percent of the Refuge would be maintained in a SPM setting, allowing for a moderate amount of motorized opportunities. This alternative provides the second highest amount of non-motorized areas with 45% of the Refuge in a SPNM setting. This would provide increased opportunities for solitude and primitive types of recreation.

B. CAMPING OPPORTUNITIES

Campground management in this alternative would provide needed additional sites, as well as designing the Hot Springs Campground to accommodate different user groups. By providing more camping opportunities and more direction in the campground, this alternative would offer more areas to camp, fewer people at each area, and a decrease in user conflicts. Having camping at more places on the Refuge would have some negative affect on other Refuge visitors, although not as great as in Alternative B.

Closing the Guano Creek camping area would have some negative effects on hunters who prefer to camp there, but would improve wildlife observation and hiking opportunities. Mitigation for closing this area would be opening other dispersed camping areas for longer periods of time.

The Bathhouse would be redesigned to blend with the surrounding environment. This would make the area more visually appealing to visitors, but would not be expected to affect use any.

C. ROAD ACCESS

This alternative provides the second highest amount of road closures of the alternatives (181 miles), which would reduce access to some areas on the Refuge. However, many of the roads to be closed are redundant or dead end roads. Opportunities for motorized recreation would be reduced somewhat. This adverse effect would be mitigated by maintaining access points to most areas of the Refuge. Additionally, the Blue Sky road will remain open longer in the fall than Alternative A, weather permitting. This would increase wildlife viewing, sightseeing, and motorized opportunities in the fall.

Parts of the Barnhardi Road would be closed and rerouted. This would improve deer habitat in this area, improving hunting opportunities and wildlife viewing. This would also have some negative effects for people wishing to drive the loop from Hot Springs to Blue Sky and back via the Blue Sky road. The end of the road leading to Warner Ponds would be closed. These ponds are used by anglers, and closing the road access to them would force visitors to hike to the ponds (one-fourth to one-half of a mile, depending on route taken).

D. INTERPRETATION

A few additional signs and literature would be provided, offering recreationists more opportunities to learn of the Refuge and surrounding environment. The visitor room would be closed when a joint USFWS-BLM interpretive center is built at the base of the Mountain. Having less direction and contact on the Refuge may lead to increased public use violations. However, the interpretive center at the base of the Mountain would provide a valuable service to visitors arriving from the west. Visitors coming from the east through the Refuge would not have as much direction or information.

E. HIKING OPPORTUNITIES

This alternative would provide additional opportunities for hiking along closed roads. A number of roads would be closed that would provide hiking opportunities for those who like to follow a path. No developed trails would be constructed.

F. HUNTING AND FISHING OPPORTUNITIES

Opportunities for hunting and fishing would not change in this alternative as compared to baseline management. Hunting would still affect recreationists by the relatively high number of people on the Refuge during hunting season, and those who do not like to visit during hunting season.

G. WILDLIFE VIEWING OPPORTUNITIES

Alternative D provides more change in wildlife habitat than the other alternatives. It would create more diverse habitat and wildlife, which would have a very positive effect on wildlife viewing opportunities.

H. AESTHETICS

This alternative would allow for the highest amount of long-term benefits, such as wildlife viewing opportunities and visual qualities. The amount of acreage for prescribed burning in this alternative is greater than any other. This may cause negative short-term affects on visual quality because people are more likely to be recreating in or around a treated area. Herbicide and mechanical treatment of vegetation would be minimal, and thus would have limited effects on recreation.

Elimination of livestock grazing would make the Refuge a more desirable place to visit for some people seeking a natural setting. Fences that would be removed are located in the tableland area of the Refuge where recreation use is low, and would probably not affect recreation opportunities.

Rerouting the road out of Guano Creek to an adjacent upland area would detract from the visual quality of the area. However, it would improve visual quality for people hiking along Guano Creek. The rerouted road would be located to minimize adverse impacts to visual qualities of the area.

V. EFFECTS ON THE LIVESTOCK GRAZING PROGRAM

There would not be a livestock grazing program for the next 15 years under this alternative.

VI. SOCIO-ECONOMIC IMPACTS

This alternative would have adverse impacts on revenue gained from cattle grazing. Using Alternative A as a baseline, annual losses between $10,000 and $287,000 are estimated, depending on whether or not ranchers could find alternative grazing pastures in the local area. The maximum figure would reflect losses if alternative pastures are not available, and ranchers reduce production.

This alternative maximizes non-consumptive recreation/tourism values on the Refuge, but offers more moderate hunting and camping values than does Alternative B. It does not provide for cattle grazing. Net local business benefits relative to Alternative A, at the 15-year benchmark, could decline by up to $99,000 per year if local ranchers are unable to find alternate pasture - or could increase by up to $178,000 per year if alternative pasture is available. At the 50-year benchmark, business benefits from this alternative are estimated to exceed Alternative A by between $197,000 and $474,000 per year. This is second behind Alternative B.

VII. EFFECTS ON CULTURAL RESOURCES

This alternative has a chance of damaging cultural resources by fire because of the large amount of prescribed fire in the alternative. Increased prescribed burning would increase the chances of an escaped fire damaging historic structures. However, possibilities of an escaped prescribed burn would be minimal because precautions would be undertaken when burning near historic and other structures. Camping areas in dispersed location would have to be evaluated for cultural resources prior to development. Cultural inventories would have to be completed in this alternative before any roads are rerouted.

VIII. EFFECTS ON SURROUNDING LANDS

Elimination of livestock grazing on the Refuge for the next 15 years under this alternative could result in scheduling or other changes to livestock management on other lands, including BLM grazing allotments (please see comment 187, Appendix O) and private pasture. Changes have already been made on one allotment (AMP #0216) due to the absence of grazing on the Refuge during 1991-1993 (Refuge files). Changes on other allotments have not been requested. Any changes made on BLM allotments to better accommodate livestock operators that have held permits on the Refuge could have an influence on rangeland conditions to allotments in which changes are made. This may also hold for private pasture. Four livestock operators currently hold livestock grazing permits on the Refuge. Socio-economic impacts are discussed in a previous section.

Improvements to pronghorn habitat and increased numbers of bighorn sheep on the Refuge may result in higher use of surrounding lands, as these species (and possibly others) move back and forth over the Refuge border. Benefits to wildlife would be highest under this alternative. Restrictions on the number of camping parties per campground on the Refuge may increase camping pressure on surrounding BLM lands as visitation of the Refuge increases. This could potentially affect lands on which off-Refuge campgrounds are located, although significant adverse impacts are not anticipated.

ALTERNATIVE E - CUSTODIAL MAINTENANCE

Note: Assessments of this alternative's impacts on the natural and social environment were based on information summarized in Appendices I, J, and L as well as from information obtained during meetings and other communications with natural resource professionals.

I. EFFECTS ON HABITAT

A. SOILS

Whereas considerable headway would be made in reducing soil erosion in riparian areas, soil erosion in upland habitats would decrease only marginally within 15 years of implementing this alternative. In uplands, eliminating livestock would likely result in increased litter, but not necessarily in increased herbaceous cover. Low herbaceous vegetation cover would persist throughout most of the Refuge. Road closures, and natural re-vegetation of these roads (beyond 15 years) would lessen soil erosion to a limited degree.

Streambank stability would improve considerably, though somewhat less so than under Alternative D. Alternative D would restore some riparian areas quicker through prescribed burning. Eventually, riparian areas would restore to similar degrees in both alternatives. Soil compaction would not be a problem under this alternative.

Additional information on the effects of this alternative on soils is provided under each vegetation type in the Vegetation and Watershed Values section.

B. WATER QUALITY

Water quality would improve minimally during the next 15 years. Reduced streambank erosion would positively affect water quality, but excessive erosion in upland habitats would persist. Herbicides would not be a factor in this alternative. Over the long-term, water quality would improve somewhat because restored riparian areas would better be able to capture and store sediment from uplands.

C. AIR QUALITY

No significant impacts to air quality would be expected. Natural fires may cause smoke for limited durations, but these fires are expected to be infrequent.

D. VEGETATION AND WATERSHED VALUES

In 15 years, conditions of upland habitats would be similar to their present condition. Given limited information, no attempt was made to predict the number of acres that could burn by natural fires under this alternative. As such, the number of acres that could be converted to and maintained in early succession was not calculated. Therefore, in-depth analysis of the effects of implementing this alternative on wildlife and socio-economic conditions does not reflect the influence of natural fires even though occurrence of fire is likely in the 15 years following implementation and over the long-term. Probable effects of fire on habitat and wildlife are described in general terms.

1. Desert Shrub Habitats

a) **Wyoming Big Sagebrush**

Without active shrub reduction measures, shrub cover in late succession stands would remain at present levels in the short-term (15 years). Natural fires may eventually occur in Wyoming big sagebrush, but less frequently than in mountain big sagebrush, as was the case historically. Fires that do occur would likely be large and severe with little interspersion. Without taking measures to restore this vegetation type prior to allowing natural fires to burn, there would be a higher probability of conversion to annual (cheatgrass) grassland habitat (Tisdale et al. 1969, Bunting et al. 1987). Conditions in Wyoming big sagebrush would not substantially improve prior to the incidence of fire (e.g., high shrub cover, low herbaceous cover, and low seed-source of native grasses and forbs). Quality of wildlife habitat in the long-term would not be improved over current conditions if large acreages are maintained in annual grassland habitat (Thomas and Maser 1979b). If such conditions prevailed, soil erosion would not decline to any large degree.

Removing livestock would not result in substantial changes to this vegetation type, except that residual cover would increase in areas where cattle concentrated during the period 1971-1990. Subsequently, grass and forb cover would remain near current levels.

2. Shrub-grassland Habitats

a) **Low Sagebrush**

Conditions are not expected to change substantially in low sagebrush during the 15 years following implementation of this alternative. Natural fires would be expected over the long-term, especially at higher elevations (e.g., Hart Mountain, Poker Jim Ridge). Where large fires occur, habitat interspersion would be limited to the fireline (line between burned and unburned areas) and a few unburned patches. Soil and site factors would limit cheatgrass encroachment; ecological status is higher than it is for most Wyoming big sagebrush.

Elimination of livestock grazing would result in very few changes in habitat condition. Failure to control juniper would increase habitat diversity on the more productive sites, though it would reduce the amount of productive low sagebrush habitat. It would benefit wildlife species associated with western juniper. Road closures would reduce soil erosion in some areas over the long-term.

b) **Mountain Big Sagebrush**

This vegetation type, of the major ones on the Refuge, has the greatest chances of igniting and being maintained by natural fires. Fires that do occur could be large with little interspersion. If mountain big sagebrush eventually returned to historic fire return intervals under this alternative, periodic burns would be less severe than initial fires, and a substantial portion of the vegetation type would be maintained in a grassland-like state.

Changes in habitat conditions brought about by non-use by livestock would occur to the extent that cattle had used this vegetation type during the period 1971-1990. Increased residual herbaceous cover and litter would be expected in areas near water sources and on gradual slopes. Changes in livestock grazing management would not affect mountain big sagebrush on steep slopes.

If such conditions prevailed over the long-term, soil erosion would decline and water infiltration would be enhanced. Few changes likely would occur in the short-term.

c) **Big Sagebrush-bitterbrush**

Predicted effects of this alternative on big sagebrush-bitterbrush would be the similar to effects on mountain big sagebrush. Accidental fires, which are the major contributor to most acres burned on the Refuge in recent history, would cease because camping would not be permitted and prescribed burning would not be employed.

d) **Wheatgrass**

Predicted effects of this alternative on wheatgrass would be the similar to effects on mountain big sagebrush.

3. Montane Shrub Habitats

a) **Mountain Shrub**

It is likely that this vegetation type would eventually burn under this alternative. This would occur to the extent that mountain big sagebrush burns.

4. Conifer Forest Habitat

a) **Ponderosa Pine and White Fir**

Few changes would be expected in these vegetation types in the short-term. The stands would likely burn in the long-term. Given current conditions, a crown fire likely would reduce the ponderosa pine stand at Blue Sky. However, trees not burned would allow rejuvenation of the stand. A healthier stand would alleviate crown fires and promote underburning.

5. Deciduous Forest Habitat

a) **Quaking Aspen**

Short-term habitat recovery under this alternative would be similar to that under Alternative B, except that damage from livestock would be eliminated. No use of prescribed burning would limit recovery as compared to alternatives C and D. Eventually, health of stands would improve, assuming incidence of natural fires.

Effects of closing Guano Creek Campground and roads through aspen stands is described in Alternative D.

6. Riparian Shrub Habitats

a) **Willow**

Consequences of this alternative would be similar to those that would occur under Alternative D, except that willow habitat would not be burned through prescription, nor would willow be planted along stream corridors.

7. Marsh Habitats

a) **Bluegrass-ryegrass**

The bluegrass-ryegrass type would recover at a quicker rate than it would under alternatives A and B because of the absence of influence of livestock. It would recover at a slower rate than alternatives C and D because areas that could potentially support dry meadow habitat would not be burned through prescription. Thus sagebrush would continue to invade floodplains classified as the bluegrass-ryegrass type. In the long-term, when stream channels have recovered and water tables are restored in some areas, sagebrush cover would decline. The frequency and extent of natural fires in Wyoming big sagebrush and low sagebrush would dictate the frequency at which meadows of this vegetation type would burn.

b) **Sedge-rush-bluegrass**

Recovery rate of this vegetation type would occur at a similar rate as would occur under Alternative D. Thus, consequences described under Alternative D, except that prescribed burning of meadows, would apply. Road closures would positively impact wet meadow habitat.

c) **Silver Sagebrush**

Effects of no active management on silver sagebrush would be similar to those described under Alternative C.

d) **Poverty weed-primrose and Rush-spikerush-arnica**

Consequences would be similar to those described under Alternative D, except that prescribed burning of meadows would not take place.

e) **Cattail-bulrush**

Consequences for cattail-bulrush on Big Flat would be similar to those described under Alternative D. Cattail-bulrush on the Shirk Ranch would be adversely affected because water control structures would not be used to maintain a constant water supply. In general, elimination of livestock grazing would enhance this habitat for wildlife dependent on marsh habitat.

8. <u>Aquatic Habitats</u>

a) **Pondweed**

No significant impacts would occur.

b) **Aquatic non-vegetated**

<u>Lakes</u> Little change would be expected in non-vegetated lakes.

<u>Streams</u> Effects would be very similar to Alternative D, except that willows would not be planted, aspen would not be burned through prescription, and check dams would not be used. Therefore, riparian area recovery would proceed at a slightly slower rate than Alternative D. Closing all secondary roads would allow recovery of road crossings through streams.

II. **EFFECTS ON WILDLIFE**

B. FEATURED SPECIES

Descriptions of the effects on pronghorn, bighorn sheep and mule deer were adopted from an assessment completed by Yoakum (1993) in conjunction with information obtained during several meetings with other natural resource professionals and information presented in Appendices I and J.

1. Pronghorn

Future trend of the pronghorn population under this alternative would depend on the extent of natural fires. While improved conditions in riparian meadows would benefit pronghorn, non-maintenance of waterholes could have adverse effects on the population. Reduced competition from livestock would benefit pronghorn. However, feral horses would continue to compete with pronghorn. Feral horse numbers would increase over time. Closing roads in fawning habitat would benefit the population as well. Removal of fences would benefit pronghorn.

2. Bighorn Sheep

Bighorn sheep population status would depend in large part on the extent of natural fires on top of Hart Mountain and Poker Jim Ridge. The higher the incidence of natural fires on Hart Mountain and Poker Jim Ridge, the higher the benefits to bighorn sheep. Elimination of cattle from Hart Mountain would benefit bighorn sheep.

3. Mule Deer

The mule deer populations likely would decrease under this alternative. Big sagebrush-bitterbrush stands would continue to stagnate, barring natural fires, and juniper would continue to invade in the short-term. If natural fires were extensive, bitterbrush cover, and cover of other important shrubs would be reduced as the amount of land in early succession increased. Recovery of aspen and willow stands over the long-term would be beneficial to mule deer. Mule deer also would benefit because disturbance from, and competition with, cattle would not occur. They also would benefit from the closure of Hot Springs and Guano Creek campgrounds, closure of the Barnhardi, and closure of other roads that enter riparian areas.

4. Sage Grouse

Sage grouse populations would remain static or slightly increase under this alternative. Without a habitat management program, minimal improvements in habitat condition would occur in the near future, except in riparian areas where improvement would be substantial. An increase in residual grass cover in some areas (primarily on north and south Hart Mountain) would benefit sage grouse nesting. Riparian areas would improve over the long-term and provide higher quality brood-rearing habitat. However, excessive shrub cover would dominate most of the Refuge (e.g., Wyoming big sagebrush) and limit sage grouse productivity and ultimately population size. Furthermore, natural fires that burn large areas (e.g., 20,000 acres) with limited interspersion could potentially eliminate large areas of sage grouse habitat and reduce sage grouse populations.

5. Trout

Trout would benefit considerably from the elimination of cattle grazing. However, aspen would not recover to the extent that it would under Alternative D. Willow would not be planted in this alternative, and consequently, streams bordered by willow-potential areas would not restore to the same degree. Low gradient systems would recover at rates similar to what they would under Alternative D. Shading along stream channels eventually would be restored as riparian vegetation increased in cover and the width of stream channels narrowed over the long-term. Instream habitat would improve. Meandering in low gradient systems would increase, which would increase the length of streams in these areas. In the long-term, the amount of perennial water flow in summer would increase. Trout would benefit from the removal of campgrounds in the Hot Springs area and along Guano Creek, closure of the Barnhardi Road, and closure of other roads that cross perennial streams.

C. WILDLIFE DIVERSITY

Alternative E could increase species richness more than Alternative A, but likely less than alternatives C and D. Richness would not change substantially over the short-term, but could increase over the long-term, depending on the frequency, severity, pattern, and size of natural fires. Long-term restoration rates and species richness also would be influenced by management activities on lands surrounding the Refuge (e.g., fire suppression).

Wildlife associated with late and very late stages of succession would be prevalent in Refuge uplands during the short-term. To the extent that natural fires occurred on the Refuge under this alternative, species associated with early and mid succession would benefit.

Where large fires occur, habitat interspersion likely would be limited to the fireline edge and a few unburned patches. In burned areas, dominant wildlife would comprise species associated with early and mid succession stages because of the limited amount of interspersion of early, mid, and late succession stages that likely would occur. Wildfires would likely occur in Wyoming big sagebrush over the long-term but less frequently and extensively than in mountain big sagebrush, as was the case historically. Absence of interspersion would be the key factor that limited wildlife richness during succession after wildfire in sagebrush habitats. Wildlife associated with young juniper would increase over the short-term but decline over the long-term as wildfire reduced young juniper to its pre-settlement distribution.

Long-term, numerical changes in species richness would be greater in wetland habitats than upland habitats in Alternative E. Major short-term changes would occur in the amount and height of residual cover available to wildlife in late and very late progression stages of riparian and emergent wetlands. To the extent that natural fires occur in headwater regions, richness of wildlife associated with late and very late stages of riparian vegetation types would increase because of increase in water supplies after burning. The distribution of willow and aspen would increase to the extent that natural fires occur because both species regenerate rapidly after burning and are dependent on mineral substrates for establishment from seed. Consequently, wildlife richness could gradually increase in willow and aspen as willow and aspen established and developed into mature stands characteristic of very late stages of progression.

III. EFFECTS ON SPECIAL AREA MANAGEMENT

No foreseeable changes would occur in management of special management areas within the next 15 years. Poker Jim Ridge RNA would continue to be managed as a Research Natural Area. There currently are no other special management areas on the Refuge.

Two Semi-primitive Non-motorized/Primitive areas on the Refuge would be recommended for study to assess their wilderness potential. Determinations as to whether or not RNAs or wilderness areas would be added to Hart Mountain NAR cannot be made at this time.

IV. EFFECTS ON RECREATION OPPORTUNITIES

A. RECREATION OPPORTUNITY SPECTRUM

This alternative would provide the most opportunities for solitude and primitive types of recreation. Sixty-three percent of the Refuge would be under a SPNM setting, and 26% in a Primitive setting. This would offer abundant opportunities for non-motorized types of recreation.

B. CAMPING OPPORTUNITIES

Visitation likely would decrease because of the isolated location of the Refuge, and because people would not be permitted to camp on the Refuge under this alternative. However, some camping would be available on surrounding BLM lands. Elimination of camping on Hart Mountain would increase camping pressures on these BLM lands.

The Bathhouse would be closed to all use. This would have a large negative effect on recreation because this is one of the more popular activities on Hart Mountain.

C. ROAD ACCESS

Overall use of Hart Mountain would likely decrease because most of the Refuge would be closed to motorized access. Only 50 of the 363 miles of roads on the Refuge would be open to the public. Sightseeing and wildlife observation from vehicles would be drastically reduced.

D. INTERPRETATION

The visitor room would be closed. This would eliminate an important contact station for visitors. A kiosk would be developed along the main road to provide information about the Refuge and surrounding lands. People may be more apt to violate public use regulations because of a lack of contact with Refuge staff.

E. HIKING OPPORTUNITIES

This alternative would provide fewer opportunities for day hiking because access points would be reduced. Overnight camping would not be permitted, and hiking trails would not be constructed. With most of the Refuge closed to motorized access, hiking and horseback riding would become the primary means of travel.

F. HUNTING AND FISHING OPPORTUNITIES

Hunting and fishing opportunities would not be provided under this alternative. This would have a positive effect on people that presently may stay away from the Refuge during hunting season.

G. WILDLIFE VIEWING OPPORTUNITIES

Under this alternative, wildlife viewing opportunities, based on habitat conditions and wildlife status, would remain similar to current conditions in the short-term. Taking into account the very limited road access proposed by this alternative, opportunities for wildlife observation would be reduced. In the long-term, wildlife viewing opportunities would increase, especially in riparian areas, for people willing to hike or horseback into the Refuge.

H. AESTHETICS

There would not be any deliberate vegetation treatment in this alternative. A slight decline in habitat diversity, a consequence of no vegetation manipulation, may lead to a decline in wildlife viewing opportunities in the short-term. Because livestock grazing would be eliminated, some recreation experiences may be enhanced for some persons. The removal of most fencing would have a positive effect on recreation, especially for those seeking a natural environment.

V. **EFFECTS ON THE LIVESTOCK GRAZING PROGRAM**

There would not be a livestock grazing program for the next 15 years under this alternative.

VI. **SOCIO-ECONOMIC IMPACTS**

This alternative would leave the Refuge virtually unused. It is the least desirable, save for those interested exclusively in riparian/wetland habitat. Livestock grazing would not be permitted, and recreation opportunities would be limited. It is estimated that this alternative would cost local businesses between $527,000 and $804,000 annually depending on assumptions used.

VII. **EFFECTS ON CULTURAL RESOURCES**

This alternative provides the most protection to cultural resources by closing most access to the Refuge. There would not be any prescribed burning, livestock grazing, or camping in this alternative.

VIII. **EFFECTS ON SURROUNDING LANDS**

Elimination of livestock grazing on the Refuge for the next 15 years under this alternative could result in scheduling or other changes to livestock management on other lands, including BLM grazing allotments (please see comment 187, Appendix O) and private pasture. Changes have already been made on one allotment (AMP #0216) due to the absence of grazing on the Refuge during 1991-1993 (Refuge files). Changes on other allotments have not been requested. Any changes made on BLM allotments to better accommodate livestock operators that have held permits on the Refuge could have an influence on rangeland conditions to allotments in which changes are made. This may also hold for private pasture. Four livestock operators currently hold livestock grazing permits on the Refuge. Socio-economic impacts are discussed in a previous section.

Improvements to pronghorn habitat and increased numbers of bighorn sheep on the Refuge may result in higher use of surrounding lands, as these species move back and forth over the Refuge border. Because overnight camping would not be permitted under this alternative, pressure on BLM campgrounds would increase. However, visitation of the Refuge would likely decline, resulting in fewer people looking for camp sites (compared to current visitation).

SUMMARY OF CUMULATIVE IMPACTS

This section provides a summary of the cumulative impacts that would be expected for each alternative during the next 15 years, and over the long-term (note that the planning horizon of this EIS is 15 years). Long-term can range from 50 to 200 years. Assessments are based on reviews of technical information provided in Chapter 3 (Wildlife Section) and Appendices I and J, and information provided in previous sections of Chapter 4. Socio-economic impacts were discussed under each alternative.

ALTERNATIVE A (NO ACTION)

Because shrub cover would be reduced on very few acres, low cover of herbaceous vegetation would be maintained throughout most of the Refuge. Additionally, a low amount of upland habitat in mid or early succession would be available for species that require these types of habitat. These factors would continue to limit wildlife diversity on the Refuge (Tables 3-13, 4-3, and 4-4).

Water infiltration into the soil would not be as high as it would be if cover of herbaceous vegetation was higher. High shrub and juniper cover would continue to restrict cover of herbaceous vegetation. Juniper cover would continue to increase. Excessive soil erosion, therefore, would continue, as would excessive overland flow during storms. Soil erosion on roads also would contribute to excessive erosion in uplands. Wildlife that use juniper habitat would benefit under this alternative, both in the short-term and long-term.

Continued cattle grazing in riparian areas would not allow stream-side vegetation to stabilize banks and catch sediment to the degree it would if left ungrazed. Residual cover would not be maintained year to year, thus having adverse impacts to riparian wildlife communities. Unstable banks would continue to erode. Stream channels would remain wide and shallow in riparian meadows. Water tables would remain at a low level, thus limiting the amount of riparian vegetation in meadows to a thin strip within gullies. Where lush riparian vegetation could potentially occur, sagebrush and rabbitbrush would continue to dominate. One consequence of stream channels located in gullies is that the energy of flood waters would be concentrated within the confining walls of terraces. Flood waters thus would continue to erode away at unstable streambanks and channels. Some water tables may drop further. Excessive overland flow in uplands during storms would contribute to flood waters.

Low water tables in riparian meadows and low infiltration of water in uplands would continue to restrict the water storage capacity of watersheds. A consequence of this would be excessive flooding in the spring and dry stream channels later in the season (more-so than would occur under healthy conditions).

This would continue to limit trout populations. High sediment loads and water temperatures also would negatively affect trout. Maintenance of wide, shallow stream channels and a low amount of stream-side vegetation would maintain higher than natural water temperatures. Herbicides have the potential to reduce water quality. However, measures would be taken to minimize impacts, and if adverse impacts occur, they would be limited in area. Use of herbicides would be very limited.

Continued cattle grazing, browsing by mule deer, beaver activity, fire suppression, and non-use of prescribed burning in aspen stands would cause more aspen stands to die out. Others would continue to be comprised of even-aged stands. Willow stands would continue to be adversely impacted. Structural diversity would remain low, and consequently wildlife diversity would remain low (Tables 3-15, 4-5, and 4-6).

Increased visitation of the Refuge would increase disturbances to wildlife where people occur. Disturbance to wildlife in campgrounds would continue.

ALTERNATIVE B

Reduction of shrub and juniper cover in uplands would result in increased cover of herbaceous vegetation on about 3 percent of Refuge uplands during the 15-year planning horizon (Table 2-2). Over the long-term, using a similar strategy as outlined in the alternative, shrub cover on up to about 38 percent of the Refuge uplands could potentially be restored (Table 4-2). This would allow a higher amount of herbaceous cover to be maintained within those areas. Increased cover of herbaceous vegetation would have direct benefits to pronghorn, sage grouse and other herb eating wildlife. Reduction of shrub cover also would create a small amount of grassland-like habitat (early mid succession stages). This would have immediate benefits, in localized areas, to wildlife that require grassland-like habitats (Table 3-13). Cheatgrass and diminished sources of seeds of native plants in some areas, such as in the Wyoming big sagebrush vegetation type, would hamper efforts to restore impacted areas. Treated areas likely would remain in poor ecological condition well beyond 15 years.

Wildlife associated with juniper habitat would benefit under this alternative. Juniper would continue to expand in distribution. On the other hand, wildlife associated with habitat that occurred prior to expansion of juniper (e.g., low sagebrush, big sagebrush bitterbrush, wheatgrass, aspen vegetation types) would continue to be impaired. Wildlife associated with old-growth juniper would not be affected by this, or any other, alternative.

In the short term (15 years), only areas in an early stage of succession (recently treated areas) would have higher amounts of herbaceous vegetation. Reductions in cattle grazing during the next 15 years would have limited effect on herbaceous vegetation in uplands because cattle distribution would be limited and removal of cattle from areas in a late stage of succession would not have substantial effects on cover of herbaceous vegetation. Late and very late stages of succession comprise most of the Refuge uplands. Shrub cover currently limits herbaceous vegetation in most late succession stands of sagebrush. However, areas treated during the next 15 years would have higher amounts of herbaceous cover once they reach a late stage of succession (25 to 50 years from now). Sage grouse and other birds that depend on residual grass cover in sagebrush stands for successful nesting would benefit to a limited degree in the long-term from treatment that would occur in the next 15 years. On the other hand, cattle would continue to graze in uplands, which would reduce the amount of residual cover in some of the more productive areas. Most cattle grazing under this alternative would take place at the latter end of the growing season and beyond. This would not allow grazed herbaceous forage to regrow, although it would allow succulent growth to be more accessible to some herb-eating wildlife. Impacts to residual cover would only occur every other year in most grazing units.

Infiltration of water into the soil, throughout most of the Refuge, would not be as high as it would be if herbaceous vegetation were higher. Excessive soil erosion, therefore, would continue, as would excessive overland flow during storms. Soil erosion on roads also would contribute to excessive erosion in uplands. Improvements to existing conditions would be made on about 3 percent of Refuge uplands during the 15-year planning horizon. In this limited area, increased herbaceous cover would result in more vegetative litter. This expectedly would yield increased infiltration of water into the soil, which would result in reduced overland flow of water. As such, soil erosion would decline over a small area. Reduction of shrub and juniper cover would increase soil erosion temporarily if herbaceous vegetation does not have a chance to respond before it rains.

A two-thirds reduction in cattle grazing would allow recovery of stream-side vegetation to proceed. As such, banks would become more stable and increased stream-side vegetation would catch sediment. Although cattle grazing in many riparian meadows would continue to maintain lowered amounts of residual vegetation, more would be available to wildlife and soil building than under Base Management (Alternative A). Cattle grazing in most riparian meadows would only occur every other year, which would be an improvement over Base Management. Increased stability of banks and deposition of sediments would, over time, raise the level of streambanks. One consequence of this would be narrower and deeper stream channels in low gradient systems (e.g., riparian meadows).

The extent of improvement is unknown, but expectedly would not approach the amount of restoration that would occur under the Proposed Action. Some meadows, such as Lyons and Flook meadows, would restore at similar rates as they would under the Proposed Action since they would not be grazed by cattle under this alternative. Eventually (beyond 15 years), streambanks would rise to near the level of the rest of the meadow, instead of being down in a gully.

Enhanced meadow conditions would benefit riparian wildlife. Other meadows, such as those of lower Rock Creek, would continue to be grazed year after year. Prescribed burning would not be used to reduce encroaching sagebrush, and continued cattle grazing would encourage its encroachment. Where meadow vegetation should occur, sagebrush and rabbitbrush would continue to dominate. Stream channels in these areas would not be expected to recover under such a strategy, as such water tables would not rise. Use of impacted meadows by riparian wildlife would remain low.

One consequence of restoring stream channels to their historic levels would be that the energy of flood waters would be dissipated over a wider area, and thus have much less potential for eroding streambanks. Another consequence would be that water tables in riparian meadows would rise. Eventually (beyond 15 years), restoration of water tables in some areas would allow riparian vegetation to grow throughout the valley bottom, having tremendous positive impacts on riparian wildlife communities. Because of continued cattle grazing, as prescribed under Alternative B, some riparian areas may not fully recover.

Widened floodplains, and to a limited degree reduced overland flow in uplands during storms, would reduce erosive forces on streambanks and channels, which would contribute to their restoration. Additionally, increased water percolation in uplands (over the long-term) and raised water tables in riparian meadows would increase the water storage capacity of watersheds. This would result in more water being available later into the summer and fall, which, depending on the extent of improvement, would benefit redband trout and other stream fish. Another benefit to trout would be the reduced sediment load resulting from reduced erosion in uplands (limited) and along stream channels. Streambanks that are more stable, narrower stream channels, more overhanging vegetation would lower water temperatures. Cattle grazing every other year would reduce stream-side vegetation in some areas. Herbicides have the potential to reduce water quality. However, measures would be taken to minimize impacts, and if adverse impacts occur, they would be limited in area.

Adverse impacts from cattle grazing in aspen stands would allow recovery of the stands to proceed. However, non-use of prescribed burning would limit restoration of aspen stands. Impacts to aspen stands by beaver and mule deer would be much less, given reduced pressure from cattle. Wildlife that use aspen stands would benefit, but not as much as they would under the Proposed Action. Cattle grazing in areas of willow growth generally would occur prior to July 15, and therefore, adverse impacts to willows would be minimized.

Increased visitation of the Refuge would increase disturbances to wildlife where people occur. Opening Blue Sky road year-round should not increase disturbance to wildlife significantly because it would be closed during most winters due to adverse driving conditions. However, road closures would reduce the number of areas where people could venture by vehicle. Especially beneficial to wildlife would be closing the Barnhardi Road. Disturbance to wildlife would continue in camping areas.

ALTERNATIVE C

Cumulative impacts of Alternative C would fall somewhere between those of alternatives B and D. Cumulative impacts associated with upland habitats would be most similar to those that would occur in Alternative B, except that cattle grazing would be at a much lower level (higher amount of residual grass cover in some areas), more roads would be closed (lower erosion in the long-term), and there would not be any impacts from herbicides. In the next 15 years, about 5 percent of Refuge uplands would be treated. Over the long-term, using a similar strategy as outline in the Alternative, up to half of the Refuge uplands could be restored (Table 4-2).

Cumulative impacts associated with riparian areas and recreation would be most similar to those that would occur under Alternative D, except that a limited amount of cattle grazing may limit riparian recovery to a small degree, less burning in aspen would limit recovery of these areas, and more roads would be open to the public. As such, wildlife diversity would be lower.

ALTERNATIVE D (PROPOSED ACTION)

Reduction of shrub and juniper cover in uplands would result in increased cover of herbaceous vegetation on about 12 percent of Refuge uplands (Table 2-2). Although total acres affected would be relatively small during the 15-year planning horizon, it would provide a substantial start. Over the long-term, using a similar strategy as outlined in Alternative D, up to about 80 percent of Refuge uplands could potentially be restored (Table 4-2). Increased cover of herbaceous vegetation would have direct benefits to pronghorn, sage grouse and other herb eating wildlife. Reduction of shrub cover also would create substantially more grassland-like habitat (early mid succession stages) during the next 15 years, and more-so over the long-term. This would have immediate benefits to wildlife that require grassland-like habitats. Cheatgrass and diminished sources of seeds of native plants in some areas, such as in the Wyoming big sagebrush vegetation type, would hamper efforts to restore areas in poor ecological condition. Areas dominated by cheatgrass would likely remain in relatively poor ecological condition beyond the planning horizon. Increased populations of pronghorn and bighorn sheep are not expected to have adverse impacts to vegetation in Refuge uplands.

Overall, the Refuge would continue, during the next 15 years, to provide upland habitat for wildlife that use areas of high shrub cover, relatively low cover of herbaceous vegetation, and low habitat diversity; in other words, wildlife diversity would remain low throughout most of the Refuge (Tables 3-13 and 4-3). Over the long-term, however, wildlife diversity would increase in uplands (Table 4-4).

Wildlife associated with juniper habitat would be negatively impacted by this alternative over the long-term. Adverse impacts to these species would be limited during the next 15 years. On the other hand, wildlife associated with habitat that occurred prior to expansion of juniper (e.g., low sagebrush, big sagebrush bitterbrush, wheatgrass, aspen vegetation types) would benefit. Wildlife associated with old-growth juniper would not be affected by this, or any other, alternative.

In the short term (15 years), only areas in an early stage of succession would have higher amounts of herbaceous vegetation. Elimination of cattle grazing during the next 15 years would have limited affect on herbaceous vegetation in uplands, and thus areas remaining in a late stage of succession would not change substantially. However, areas treated during the next 15 years would have higher amounts of herbaceous cover once they reach a late stage of succession (25 to 50 years from now). Sage grouse and other birds that depend on residual grass cover in late succession stands of sagebrush for successful nesting would benefit in the long-term from treatments that occur in the next 15 years.

Increased herbaceous cover would result in more vegetative litter. Given these two factors, increased infiltration of water into the soil would be expected, and expectedly would result in reduced overland flow of water. As such, soil erosion would decline to a small degree in the short-term, and more-so in the long-term. Closing roads and allowing them to re-vegetate, over the long-term, would contribute to reductions in soil erosion in uplands. Another consequence of increased water infiltration would be increased percolation into ground-water reserves. Reduction of shrub and juniper cover would increase soil erosion temporarily, especially if done mechanically, if herbaceous vegetation does not have a chance to respond before it rains. Rerouting roads also would temporarily increase sediments coming off uplands, but the long-term impact would be positive to riparian areas. Moving camp sites and roads away from the stream channel in Hot Springs Campground would reduce the amount of sedimentation originating there.

The changes described in the last paragraph would be limited in area during the 15-year planning horizon. Many of the conditions described under Alternative A would predominate over most Refuge uplands for the next 15 years because absence of cattle grazing without reducing shrub cover would have little effect in most upland areas.

Rest from livestock grazing in riparian areas would allow stream-side vegetation to stabilize banks and catch sediment. It also would result in more residual cover being available to riparian wildlife. Increased stability of banks and deposition of sediments would, over time, raise the level of streambanks. One consequence of this would be narrower and deeper stream channels in low gradient systems (e.g., riparian meadows). Eventually (beyond 15 years), streambanks would rise to near the level of the rest of the meadow, instead of being down in a gully. One consequence of this would be that the energy of flood waters would be dissipated over a wider area, and thus have much less potential for eroding streambanks. Another consequence would be that sagebrush, that has encroached onto meadows because of lowered waters tables in some areas, would die out. Eventually, restoration of water tables would allow riparian vegetation to grow throughout the valley bottom, having tremendous positive impacts on riparian wildlife communities. It would benefit those species that require tall, dense vegetation in meadows, and especially those that require wet meadow habitat with tall, dense vegetation.

Reduced overland flow in uplands during storms and widened floodplains would reduce erosive forces on streambanks and channels, which would contribute to their restoration. Additionally, increased water percolation in uplands and raised water tables in riparian meadows would increase the water storage capacity of watersheds. This would result in more water being available later into the summer and fall, which, depending on the extent of improvement, would greatly benefit redband trout and other stream fish. Another benefit to trout would be the reduced sediment load because of reduced erosion in uplands and along stream channels. Stable streambanks, narrower stream channels, more overhanging vegetation would lower water temperatures. Herbicides have the potential to reduce water quality; however, measures would be taken to minimize impacts. If adverse impacts occur, they would be limited in area.

Rest from livestock grazing and prescribed burning in aspen and willow stands would result in greater structural diversity. A major consequence of this would be increased wildlife diversity. Impacts to aspen stands by beaver and mule deer would be much less, given reduced pressure from cattle. However, some small stands of aspen would be impacted by these animals, thereby hampering restoration of some stands.

Increased visitation of the Refuge would increase disturbances to wildlife where people occur. Developing additional campgrounds would increase disturbance to wildlife in localized areas. However, new camping areas would have less impacts than the existing campground in Guano Creek. Closing the Guano Creek Campground and the Barnhardi Road would reduce disturbance to wildlife along upper Guano Creek. Opening Blue Sky road year-round should not increase disturbance to wildlife significantly because it would be closed during most winters due to adverse driving conditions. However, road closures throughout the Refuge would reduce the number of areas where people could venture by vehicle. Especially beneficial to wildlife would be closing the Barnhardi Road.

An increase in prescribed burning as proposed by Alternative D would increase the potential for prescribed burns turning to wildfires. Careful planning and implementation of prescribed burns during relatively low severity conditions would minimize the chances of burns getting away.

ALTERNATIVE E

Cumulative impacts associated with upland habitats would be similar to those that would occur under Alternative A, except that erosion on roads would be reduced over the long-term, adverse impacts from cattle grazing would be eliminated over a limited area, and shrub cover would not be reduced through prescribed burning over a limited area. Eliminating livestock grazing without reducing shrub cover would have limited benefits to most upland areas of the Refuge.

Cumulative impacts associated with riparian areas would be similar to those that would occur under Alternative D, except less burning in aspen would limit recovery of these areas, and closing most roads through riparian areas would reduce soil erosion and disturbance to wildlife. Additionally, because uplands would only be restored to the extent that they would be restored under Alternative A, except for exceptions noted above, effects of upland habitat conditions could lower recovery rates of riparian areas to some degree.

Cumulative impacts associated with disturbance to wildlife from visitors would be greatly reduced because most of the Refuge would be inaccessible by vehicle.

SECTION TWO - ADDITIONAL DETAIL ON THE IMPACTS OF THE PROPOSED ACTION

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Long-term productivity, in the case of Hart Mountain NAR, refers to the capability of the land to provide resources into the future. The intent of the Preferred Alternative is to enhance the long-term productivity of the land to ensure maintenance of healthy populations of native wildlife into the future. Long-term objectives require short-term actions (e.g., prescribed burning) to achieve long-term benefits to the natural environment and wildlife. Short-term management actions also result in short-term benefits to wildlife. For example, prescribed burning an area benefits species associated with grassland habitats; but benefits for a particular burn are only temporary for these species. Increased long-term productivity of the land would benefit short-term uses by visitors to the Refuge (e.g., wildlife observation, hiking).

Development of additional camping areas would impact the sites where development occurs. However, permanent structures, incapable of being dismantled, would not be constructed on these sites. If deemed necessary in the future, managers could close these campgrounds and rehabilitate the areas to return them to their natural condition. Several existing roads in sensitive habitats would be rerouted to mitigate effects on these habitats. Although sites where rerouted roads would be constructed would decline in productivity, there would be an overall net increase in productivity because roads would be taken out of riparian habitats. Short-term uses addressed in this paragraph would affect overall productivity of the Refuge to a very limited degree.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible commitment of resources results from an action that changes resources to the extent that they are either lost or would take an extremely long time to replace or recover. Any accidental damage or loss of a cultural resource would constitute an irretrievable commitment of resources. Prescribed burns would be carried out to ensure that this would not occur. Additionally, surveys would be conducted prior to rerouting roads. Irretrievable losses of cultural resources could occur if they are accidentally destroyed before they are discovered. No other potential irreversible commitment of resources have been identified.

An irretrievable commitment of resources refers to losses of production or use of renewable resources for a period of time. This can occur when land or resources are allocated to other uses during this period. Elimination of cattle grazing from Refuge lands during the next 15 years constitutes an irretrievable loss to the livestock grazing industry because herbaceous vegetation growing on the Refuge during that time period would not be consumed by livestock. On the other hand, vegetation not used by livestock during this time would be used by wildlife for nesting, thermal cover, hiding cover, and forage, and for soil protection and formation.

Prescribed burning riparian habitats would constitute an irretrievable loss to some Refuge visitors for similar reasons. Road closures may be considered an irretrievable loss by some members of the public (e.g., foregone hunting, driving opportunities). To other members of the public, it may constitute additional opportunities (e.g., hiking, wildlife viewing).

UNAVOIDABLE ADVERSE IMPACTS

Implementation of a comprehensive management plan for the Refuge may result in some adverse environmental effects that cannot be avoided, even with mitigation measures.

Smoke from prescribed burning and possible wildfires may negatively impact visual quality for some people for a short time. Burned landscapes also may be viewed as an adverse impact by people not accustomed to wildland fires. Effects of properly prescribed fires, from the standpoint of resource management on the Refuge, are not viewed as adverse impacts to the environment. They are viewed as a necessary component of the natural environment.

Mechanically treating vegetation would cause soil disturbance and possibly increase cheatgrass invasion; some of these impacts would be unavoidable. Herbicides would result in temporary reductions in forb cover. These procedures would be carried out where prescribed burning is unfeasible. The intention is to only use them until sufficient herbaceous cover is produced so that prescribed burning could be implemented. Water quality would be impaired to a limited degree in localized areas.

Development and use of camping areas would have the following unavoidable impacts: vegetation damage, soil compaction, and wildlife disturbance and displacement. Some of these impacts can be lessened through design of campgrounds. Rerouting roads would cause soil disturbance and would increase soil erosion in localized areas. These impacts would be minimized by ensuring development based on environmental standards. However, there would be a net benefit of rerouting roads because roads in sensitive areas would be rehabilitated.

POTENTIAL CONFLICTS BETWEEN THE PROPOSED ACTION AND FEDERAL, STATE, AND LOCAL LAND USE PLANS

This section is provided in accordance with CFR §§1502.16(c) and 1506.2(d), which direct that an EIS provide a discussion on the possible conflicts between the proposed action and Federal, State, and local land use plans, and that, where an inconsistency exists, to describe the extent to which the agency (i.e., the Service) would reconcile the proposed action with any approved plans. The only land use plan with which the Proposed Action (Alternative D) may conflict is the Lake County Emergency Ordinance and Interim Public Land Management Plan (LCBC 1992). Potential conflicts and inconsistencies with the Plan pertain to (1) agricultural use, including livestock grazing; (2) Wilderness areas and Research Natural Areas; and (3) predator control. These issues are discussed below.

LCBC (1992:11) states that "...the Board requires a multiple use public land management policy." All alternatives considered in this FEIS conflict with this interim ordinance; this inconsistency cannot be reconciled because Service policy and other authorities would not permit such a policy on lands administered by the Service. The plan also states that "[o]pportunities for agriculture on Federal and State lands shall be continued at levels consistent with historic custom and culture..." and further, that "[l]ands that have been dedicated to grazing will continue to be dedicated to grazing." Alternative D proposes the complete elimination of livestock grazing for a 15 year period beginning with the implementation of the FEIS. This is in conflict with the County interim ordinance that calls for the continuation of agricultural practices on Federal lands at historic levels. This conflict would not be reconciled to any degree for the next 15 years under the Alternative D. The issue would be re-evaluated after the 15-year planning horizon. Elimination of livestock grazing from the Refuge for 15 years does not conflict with the ordinance pertaining to "lands that have been dedicated to livestock grazing" because Hart Mountain NAR has not been dedicated to livestock grazing. Livestock grazing has been a secondary use on the Refuge.

LCBC (1992:14) states that "[n]o additional Wilderness, roadless or research natural areas shall be designated in Lake County." Alternative D, pending implementation, would not designate any new wilderness areas or research natural areas on the Refuge. The Alternative calls for three areas to be studied for their wilderness potential, which is required by FWM 602 and 610 FW 2.1 (USFWS 1992c). Determinations as to whether wilderness areas or Research Natural Areas would be added to the Refuge cannot be made at this time. Therefore, the extent to which implementation of Alternative D would conflict with the above stated interim ordinance would not be made known until after the study process, and in the case of wilderness areas, after Congress has acted on any areas that are recommended for wilderness.

LCBC (1992:15-16) states that "Lake County supports the control of predatory animals... on all State and Federal lands in accordance with local custom and culture, protecting bordering private lands and within the boundaries of good husbandry practices and sound environmental restraints..." and that "Government agencies shall be required to prepare and implement plans for controlling predatory animals... in accordance with proven and recognized husbandry practices." From the standpoint of the proposed predator control program as it relates to customary predator control programs, there likely would be a high level of inconsistency. The level of predator control needed to fit within the framework of "protecting bordering private lands" depends on many factors, and therefore, the degree to which the proposed program would be in conflict is unknown. From the standpoint of the proposed predator control program as it relates to good and proven husbandry practices and sound environmental constraints, there should not be any conflicts (although this is dependent on interpretation). Alternative D would allow for predator control under some (albeit limited) circumstances. Because the interim ordinance does not specify under what conditions predator control should be exercised on Federal lands, the extent of possible inconsistencies is unclear.

Chapter 5
CONSULTATION AND COORDINATION

Chapter 5
CONSULTATION AND COORDINATION

PUBLIC INVOLVEMENT

Scoping activities were undertaken to solicit public participation in the development of this FEIS. A variety of federal, state, local, private entities, and individuals were contacted to participate in the NEPA process. Several public meetings and workshops were held, and periodic Planning Updates were mailed to people on the mailing list. These meetings and mailings were designed to inform interested publics of the planning process (timeline, data gathering and results), and to obtain comments and suggestions from people. The following is a chronology of activities leading up to the preparation of the FEIS:

May 1990	Meeting with staff of Malheur NWR and Lakeview District BLM to discuss management options at the Shirk Ranch.
December 1990	Planning Update #1 sent to public - identified inadequacies of 1969 plan and announced scoping meetings to be held in Lakeview & Bend.
January 1991	Lakeview scoping meeting held - 225 people attended. Bend scoping meeting held - 52 people attended. Meeting with Lake County Chamber of Commerce's Hart Mountain Liaison Committee (Liaison Committee). Planning Update #2 sent to public - described results of scoping meetings & written comments (246 oral comments, 114 written comments).
February 1991	Meeting with Liaison Committee - objectives of group and subjects to be dealt with were determined (range management, wildlife, public use).
March 1991	Planning Update #3 sent to public - it explained the purpose of the Refuge, compatibility, economy, recreation, drought situation. Field trip with Liaison Committee to Hart Mountain.
April 1991	Meeting with Liaison Committee - soil protection, fire, pronghorn habitat and fawning, and bighorn sheep (critical use areas) were discussed.

May 1991	Meeting with Liaison Committee and ODFW wildlife biologist - mule deer (populations, fawning, habitat) and predators were addressed.
July 1991	Planning Update #4 sent to public - it addressed a law suit brought by Sierra Club Legal Defense Fund against the Service, riparian areas, and it announced management planning workshop. Meeting with Liaison Committee.
August 1991	Management Planning Workshop held on Hart Mountain - resource experts from ODFW, BLM, Oregon State University (OSU), Evergreen State College (Washington), Rutgers University (New Jersey), Refuge staff, and a wildlife consultant presented information on key wildlife species and their habitat needs, current habitat conditions. Additional issues were raised and recommendations for management were discussed (87 people participated).
September 1991	Notice of Intent to prepare an EIS was published in the Federal Register. Planning Update #5 sent to public - announced that the Service will prepare an EIS. Planning Update #6 sent to public - reviewed the planning workshop, announced campground workshop to be held on Hart Mountain NAR.
October 1991	Campground workshop held - recommendations were obtained for improving camping on the Refuge (19 people participated).
February 1992	Planning Update #7 sent to public - identified significant issues and described results of campground workshop.
July 1992	Meeting at Hart Mountain NAR with a wildlife consultant, ecological consultant, and professor from the Department of Rangeland Resources, OSU - to provide site specific information on wildlife-habitat relationships, habitat problems, and recommendations regarding management actions to improve or maintain specific habitats. Meeting with former managers of Hart Mountain NAR - they provided Refuge staff with historic perspective of Refuge management and suggestions for future management.

August 1992	Meeting with members of the Liaison Committee, OSU Department of Rangeland Resources, The Wilderness Society, Oregon Natural Resources Council, Oregon Natural Desert Association, and ODFW - to provide site specific information for use in alternative development.
September 1992	Meeting with Lakeview District BLM - obtained information on their concerns and on planning activities in which they would be interested in being involved.
October 1992	Planning Update #8 sent to public - identified new issue (wilderness and Research Natural Areas), Refuge goals, and progress being made in data collection. Meeting with Liaison Committee - to give them an update on progress being made on the EIS, and to provide suggestions on types of information and recommendations that could be used by the Service in developing the EIS. Meeting with Lake County Chamber of Commerce - discussed progress being made on EIS and answered related questions.
December 1992	Chamber of Commerce submitted livestock grazing recommendations.
January 1993	Meeting with ODFW and a wildlife consultant to review and discuss habitat conditions, objectives, and alternatives for the EIS.
February 1993	Meeting with members of the OSU Game Bird Research Program to review and discuss Refuge habitat conditions, objectives, and alternatives for the EIS. Meeting ODFW to review and discuss alternatives being developed for EIS.

April 1993	Planning Update #9 sent to public - outlined preliminary results of habitat and wildlife inventories and surveys being conducted at Hart Mountain NAR. Meeting with fisheries biologists from ODFW and Lower Columbia Fishery Resource Office (Service), to discuss current habitat condition of Rock and Guano creeks, and strategies for managing and restoring stream habitat and fish populations. Refuge staff briefed the Lake County Chamber of Commerce on current habitat condition on the Refuge using results of biological surveys and monitoring.
May 1993	Refuge staff briefed the Lake County Commissioners on current habitat conditions of the Refuge.
13 August - 12 October 1993	Public comment period (please refer to Appendix O).
October 1993	Consulted with ODFW regarding the proposed prescribed burning program.
November 1993	Regional Director and Assistant Regional Director, Refuges and Wildlife of the Service met with the Lake County Commissioners to allow the Commissioners opportunity to present their concerns regarding the DEIS to the Regional Director.
December 1993	Consulted with the Lakeview BLM District Office regarding Alternative B's Livestock Grazing program.
February 1994	Consultant Jim Yoakum met with the Lakeview District Office regarding potential uses of livestock for managing wildlife on Hart Mountain NAR.
March 1994	Consulted with the Lakeview BLM District Office regarding potential impacts to off-Refuge lands, and potential activities that could be coordinated between BLM and the Service.

LIST OF AGENCIES AND INDIVIDUALS TO WHICH A DEIS WAS SENT

Federal Officials

U.S. Representative Bob Smith
U.S. Senator Mark Hatfield
U.S. Senator Bob Packwood

Federal Agencies

Siskiyou National Forest, Grants Pass, OR
Fremont National Forest, Lakeview, OR
Bureau of Land Management, Lakeview, OR
Bureau of Land Management, Susanville, CA
Bureau of Land Management, Vale, OR
Bureau of Land Management, Salmon, ID
USDA Soil Conservation Service, Bend, OR
USDA Soil Conservation Service, Lakeview, OR
National Environmental Protection Agency, Washington D.C.
Environmental Protection Agency, Region 10, Seattle, WA
Department of the Interior:

- Assistant Secretary, Fish and Wildlilfe and Parks, Washington, D.C.
- Assistant Secretary, Land and Minerals Mgt., Washington, D.C.
- Assistant Secretary, Water and Science, Washington, D.C.
- Assistant Secretary, Territorial and International Affairs, Washington, D.C.
- Assistant Secretary, Policy, Management and Budget, Washington, D.C.
- Assistant Secretary, Indian Affairs, Washington, D.C.
- Office of Environmental Affairs, Washington, D.C.
- Public Affairs Officer, Washington, D.C.
- Library of Natural Resources, Washington, D.C.
- Director, National Park Service, Washington, D.C.
- Director, Bureau of Land Management, Washington, D.C.
- Oregon State Director, Bureau of Land Management, Portland, OR
- Director, Bureau of Mines, Washington, D.C.
- Director, Geological Survey, Washington, D.C.
- John Day Fossil Beds Nat'l Monument, John Day, OR

US Fish and Wildlife Service:

- Service Director, Washington D.C.
- Division of Habitat Conservation, Washington, D.C.
- Division of Refuges, Washington, D.C.
- Division of Realty, Washington, D.C.
- Division of Endangered Species, Washington, D.C.
- Branch of Federal Activities, Washington, D.C.
- Office of Management Authority, Washington, D.C.
- Public Affairs Officer, Washington D.C.
- Regional Director, Portland, OR
- Chief, Division of Refuges, Arlington, VA
- NEPA Coordinator, Arlington, VA
- Regional Environmental Office, Portland, OR
- Assistant Regional Director, Refuges and Wildlife, Portland, OR
- Associate Manager, Refuges and Wildlife, Portland, OR
- Refgue Supervisor Idaho/Oregon/Washington, Portland, OR
- Chief, Division of Refuge Operation Support, Refuges and Wildlife, Portland, OR
- Chief, Division of Realty, Portland, OR

Fish and Wildlife Enhancement, Portland, OR
Regional Solicitor, Portland, OR
Assistant Regional Director, Public Affairs, Portland, OR
Assistant Regional Director, Law Enforcement, Portland, OR
Assistant Regional Director, Ecological Services, Portland, OR
Assistant Regional Director, Fisheries and Federal Aid, Portland, OR
Refuges and Wildlife, Denver, CO
Klamath Basin Refuges, Tulelake, CA
Umitilla National Wildlife Refuge, Umitilla, OR
Malheur National Wildlife Refuge, Princeton, OR
Lower Columbia Fishery Resource Office, Vancouver, WA
Charles M. Russell National Wildlife Refuge, Lewiston, MT
Cabeza Prieta National Wildlife Refgue, Ajo, AZ
Hawaiian & Pacific Islands NWR Complex, Honolulu, HA
Lower Snake River, USFWS

State Officials

State Senator Denny Jones
State Senator Eugene Timms

State Agencies

Division of State Lands, Lakeview, OR
Nevada Department of Wildlife
Oregon Department of Fish and Wildlife (ODFW), Portland, OR
ODFW, Lakeview, OR
ODFW, Hines, OR
ODFW, Summer Lake, OR

County and Local Governments

Lake County Road Department, Lakeview, OR
Lake County Extension Office, Lakeview, OR
Lake County Chamber of Commerce, Lakeview, OR
Lake County Planning Department, Lakeview, OR
Lake County Commissioners, Lakeview, OR
Mayor, Town of Lakeview, OR
Grant County Extension Service, Canyon City, OR

Universities and Colleges

Oregon State University, Dept. of Fisheries & Wildlife, Corvallis, OR
Oregon State University, Dept. of Rangeland Resources, Corvallis, OR
Southern Oregon State College, Dept. of Biology, Ashland, OR
University of Nevada, Dept. of Anthropology, Reno, NV
Evergreen State College, Olympia, WA
University of Oregon, Dept. of Biology, Eugene, OR
University of Oregon, Institute of Molecular Biology, Eugene, OR
Portland State University, Dept. of Geography, Portland, OR
University of Colorado, Dept. of Geography, Boulder, CO
Lewis and Clark College, NW School of Law, OR
College of Agriculture, Moscow, ID
University of Nevada, Dept. of Anthropology, Reno, NV

Libraries

Lake County Library, Lakeview, OR
Deschutes County Library, Bend, OR
Klamath County Library, Klamath Falls, OR
Kerr Library, Oregon State University, Corvallis, OR
University of Oregon Library, Eugene, OR
The Libraries, Colorado State University, Ft. Collins, CO

Organizations, Businesses, and Civic Groups

Public Lands Action Network, Sante Fe, NM
High Country News, Carson City, NV
High Country News, Paonia, CO
Salem Audubon Society, Salem, OR
Freer Survival School, Portland, OR
American Wildlands, Reno, NV
Great Basin Society, Princeton, OR
Central Oregon Audubon Society, Bend, OR
Northwest Envrionmental Defense Center, Portland, OR
People for Animal Rights, Portland, OR
The Nature Conservancy, Portland, OR
The Wilderness Society, Washington D.C.
The Wilderness Society, San Fransisco, CA
The Wilderness Society, Portland, OR
Agricultural Communications, Corvallis, OR
Oregon Birds, Portland, OR
Defenders of Wildlife, Sacramento, CA
Defenders of Wildlife, Portland, OR
Rest the West, Portland, OR
Native Plant Society, Bend, OR
Ducks Unlimited, Lakeview, OR
Refuge Reporter, Millwood, VA
Agri-Times Northwest, Pendleton, OR
High Desert Ecological Research Institute, Bend, OR
Eugene Natural History Society, Eugene, OR
Meyer Resources, Davis, CA
Oregon Natural Resource Council, Portland, OR
Oregon Natural Desert Association, Bend, OR
The Bulletin, Bend, OR
Vulcan Power Company, Bend, OR
Oregon Hunters Association, Bend, OR
Southern Oregon Resources Alliance, Roseburg, OR
Oregon Waterfowl & Wetlands Association, Lakeview, OR
Warm Springs Tribe, Warm Springs, OR
National Wildlife Refuges Association, Boring, OR
National Wildlife Refuges Association, Potomac, MD
Oregon Disabilities Commission, Beaverton, OR
North American Pronghorn Foundation, Casper, WY
Natural Resources Defense Council, Washington, D.C.
Desert Survivors, Oakland, CA
S.T.R.A., Virginia
Dynamic Corporation, Rockville, MD
Woodward-Clyde Consultants, Portland, OR
Capitol Press, Salem, OR

Capitol Press, Medford, OR
KQIK Radio, Lakeview, OR
OR Public Broadcasting, Portland, OR
Mail-Tribune, Medford, OR
Register-Guard, Eugene, OR
Associated Press, Grants Pass, OR
Lake County Examiner, Lakeview, OR
Herald and News, Klamath Falls, OR
Oregonian, Portland, OR
National Audubon Society, Washington, D.C.
Oregon Wildlife Federation, Portland, OR
A.F.S.E.E.E., Eugene, OR
The Bush School, Seattle, WA
Nevada Natural History Program, Carson City, NV
Jefferson Public Radio, Ashland, OR
Oregon Trout Office, Portland, OR
Sierra Club Legal Defense Fund, Seattle, WA

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Pitzer, Charles
Plumb, William
Poole, Ron
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Wilson, Harry & Joy
Wilson, Jane
Windom, Buck
Winkler, Carol
Woolley, Gant A.
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LIST OF PREPARERS

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Brian Day USFWS, Sheldon NWR	Wildlife Biologist	Responses to public comments on DEIS/Assistance with proofreading
Anita DeLong USFWS, Sheldon NWR	Assistant Refuge Manager	Assistance with writing/Review of FEIS/Responses to public comments on DEIS
Don DeLong USFWS Complex Office	Fish and Wildlife Biologist/ EIS Team Leader	Issue development/Alternative development/ Principal EIS document writer and editor/ Coordinator/EIS document review/Preparation of Technical Appendices/Responses to public comments/ID Team
Dr. David Dobkin High Desert Ecological Research Institute	Ecologist	Riparian bird-habitat study and reports/Alternative development/Review of DEIS
Mike Gregg USFWS, Sheldong NWR	Fish and Wildlife Biologist/ Livestock Grazing Management	EIS document writing
Dave Lentz USFWS, Complex Office	Fire Management Officer	Review of proposed fire program/Air quality analysis/ Responses to public comments on DEIS
Gary McFadden USFWS, Sheldon NWR	Fish and Wildlife Biologist/ Livestock Grazing Management	Alternative development/ID Team
Philip Meyer Meyer Resources	Economist	Socio-Economic analysis and report/Responses to public comments on DEIS/ID Team
Ruth Anne Miller USFWS, Complex Office	Outdoor Recreation Planner	Issue development/Alternative development/EIS document writing, editing and review/ROS development/Map digitizing and production/ Responses to public comments on DEIS/ID Team

John Morton USFWS, Complex Office	Fire Management Officer	Alternative development/Fire Management Report/ID Team
Gina Proctor USFWS, Complex Office	Purchasing Agent	EIS document typing, report typing, and typing of notes for EIS files/Proofreading
Bill Pyle USFWS, Complex Office	Complex Biologist	Issue development/Alternative development/ Wildlife-Habitat Matrix development and analysis/ Vegetation maps delineation/Preparation of technical appendices/EIS document review/ Responses to public comments on DEIS/ID Team
Barry Reiswig USFWS, Complex Office	Project Leader	Public Involvement/Issue development/Alternative development/Review of EIS documents and associated reports
Adam Rich USFWS, Hart Mountain NAR	Wildlife Biologist (seasonal)	Riparian Nongame Bird Report
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Susan Saul USFWS, Regional Office	Refuge Program Specialist	Public Involvement/Issue development/EIS document review
Mike Smith USFWS, Complex Office	Assistant Project Leader	Public Involvement/Issue development/alternative development/Review process
Beth St. George USFWS, Sheldon NWR	Wildlife Biologist	Issue development/Alternative development/ Special Reports
Dave St. George USFWS, Sheldon NWR	Wildlife Biologist	Issue development/Alternative development/ Special Reports
Melvie Uhland USFWS, Regional Office	Visual Information Specialist	Graphics assistance and assistance with Printing
Linda Wester USFWS, Regional Office	Cartographic Technician	Assistance in map production
Jim Yoakum Western Wildlife	Wildlife Consultant	Special Reports (review of reports submitted by special interest groups, effects of alternatives on big game species, wildlife-livestock interactions)/ Alternative development/Technical assistance in regard to pronghorn and wildlife-livestock grazing relationships/Extensive review of EIS document/ Responses to public comments on DEIS

Hart Mountain
National Antelope Refuge
Comprehensive Management Plan
(Volume II of II)

Final Environmental Impact Statement

Prepared by
U.S. Fish and Wildlife Service

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APPENDIX A
AUTHORITIES

The following is a partial list of the more pertinent Acts of Congress, Executive Orders, and treaties which are relevant for refuge administration. The brief description provided is for informational purposes only; if specific advice is necessary, the entire Act, Executive Order, or treaty should be referenced.

LEGISLATION

Antiquities Act of 1906 (16 U.S.C. 431-433; 34 Stat. 255. The Act requires that a permit be obtained for examination of ruins, excavation of archaeological sites and the gathering of objects of antiquity on lands under the jurisdiction of the Secretaries of the Interior, Agriculture and the Army. This statute also authorizes the President to designate by public proclamation objects or areas of historic or scientific interest as national monuments. The Act authorizes the scientific investigation of antiquities (archaeological, historical, paleontological), subject to the stipulations outlined in permits issued to recognized educational and scientific institutions for the purpose of systematically and scientifically gathering data of scientific value. Paleontological resources fall under the authority of this Act also. (See Refuge Manual, Chapter 5, Part 16, Cultural Resources.)

Archeological and Historic Preservation Act of 1974 (16 U.S.C. 469-469c; 74 Stat. 220), as amended. This Act amends the Reservoir Salvage Act of 1960 to expand its provisions to the preservation of historic and archaeological data in all Federal or Federally assisted or licensed construction projects that might otherwise be lost. This Act directs Federal agencies to notify the Secretary of the Interior whenever they find a Federal or Federally assisted, licensed or permitted project may cause loss or destruction of significant scientific, prehistoric, or archaeologic data. Funds may be appropriated, donated, and/or transferred for the recovery, protection, and preservation of such data. (See Refuge Manual, Chapter 5, Part 16, Cultural Resources.)

Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-470ee; 93 Stat. 721). This Act strengthens and expands the protective provisions of the Antiquities Act of 1906 with respect to archaeological resources. It replaces the 1906 Act's permitting procedures for archaeological research. (See Refuge Manual, Chapter 5, Part 16, Cultural Resources.)

Bald and Golden Eagle Protection Act of 1972 (16 U.S.C. 668-668d; 54 Stat. 250), as amended. This Act prohibits the taking, possession, sale and transport of bald eagles and golden eagles except in certain circumstances and pursuant to regulations issued by the Secretary of the Interior.

Black Bass Act of 1926 (16 U.S.C. 851-856; 44 Stat. 576), as amended. This Act prohibits the importation or transportation in interstate or foreign commerce of black bass and other game fish in violation of foreign, State, or other law, or the purchase of such fish.

Clean Air Act (1970) and 1977 Amendments (42 U.S.C. 1857-1857f; 69 Stat. 322, and 91 Stat. 685. This Act and its amendments charge Federal land managers with direct responsibility to protect the "air quality and related values" of lands under their control. These values include fish, wildlife, and their habitats. The 1977 amendments establish Class I, II, and III areas where the increase of sulfur dioxide and particulate matter is to be restricted. Mandatory Class I Federal lands include all wilderness areas which exceed 5,000 acres and which were in existence on the date of enactment of the Clean Air Act Amendment of August 7, 1977.

Clean Water Act (1987) and Major Amendments (33U.S.C. 1251-1387). This act and its amendments has as its objective the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. Two goals also were established in the 1972 legislation: zero discharge of pollutants and water quality that is both "fishable" and "swimmable". Section 404 charges the U.S. Army Corps of Engineers with regulating discharge of dredge or fill material into waters of the United States, including wetlands. Section 401 of the Act requires that federally permitted activities comply with the federal Clean Water Act, state water quality laws, and any other appropriate state laws.

Endangered Species Act of 1973 (16 U.S.C. 1531- 1543; 87 Stat. 884), as amended. This Act provides for the conservation of threatened and endangered species of fish, wildlife and plants by Federal action and by encouraging the establishment of state programs. It provides for the determination and listing of endangered and threatened species and the designation of critical habitats. Section 7 of the Act requires refuge managers to perform internal consultation before initiating projects which affect or may affect endangered species.

Federal Aid in Fish Restoration and Management Projects Act of 1950 (16 U.S.C. 777-777k; 64 Stat. 430), as amended. This Act, also known as the Dingell-Johnson Act, provides Federal aid to the states for sport fish restoration. Federal funds from an excise tax on sport fishing tackle are provided to States on a matching basis (75/25) for land acquisition, research, development, and management projects.

Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. 669-669i; 50 Stat. 917), as amended. This Act, commonly known as the Pittman-Robertson Act, provides Federal aid to the states for wildlife restoration work. Federal funds from an excise tax on sporting arms and ammunition are provided to States on a matching basis (75/25) for land acquisition, research, development, and management projects.

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (7 U.S.C. 136-136y; 86 Stat. 975), as amended. Public Law 92-516, approved October 21, 1972, amended the Federal Insecticide, Fungicide, and Rodenticide Act of June 25, 1947 (61 Stat. 163) and established under the Administrator of the Environmental Protection Agency a program for controlling the application of pesticides to assure greater protection to man and the environment.

Federal Land Policy and Management Act of 1976 (43 U.S.C. sections; 90 Stat. 2743. Public Law 94-579, approved October 21, 1976, constitutes an "Organic Act" for the Bureau of Land Management, Department of the Interior. Among other things, it establishes new procedures for creating, modifying, and terminating withdrawals and reservations of public lands. New withdrawals of public lands for refuge purposes are subject to withdrawal procedures of the Act; however, lands so added cannot be removed from the system except by Act of Congress pursuant to the National Wildlife Refuge System Administration Act of 1966.

Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471-535, and other U.S.C. sections; 63 Stat. 378), as amended. The Act, as amended several times, provides for management and disposal of government surplus property (excess property not required for the needs of any Federal agencies) and excess property (property under the control of any Federal agency which is not required for its needs). Public law 94-519, approved October 17, 1976 (90 Stat. 2451), provided major changes to section 203 of the act (40 U.S.C. 484) regarding procedures for disposal of surplus property.

Federal Water Pollution Control Act Amendment of 1972 (33 U.S.C. 1251-1265, 1281-1292, 1311-1328, 1241-1345, 1361-1376) 86 Stat. 816. The amendments to the Clean Water Act (P.L. 95-217, which amends the Clean Water Act P.L. 92-500), established criteria and performance standards for the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters.

Fish and Wildlife Act of 1956 (16 U.S.C. 742a- 742j; 70 Stat. 1119), as amended. Public Law 84-1024 initially established the Fish and Wildlife Service under the Assistant Secretary for Fish and Wildlife and a Commissioner for Fish and Wildlife. The Service consisted of the Bureau of Sport Fisheries and Wildlife and a Bureau of Commercial Fisheries, each having a Director. In 1970, the Bureau of Commercial Fisheries was transferred to the Department of Commerce. (See Refuge Manual, Chapter 1, Part 2, History of Fish and Wildlife Service, for details.) The Act was amended by Public Law 93-271 to abolish the office of Commissioner and establish the U.S. Fish and Wildlife Service under a Director. Under this Act, the Secretary is authorized to take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources including, but not limited to, research, development of existing facilities and acquisition by purchase or exchange of land and water or interests therein. The Act also authorizes the Service to accept gifts of real or personal property for its benefit and use in performing its activities and services. Such gifts qualify under Federal income, estate, or gift tax laws as a gift to the United States.

Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661-666c; 48 Stat. 401), as amended. Public Law 73-121 authorizes the cooperation with other Federal or state agencies and others in the development, protection, rearing, and stocking of fish and wildlife and controlling losses. It also authorizes studies to prevent losses and to enhance fish and wildlife at Federal water resource projects and the use of project lands for wildlife by states and/or the Service (in cases where such lands have value for the national migratory bird management program). Finally, it authorizes Federal water resource agencies to acquire lands specifically for fish and wildlife in connection with water resource projects.

Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 742a; 16 U.S.C. 742f, 16 U.S.C. 7421; 92 Stat. 3110). Public Law 95-616 was passed to improve the administration of fish and wildlife programs and amends several earlier laws including the Refuge Recreation Act, the National Wildlife Refuge System administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States.

Geothermal Steam Act, Section 1013(c) (30 U.S.C. 1001-1021) prohibits geothermal leasing of refuges.

Historic Sites, Buildings and Antiquities Act of 1935 (16 U.S.C. 461-467; 49 Stat. 666), as amended. This Act of August 21, 1935, also popularly known as the Historic Sites Act, as amended by Public Law 89-249, October 9, 1965 (79 Stat. 971), declares it a national policy to preserve historic sites and objects of national significance, including those located on refuges, for public use. It provides procedures for designation, administration, and protection of sites, and establishes an advisory board. Among other things, national landmarks are designated under authority of this Act, and as of September 1988, 31 national wildlife refuges contained such sites. (See Refuge Manual, Chapter 5, Part 16, Cultural Resources.)

Lacey Act of 1900 (16 U.S.C. 667E, 701; 18 U.S.C. 42-44; 62 Stat. 285), as amended. This Act provides that the responsibilities of the Department of the Interior include preservation, distribution, introduction, and restoration of game birds and other wild birds. It authorizes regulations for the introduction of American or foreign "birds or animals" into new locations and provides criminal penalties for the interstate transportation of wildlife taken in violation of state, Federal, or foreign laws. Also amended by Executive Order 11987, below.

Land and Water Conservation Fund Act of 1965, (16 U.S.C. 460L-4 to 460L-11; 78 Stat 897), as amended. This Act provides funding through receipts from the sale of surplus Federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715r; 45 Stat. 1222), as amended. The Bird Conservation Commission which consists of the Secretaries of the Interior (chairman), Agriculture, and Transportation, two members from the House of Representatives, and an ex-officio member from the state in which a project is located. The Commission approves acquisition of land and water, or interests therein, and sizes the prices for acquisition by the Secretary for sanctuaries or for other management purposes. Under this Act, to acquire lands, or interests therein, the state concerned must consent to such acquisition by legislation. Such legislation has been enacted by most states.

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718-718h; 48 Stat. 451), as amended. Public Law 73-124, also known as the Duck Stamp Act, requires waterfowl hunters 16 years of age and older to possess a duck stamp, authorizes the acquisition of lands or interests in lands for waterfowl production areas, and prescribes the use of duck stamp net revenues to acquire migratory bird refuge areas under provisions of the Migratory Bird Conservation Act. As amended, the Act authorizes the sale of duck stamps at refuges as well as other locations. Monies derived from the sale of the stamps are placed in a fund known as the Migratory Bird Conservation Fund, and are supplemented by advance appropriations under the Wetlands Loan Act of 1961, as amended. Approval of the Governor or the appropriate state agency is required for purchases under the Act using the fund.

Migratory Bird Treaty Act of 1918, (16 U.S.C. 703-712;40 Stat. 755), as amended. This Act implements treaties with Great Britain (for Canada), Mexico, Japan, and the Soviet Union for the protection of migratory birds which is designated by this Act as a Federal responsibility. The Act is the basis for setting and enforcing hunting seasons and regulations for migratory birds. It authorizes the Secretary to close areas, Federal or non-Federal, to the hunting of migratory birds.

National Environmental Policy Act of 1969, (43 U.S.C. 4321-4347; 83 Stat. 852). This Act requires the preparation of an environmental impact statement for major Federal actions significantly affecting the quality of the human environment. An impact statement must include impacts of the proposed action as well as of alternatives, including no action. Regulations for implementation of the National Environmental Policy Act are found in 40 CFR Parts 1500-1508 (1978). (See Refuge Manual, Chapter 4, Part 5, National Environmental Policy Act Compliance.)

National Historic Preservation Act of 1966, (16 U.S.C. 470-470b, 470c-470n; 80 Stat. 915; 90 Stat. 1319), as amended. Public Laws amending this Act include 89-665, 94-422, 94-458, and 95-515. These Acts are far-reaching and greatly expand Federal policy on archaeological and historic resources. Historic preservation is defined as the protection, rehabilitation, restoration and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture, including encouraging preservation not only on the national level, but state and local levels. They expand the National Register of Historic Places beyond the scope of the National Historic Landmark program to include resources of state and local significance. The Acts authorize matching grants to states and the National Trust for Historic Preservation for acquisition and development of properties listed in the National Register and for development of historic preservation planning programs. (See Refuge Manual, Chapter 5, Part 16, Cultural Resources.)

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee; 80 Stat. 927), as amended. Public Law 89-669 defines the National Wildlife Refuge System as including wildlife refuges, areas for the protection and conservation of fish and wildlife which are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Secretary is authorized to permit any use of an area provided such use is compatible with the major purposes for which such area was established. The purchase consideration for rights-of-way go into the Migratory Bird Conservation Fund for the acquisition of lands. By regulation, up to 40 percent of an area acquired for a migratory bird sanctuary may be opened to migratory bird hunting unless the Secretary finds that the taking of any species of migratory game birds in more than 40 percent of such area would be beneficial to the species. The Act requires an Act of Congress for the divestiture of lands in the system, except (1) lands acquired with Migratory Bird Conservation Commission funds, and (2) lands can be removed from the system by land exchange, or if brought into the system by a cooperative agreement then pursuant to the terms of the agreement.

Refuge Recreation Act of 1962 (P.L. 87-714; 16 U.S.C. 460k-4601-4; 76 Stat. 653), as amended. This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the areas' primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public use.

Refuge Revenue Sharing Act of 1935 (16 U.S.C. 715s; 49 Stat. 383), as amended. This Act provides for the sharing with counties of revenues from areas solely or primarily administered by the Service. For lands purchased by the Service, the greatest of the following amounts is paid to the counties; 75 cents per acre, or three-fourths of one percent of the appraised value of the land, or 25 percent of the net receipts of revenue produced from the land. For Service lands withdrawn from the public domain, the payments to the counties remain at 25 percent of the net receipts. These payments are in lieu of taxes. The Act authorizes appropriations to make up deficiencies if there is insufficient money in the funds to make the payments to the counties.

Refuge Trespass Act of 1909 (18 U.S.C. 41; 62 Stat. 686), as amended. The Act of June 25, 1948, consolidated penalties and provisions of various Acts from 1905 through 1934 which make it unlawful (except in compliance with rules and regulations), to hunt, trap, capture, willfully disturb, or kill any bird or wild animal. It is unlawful to take or destroy the eggs of any such bird or fish on any lands or waters which are set apart or reserved as sanctuaries, refuges, or breeding grounds for such bird, fish or animals under any law of the United states, or willfully injure, molest or destroy any property of the United States on any such lands or waters. The Act specifies a maximum fine of $500 and/or imprisonment for not more than six months.

Solid Waste Disposal Act of 1965 (42 U.S.C. 6901-6987; 90 stat. 2795). The Act established the development of recommended guidelines (sec. 209) for solid waste recovery, collection, separation, and disposal systems, and the Applicability of Solid Waste Disposal Guidelines to Executive Agencies. The reference to the Secretary in this Act means the Administrator of the Environmental Protection Agency.

Wilderness Act of 1964 (16 U.S.C. 1131-1136; 78 Stat. 890). The Act directs the Secretary of the Interior to review, within ten years, every roadless area of 5,000 acres or more and every roadless island regardless of size within the National Wildlife Refuge System and to recommend to the President the suitability of each such area. A detailed discussion of this Act may be found in Refuge Manual, Chapter 6, Part 9.

Wildlife Conservation - Transfer of Certain Real Property (16 U.S.C. 667b). Public Law 80-537 (1948) provides, upon request, that real property which is under the jurisdiction or control of a Federal agency and no longer required by that agency can be transferred as excess land, without reimbursement, to the Department of the Interior if suitable for migratory bird management purposes. It also authorizes the transfer of these same types of lands to state conservation agencies for management of wildlife other than migratory birds.

EXECUTIVE ORDERS

Executive Order 7523 (1936). "...The public lands in the following-described area in Lake County, Oregon, are hereby withdrawn from settlement, location, sale, or entry and reserved and set apart for the use by the Department of Agriculture, subject to existing valid rights, as a range and breeding ground for antelope and other species of wildlife..." After describing the area, the Executive order continued with the following, "...The reservation made by this order supersedes as to any of the above described lands affected thereby the temporary withdrawal for classification and other purposes made by Executive Order 6910 of November 25, 1934, as amended..."

Executive Order 11593 (1971). Protection and enhancement of the cultural environment. This order directs Federal agencies to inventory historic, archaeological, and paleontological properties for inclusion on the National Register of Historic Places and to adopt policies that would contribute to the protection of such resources on non-Federal lands. (See Refuge Manual, Chapter 5, Part 16, Cultural Resources, for details.)

Executive Order 11643 (1972), amended by Executive Orders 11507 and 11282. Prevention, control, and abatement of environmental pollution at Federal facilities. This Order requires Federal agencies to comply with Public Law 92-500 (Federal Water Pollution Control Act Amendments) and gives the details for complying.

Executive Order 11752 (1973), supersedes Executive Orders 11507 and 11282. Prevention, control, and abatement of environmental pollution at Federal facilities. This Order requires Federal agencies to comply with Public Law 92-500 (Federal Water Pollution Control Act Amendments) and gives the details for complying.

Executive Order 11870 (1973), amending Executive Order 11643. This amendment to Executive Order 11643 allows for the experimental use of sodium cyanide for predator control programs on public lands.

Executive Order 11917 (1976), amending Executive Order 11643. Authorizes the head of an agency to authorize use of sodium cyanide in the M-44 device on Federal lands subject to restrictions prescribed by the Environmental Protection Agency, except that use is prohibited in areas where endangered or threatened species might be adversely affected, areas of the National Wildlife Refuge System, and prairie dog towns.

Executive Order 11987 (1977). Exotic organisms. This Order states that Federal executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystem on lands and waters that they own, lease or hold for purposes of administration.

Executive Order 11988 (1977). Floodplain management. Each Federal agency shall provide leadership and take action to reduce the risk of flood loss and minimize the impact of floods on human safety, and preserve the natural and beneficial values served by floodplains.

Executive Order 11990 (1977). Protection of wetlands. This Order stresses avoidance to the extent possible, of long- and short-term adverse impacts associated with the destruction and modification of wetlands, and the avoidance of direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Executive Order 12196 (1980). Occupational safety and health programs for Federal employees. All employing units and authorities of the Federal government shall cooperate with the Secretary of Labor to help him/her adopt safety and health programs.

MAJOR TREATIES

Convention between the United States and the United Mexican States for the Protection of Migratory Birds and Game Mammals. Feb 7, 1936. Adopts a system for protecting certain migratory birds in the United States and Mexico. Allows, under regulation, the rational use of certain migratory birds. Provides for enactment of laws and regulations to protect birds by establishment of closed seasons and refuge zones. Prohibits killing of insectivorous birds, except under permit when harmful to agriculture. Provides for enactment of regulations on transportation of game mammals across the United States-Mexican border.

Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (United States and 17 other American Republics). April 28, 1941. Protects and preserves in their natural habitat representatives of all species and genera of their native flora and fauna, including migratory birds, and protects regions and natural objects of scientific value. The nations agreed to take certain actions to achieve these objectives, including the adoption of "appropriate measures for the protection of migratory birds of economic or aesthetic value or to prevent the threatened extinction of any given species"

APPENDIX B
HABITAT CLASSIFICATION OF HART MOUNTAIN NAR

Distribution and abundance of wildlife is related to the distribution and abundance of habitat comprised principally of vegetation and geomorphic features such as rock outcrops (Maser et al. 1979a, 1984b, Brown 1984, Scott et al. 1993). Distribution of vegetation types and wildlife habitat is influenced by many physical processes including fire, herbivory, and hydrology (Franklin and Dyrness 1973, Wright et al. 1979, Mack and Thompson 1982, Gebhardt et al. 1989, Minshall et al. 1989, USSCS 1993). Knowledge of physical and biological components, processes, and inter-relationships provide a basis for decision-making in wildlife management. The purpose of this section is to review procedures, describe habitat resources, and discuss ecological processes that influence habitat availability.

Many systems are used to characterize habitat resources. Franklin and Dyrness (1973), Dealy et al. (1981), Brown (1984), Maser et al. (1984a), Kovalchik (1987), Minshall et al. (1989), Crawford et al. (1992), and USSCS (1993) comprise few of the many technical reports that describe habitat resources of the northern Great Basin. Each report reflects a different emphasis (ranging from soils to wildlife habitat) and scope (ranging from regional to local). At Hart Mountain NAR, vegetation inventory and monitoring historically has emphasized description of soils and vegetation composition (Rouse 1958, USSCS 1969, USFWS 1970, Cahoon 1970, Anderson et al. 1990a). For the DEIS, we characterized vegetation using the hierarchal classification of Brown (1984) (Table B-1). The following discussion emphasizes the two primary levels of vegetation classification dealt with in the DEIS: type and structure of vegetation.

Vegetation types were delineated based on the occurrence and distribution of the dominant overstory plants (e.g., quaking aspen) and vegetation classes (e.g., forbs). Dominant plant and vegetation classes characterize vegetation types and succession stages within vegetation types, which occur on the Refuge landscape (Cowardin et al. 1979, Dealy et al. 1981, Brown 1984, Maser et al. 1984a, Bunting et al. 1987, Scott et al. 1993, USSCS 1993). Rock outcrops and stream channels (e.g., non-vegetated types) also were described because of their importance as wildlife habitat (Maser et al. 1979a, Minshall et al. 1989). Consequently, vegetation types occurring on the Refuge were mapped with aerial photographs and information from earlier mapping efforts (USSCS 1969, Anderson 1978, USFWS 1989, Morton 1993, USSCS 1993).

A total of 31 types are described; 29 are classified based on potential vegetation. Nineteen vegetation types classified as uplands comprise 94% of the Refuge (Table B-2). About 95% of uplands are comprised of vegetation types that are potentially dominated by shrubs, primarily low sagebrush, Wyoming big sagebrush, and mountain big sagebrush. Types that are characterized by grass and tree growth occur over a limited area, primarily the vicinity of Hart Mountain and Poker

Jim Ridge. Differences among vegetation types are attributed to differences in environmental factors such as total annual precipitation. For example, Wyoming big sagebrush and salt desert shrub dominate vegetation cover in arid regions that annually receive 6-10 inches of precipitation. Mountain big sagebrush, however, occurs in mountainous regions that annually receive 12-20 inches of precipitation (USSCS 1993).

Description of dominant vegetation classes of succession stages was based on remote sensing, observations of field conditions supported by Refuge records, and scientific research conducted in the Intermountain West (for example: Harniss and Murray 1973, Tausch and Tueller 1977, Dealy et al. 1978, Frischknecht 1978, Thomas et al. 1979a, Kilgore 1981, Martin 1982, Young and Evans 1978, Winward 1980, Blaisdell et al. 1982, Sturges 1983, Holmgren and Blaisdell 1984, Humphrey 1984, Koniak 1985, Bunting et al. 1987, Crawford et al. 1992, Payer 1992, Morton 1993, Pyle 1993a, Sturges 1993).

A total of 64 succession stages were described for 19 upland vegetation types (Table B-2). Analysis of succession stages discloses that shrub and tree-dominated stages of late succession comprise 93% of Refuge uplands (non-vegetated areas not included). Within areas of very late succession, 79% comprise vegetation types that are encroached by western juniper, most of which is less than 100 years-old (Dealy et al 1978, J.B. Kauffman, pers. commun.). Expansion of juniper distribution since Euro-American settlement is a widespread phenomenon in the high desert of eastern Oregon (Dealy et al. 1978). Increase in juniper is attributed primarily to fire exclusion and reduction of grasses that carry fire by livestock (Shinn 1978, Dealy et al. 1978, Kauffmann 1990). Amount of early and mid stages of succession on the Refuge is associated primarily with the occurrence of wildfires in 1972 and 1985 (Morton 1993).

In uplands, stand-replacement disturbance (e.g., fire) can initiate secondary succession and direct changes in vegetation structure (Kilgore 1981, Blaisdell et al. 1982, Kauffman 1990). For example forbs and grasses dominate early succession, grasses and shrubs dominate mid succession, shrubs dominate late succession, and shrubs and trees dominate very late succession after stand-replacement disturbance (Harniss and Murray 1973, Dealy et al. 1978, Koniak 1985, Pyle and Smith 1990, Pyle 1991a, Pyle 1993a). Additionally, succession historically was a cyclical process: vegetation stands in late succession reverted to early succession after stand-replacement disturbance (Harniss and Murray 1973, Dealy et al. 1978, Blaisdell et al. 1982, Kauffman 1990).

Fire was once the primary force that regulated succession in uplands of the Refuge. For example, upland sites originally dominated by cover of mountain big sagebrush tend to be dominated by cover of mountain big sagebrush 20-40 years after disturbance by fire (Harniss and Murray 1973, Blaisdell et al. 1982, Pyle 1991b). Therefore, amount and interspersion of succession stages of upland vegetation types was historically influenced by fire (Dealy et al. 1978, Shinn 1978, Wright et al. 1979, Thomas et al. 1979a, Kaufmann 1990, Pyle 1991b).

Disruption of natural fire regimes during the 20th century has reduced the frequency of burning and thus substantially changed the composition of landscape and wildlife habitats of the Refuge (Deming 1961b, Kaufmann 1990, Pyle and Smith 1990, Pyle 1991a, 1991b, Morton 1993). The result was an increase in the amount of Refuge land in late and very late stages of succession (Deming 1961b, Kauffman 1990, Pyle and Smith 1990, Pyle 1991a, Pyle 1991b).

In wetland environments, water supply is the primary factor that influences the distribution and structure of vegetation types (Cowardin et al. 1979, Johnson et al. 1984, Kovalchik 1987, Gebhardt et al. 1989, Minshall et al. 1989, Leonard et al. 1992). Different vegetation types occur where water regimes differ substantially within and among lake basins and riparian areas of the Refuge (Byran 1928, Good 1974, USFWS 1989, Pyle and Brown 1991, USSCS 1993). For example, riparian shrub and deciduous forest frequently characterize potential vegetation of headwater streams and emergent grasses and forbs characterize potential vegetation of seasonally inundated lake basins.

Primary factors that influence water regimes, wetland vegetation types, and wildlife habitat conditions include catastrophic flooding and land management practices associated with municipal, agricultural, and other uses of watersheds (Dunne and Leopold 1978:687, Helm and Wydoski 1980, Kauffman and Krueger 1984, DeBano and Schmidt 1989). At Hart Mountain NAR, water regimes have been influenced primarily by change in ground cover, infiltration, and morphology of stream channels (Refuge files, USSCS 1969, Pyle and Brown 1991). In the DEIS, the process of change in characteristic stages of wetland vegetation types associated with change in water regime is termed site progression (Gebhardt et al. 1989, Leonard et al. 1992).

Wetlands of riparian areas and lake basins comprise 6% of the Refuge. Twelve wetland vegetation types were described (Table B-3). Mixed deciduous shrub, willow, bluegrass-ryegrass, and sedge-rush-bluegrass types are associated primarily with riparian areas. Quaking aspen is associated with riparian areas and northern exposures of Hart Mountain. Other wetlands are associated mainly with seasonally-inundated lake basins (Good 1974, USFWS 1989). Lake basins permanently vegetated with cattail-bulrush are rare on the Refuge because of high variation in water supplies, and frequency of drought. Consequently, pondweed, rush-spikerush-arnica, and poverty-weed primrose types are prevalent. Non-vegetated wetland types include permanently-flooded lake basins with high sediment loading that limits growth of perennial plants and the lower banks and channel beds (aquatic zone) of streams. Wetland types comprise 56% emergent vegetation (e.g., rush-spikerush-arnica) in lake basins, 31% emergent vegetation (e.g., sedge-rush-bluegrass) in riparian areas, and 13% woody-riparian vegetation (e.g., willow).

Thirty-nine progression stages were described for wetland vegetation types based on review of conditions in the field and review of literature (Good 1974, Anderson 1978, Padgett 1981, Brown 1984, Brunsfeld and Johnson 1985, Youngblood et al. 1985, Kovalchik 1987, Reed 1988, Busse 1989, Evenden 1989, Gebhardt et al. 1989, Padgett et al. 1989, USFWS 1989, Leonard et al. 1992). Analysis reveals that progressions stages differ in amount within and among wetland vegetation types (Table B-4). In riparian vegetation types, progression stages comprise 46% late stages, 42% early-mid stages, and 11% very late stages. Within riparian types, progression stages differ among classes of vegetation. Whereas 52% of woody-riparian vegetation types comprise early-mid stages in degraded condition, 39% of emergent type comprise early-mid stages in degraded condition.

Very late stages of progression characterize the resource potential of healthy riparian areas (Kauffman and Krueger 1984, Van Havereen and Jackson 1986, Elmore and Beschta 1987, Kovalchik 1987, Gebhardt et al. 1989, Leonard et al. 1992). In riparian areas, early, mid, and late stages of progression are characterized by various levels of change in morphology of stream channels that lower water tables, reduce wetland vegetation, and foster encroachment of upland vegetation such as big sagebrush (Kovalchik 1987, Evenden 1989, Pyle and Brown 1991, Leonard et al. 1992). On the other hand, riparian areas in very late stages of progression have channel shapes that are minimally influenced by human actions, and which therefore support high water tables and maximum distribution of wetland vegetation (Kovalchik 1987, Evenden 1989, Pyle and Brown 1991, Leonard et al. 1992). Furthermore, such sites are considered to be in dynamic balance with geological and climatic processes (Van Havereen and Jackson 1986, Gebhardt et al. 1989, Minshall et al. 1989, DeBano and Schmidt 1989).

Unlike riparian areas, late stages of site progression characterize potential of lake basins. At Hart Mountain NAR, lake basins currently are comprised of 10% early-mid, 81% late, and 1% very late stages of progression. Like riparian areas, progression stages of lake basins are influenced by many factors that affect water regimes including short-term variation in climate, watershed area and geographic position, and land use practices in the watershed (Refuge files, Cahoon 1970, DeBano and Schmidt 1989, USFWS 1989).

Early, mid, and late stages of progression are characterized by changes in water regimes of lake basins (Cowardin et al. 1979, USFWS 1989). Changes in water regimes fluctuate in response to regulation of water supplies (e.g., Shirk Ranch) and short and long-term changes in climate, which is noted for substantial variation in the Great Basin (Hidy and Klieforth 1990:17). Consequently, some lake basins of the Refuge support no growth of vegetation during dry years (e.g., early progression). During wet years, these same sites may support emergent marsh (e.g., late progression) (Refuge files, Good 1974, USFWS 1989). With respect to land use practices, factors that influence water regimes of watersheds are more likely to affect vegetation compared to factors within a lakebed because of the terminal position of lakebeds in watersheds.

Table B-1. Classification of the Hart Mountain NAR ecosystem.[a]

Biogeographic (Continental) Realm	Formation-type	Climatic (Thermal) Zone	Regional Biome (Formation)	Vegetation Type (Climax Dominant)[b]	Succession-Progression (Structural) Stage[c]
Neartic Upland					
	Desertland Formation				
		Cold Temperate Desertland			
			Great Basin Desert Shrub		
				Wyoming Big Sagebrush	
					Grass-forb
					Grass/resprouting shrub
					Shrub/grass
					Juniper/shrub/grass
				Spiny Hopsage	
					Grass-forb
					Grass/resprouting shrub
					Shrub/grass
				Salt Desert Shrub	
					Grass
					Grass/resprouting shrub
					Shrub/grass
				Winterfat	
					Grass
					Grass/shrub
					Shrub/grass
				Squirreltail	
					Barren
					Grass
				Black Greasewood	
					Grass
					Grass/shrub
					Shrub/grass
				Black Sagebrush	
					Grass
					Grass/shrub
					Shrub/grass
	Grassland Formation				
		Cold Temperate Grassland			
			Great Basin Shrub-grassland		
				Low Sagebrush	
					Forb-grass
					Forb-grass/repsprouting shrub
					Sagebrush/grass-forb
					Juniper/shrub/grass
				Mountain Big Sagebrush	
					Grass-forb
					Grass/resprouting shrub
					Sagebrush/grass
					Juniper/shrub/grass
				Mountain Big Sagebrush-Bitterbrush	
					Grass-forb
					Grass/resprouting-shrub
					Shrub/grass
					Juniper/shrub/grass
				Basin Big Sagebrush	
					Grass-forb
					Grass/resprouting shrub
					Shrub/grass
				Fescue	
					Grass-forb
					Grass/shrub
				Wheatgrass	
					Grass-forb

Table B-1. (Continued)

Biogeographic (Continental) Realm	Formation-type	Climatic (Thermal) Zone	Regional Biome (Formation)	Vegetation Type (Climax Dominant)	Succession-Progression (Structural) Stage
					Grass/shrub
					Juniper/grass/shrub
	Shrubland Formation				
		Cold Temperate Shrubland			
			Great Basin Montane Shrub		
				Mountain Shrub	
					Grass-forb
					Resprouting shrub/grass
					Shrub/grass
					Juniper/shrub/grass
				Mountain Mahogany	
					Resprouting shrub/grass
					Shrub/grass/immature tree stand
					Mature tree stand
					Old-growth stand
	Woodland and Forest Formation				
		Cold Temperate Woodland and Forest			
			Great Basin Conifer Woodland		
				Western Juniper	
					Resprouting shrub/grass
					Shrub/grass/young tree stand
					Mature tree stand
					Old-growth stand
			Great Basin Montane Conifer Forest		
				White Fir	
					Resprouting shrub/grass
					Shrub/grass/young tree stand
					Mature tree stand
					Old-growth stand
				Ponderosa Pine	
					Resprouting shrub/grass
					Shrub/grass/young tree stand
					Mature tree stand
					Old-growth stand
	Non-vegetated Formation				
		Cold Temperate Non-vegetated			
			Great Basin Terrestrial Non-vegetated		
				Terrestrial Non-vegetated	
Neartic Wetland					
	Forest and Woodland Formation				
		Cold Temperate Swamp and Riparian Forest			
			Great Basin Deciduous Forest		
				Quaking Aspen	
					Shrub/grass-forb
					Grass-forb
					Grass-forb/aspen
					Aspen/graminoid-forb
	Shrubland Formation				
		Cold Temperate Swamp and Riparian Shrub			
			Great Basin Riparian Shrub		
				Mixed Deciduous Shrub	
					Shrub/grass-forb
					Grass-forb
					Grass-forb/mixed deciduous shrub
					Mixed deciduous shrub/graminoid-forb
				Willow	
					Shrub/grass-forb
					Grass-forb
					Grass-forb/willow

Table B-1. (Continued)

Biogeographic (Continental) Realm	Formation-type	Climatic (Thermal) Zone	Regional Biome (Formation)	Vegetation Type (Climax Dominant)	Succession-Progression (Structural) Stage
					Willow/graminoid-forb
	Marshland Formation				
		Cold Temperate Marshlands			
			Great Basin Interior Marshlands		
				Bluegrass-Ryegrass	
					Shrub/barren
					Shrub/grass
					Grass/shrub
					Grass
				Sedge-Rush-Bluegrass	
					Shrub/grass
					Grass/shrub
					Grass
					Sedge-rush-bluegrass
				Silver Sagebrush	
					Sagebrush/barren
					Sagebrush/bunchgrass
					Silver sagebrush/grass-forb
					Graminoid-forb/silver sagebrush
				Poverty Weed-Primrose	
					Barren
					Poverty weed-primrose
				Rush-spikerush-arnica	
					Barren
					Poverty weed-primrose
					Rush-spikerush-arnica
				Saltgrass	
					Greasewood
					Grass/greasewood
					Grass
				Cattail-Bulrush	
					Barren
					Rush-spikerush-arnica
					Cattail-bulrush
	Submergent Aquatic Vegetation Formation				
		Cold Temperate Submergent Aquatic Vegetation			
			Great Basin Submergent Aquatic Vegetation		
				Pondweed	
					Grass
					Rush-spikerush-arnica
					Pondweed
	Non-vegetated Formation				
		Cold Temperate Aquatic Non-vegetated			
			Great Basin Aquatic Non-vegetated		
				Aquatic Non-vegetated	

[a] Classification based on Brown (1984) and Maser et al. (1984).

[b] Ecological sites and community types are considered subsets of vegetation types.

[c] Succession is defined as the change in structure of upland vegetation types through time; progression is defined as the change in structure of vegetation types associated with a change in water availability to plants. Succession-progression stages of vegetation types are composed of different plant communities, which are not described in this table.

Table B-2. Acres of existing succession stages of upland vegetation types, Hart Mountain NAR, 1993.

Biome Vegetation type	Succession Stage Early	Mid	Late	Very Late	Total
Desert Shrub					
Wyoming big sagebrush	1,489	0	88,087	1,552	91,128
Salt desert shrub	0	0	1,546	--	1,546
Winterfat	0	0	1,199	--	1,199
Black greasewood	0	0	701	--	701
Black sagebrush	0	0	648	--	648
Spiny hopsage	0	0	374	--	374
Squirreltail	0	0	163	--	163
Shrub-grassland					
Low sagebrush	6,900	1,182	89,328	7,466	105,506
Mountain big sagebrush	528	1,857	19,003	2,475	23,863
Big sagebrush-bitterbrush	2,430	1,748	3,486	3,242	10,096
Wheatgrass	0	0	2,800	1,330	4,130
Basin big sagebrush	0	0	3,168	--	3,168
Fescue	0	0	149	--	149
Montane Shrub					
Mountain shrub	87	40	2,194	629	2,950
Mountain mahogany	0	0	0	1,449	1,449
Conifer Woodland					
Western Juniper	0	0	0	4,890	4,890
Conifer Forest					
Ponderosa Pine	0	0	69	0	69
White Pine	0	0	0	13	13
TOTAL	11,434	5,457	218,281	23,046	258,218

Table B-3. Acres of wetland vegetation types, Hart Mountain NAR.

Vegetation type	Area (acres)	Vegetation type	Area (acres)
Sedge-rush-bluegrass	3,745	Cattail-bulrush	469
Silver sagebrush	2,552	Willow	355
Poverty weed-primrose	2,408	Aquatic non-vegetated	234
Rush-spikerush-arnica	1,919	Mixed deciduous shrub	212
Quaking aspen	1,465	Saltgrass	19
Bluegrass-ryegrass	953	Total wetland	15,078
Pondweed	747		

Table B-4. Acres of progression stages[a] of wetland vegetation types, Hart Mountain NAR.

	Progression stage		
Vegetation type	Early-mid	Late	Very late
Sedge-rush-bluegrass	1,174	2,286	285
Silver sagebrush	126	2,320	106
Poverty weed-primrose	14	2,394	–[b]
Rush-spikerush-arnica	0	1,919	–
Quaking aspen	746	456	263
Bluegrass-ryegrass	648	223	82
Pondweed	615	132	–
Cattail-bulrush	454	15	–
Willow	262	57	36
Aquatic non-vegetated	234	–	–
Mixed deciduous shrub	34	88	90
Saltgrass	0	19	0

[a] Based on single and multiple progression stages: early and mid = dominated by both stages; late = dominated by late stages; very late = dominated by very late stages.
[b] Indicates progression stage was not represented in vegetation type.

APPENDIX C
CONDITION OF LATE SUCCESSION PLANT COMMUNITIES AND SOIL RESOURCES OF HART MOUNTAIN NAR

This appendix is comprised of several tables that present information on (1) range condition (ecological condition) by range site (ecological site) and vegetation type, (2) soil taxonomy (at the series level), and (3) vegetation cover for major vegetation types and range sites. As explained by Holechek et al. (1989:165), range condition measures the extent to which plant communities different from their natural potential at climax (e.g., a late stage of succession). The following rating system is commonly used (adopted from Holechek et al. 1989 and NRSTG 1985):

Range Condition	Percent of Climax
Excellent	76-100
Good	51-75
Fair	26-50
Poor	0-25

Range condition ratings provide valuable information on conditions within plant communities that are in a late stage of succession. We are unaware of a rating system that rates conditions within early, mid, or very late stages of succession. Ratings do not correspond to the condition of wildlife habitat (many additional factors are involved). Table C-1 supports assessments of upland habitat condition as described in Chapter 3 of Volume I. About 88% of the area within desert shrub and shrub-grassland biomes (which comprise 94% of Refuge uplands) is presently in a late stage of succession (Table 3-3, Volume I). Based on information in Table C-3, conditions of plant communities are relatively poor within this area -- in other words, plant-species composition of these communities differs substantially from their natural potential (in late succession). This is attributed to increased shrub and juniper cover and associated reduced grass and forb cover. Western juniper has expanded, within the last 100 years, into another 7% of the area within these vegetation types (Table 3-3, Volume I).

Available evidence does not suggest that shrub cover has changed markedly since 1968 on the Refuge (C-5). Although sample size is limited, the information reflects what would be expected based on Sneva et al. (1984), Winward (1991), and Laycock (1991). These authors assert that shrub cover would not decline without active reduction of shrub cover. In other words, rest from livestock (or other changes in grazing systems), and rest from fire and other stand-replacement disturbances would result in few changes in ecological condition. It is unclear why shrub cover estimates from 1979 and 1987 are substantially lower than estimates taken in 1968 and measurements taken in 1992. It is doubtful that shrub cover declined after 1968 and then increased again between 1987 and 1992. Limited sample size and differences in sampling techniques likely explain much of the variability.

Sampling methods differed among the years 1968, 1979, 1979, and 1992 (Table C-5). Vegetation cover on plots was estimated in 1968. Although these plots were not marked, Anderson and Franzen (1987) attempted to locate the same plots as closely as possible. Permanent plots were established at these points (32 total plots). Estimates were taken at these plots in 1979 and 1987 (Anderson and Franzen 1987). In 1992, researchers from Oregon State University (OSU) sampled vegetation at random locations, as well as at sage grouse nest sites (Crawford et al. 1992). During the same year, Service personnel sampled vegetation using the same procedures (DeLong 1993b). Because sampling procedures were identical, 1992 data from each effort were combined. Table C-5 only presents results of each sampling effort that took place within 7 Range sites; only random locations from the OSU effort are included.

Additional information is provided in Tables C-2, C-3, and C-4.

Table C-1. Acres of late-successional ecological sites and acres of ecological condition classes[a] of late-successional ecological sites[b], Hart Mountain NAR, 1968.

		Ecological condition			
Ecological site	Total acres	Poor	Fair	Good	Excel
Arid loamy terrrace	31843	26288	5555	0	0
Claypan terrace	7181	3502	3517	162	0
Droughty bottomland fan	9760	9760	0	0	0
Droughty north exposure	2628	0	1650	978	0
Droughty terrace	5758	5259	499	0	0
Dry mountain meadow	251	0	0	251	0
Gravelly ridgetop	1576	0	0	1576	0
High rolling hills	12619	0	5377	7242	0
Intermittent lake	2749	1535	1214	0	0
Juniper south exposure	6014	0	3374	2640	0
Juniper tableland	1080	1080	0	0	0
Lakebed terrace	3701	3251	450	0	0
Mahogany rockland	1263	0	1093	170	0
Moist bottomland fan	2843	1076	1767	0	0
Platy terrace	4106	183	3245	678	0
Rocky terrace	78168	27582	47721	2865	0
Rolling hills	7632	0	0	7632	0
Semi-desert terrace	34370	648	33722	0	0
Semi-wet meadow	1378	0	779	599	0
Shrubby north complex	6154	0	0	6154	0
Shrubby terrace complex	17174	0	9723	7451	0
Steep north exposure	4259	0	822	3437	0
Steep south exposure	1836	0	334	1502	0
Well-drained bottom	758	532	226	0	0
TOTAL	245101	80696	121068	43337	0
Percent		33	49	18	0

[a] "...The present state of the vegetation and soil protection of an ecological site in relation to the potential natural community [in late-succession]" (NRSTG 1985). Condition classes are determined mainly by comparison of similarity of vegetation composition on a site with vegetation composition of a reference stand in a late succession stage. Condition is evaluated as poor (0-25% similarity); fair (26-50% similarity); good (51-75% similarity; and excellent (76-100% similarity) in vegetation composition between a site and a reference stand.

[a] Ecological condition was not evaluated for the following ecological sites: lakebed (5484 acres), rockland (5319 acres), and silty sodic bottom (100 acres).

Table C-2. Acres of late-successional vegetation types and ecological sites and acres of ecological condition classes[a] of late-successional vegetation types and ecological sites[b], Hart Mountain NAR, 1968.

Vegetation type ecological site	Total acres	Ecological condition Poor	Fair	Good	Excel
Big and low sagebrush mosaic[c]					
High rolling hills	12619	0	5377	7242	0
Bluegrass-ryegrass					
Dry mountain meadow	251	0	0	251	0
Grassland					
Steep south exposure	1836	0	334	1502	0
Juniper					
Juniper south exposure	6014	0	3374	2640	0
Juniper tableland	1080	1080	0	0	0
Total	7094	1080	3374	2640	0
Low sagebrush					
Claypan terrace	7181	3502	3517	162	0
Gravelly ridgetop	1576	0	0	1576	0
Rocky terrace	78168	27582	47721	2865	0
Total	86925	31084	51283	4603	0
Mountain big sagebrush					
Droughty north exposure	2628	0	1650	978	0
Platy terrace	4106	183	3245	678	0
Rolling hills	7632	0	0	7632	0
Steep north exposure	4259	0	822	3437	0
Total	18625	183	5717	12725	0
Mountain mahogany					
Mahogany rockland	1263	0	1093	170	0
Mountain shrub mosaic[d]					
Shrubby north complex	6154	0	0	6154	0
Sagebrush-bitterbrush[e]					
Shrubby terrace complex	17174	0	9723	7451	0
Sedge-rush-bluegrass					
Moist bottomland fan	2843	1076	1767	0	0
Semi-wet meadow	1378	0	779	599	0
Well-drained bottom	758	532	226	0	0
Total	4979	1608	1772	599	0

Table C-2. (Continued)

Vegetation type and ecological site	Total acres	Ecological condition			
		Poor	Fair	Good	Excel
Silver sagebrush					
Intermittent lake	2749	1535	1214	0	0
Wyoming big sagebrush					
Arid loamy terrace	31843	26288	5555	0	0
Droughty bottomland fan	9760	9760	0	0	0
Droughty terrace	5758	5259	499	0	0
Lakebed terrace	3701	3251	450	0	0
Semi-desert terrace	34370	648	33722	0	0
Total	85432	45206	40226	0	0

[a] "...The present state of the vegetation and soil protection of an ecological site in relation to the potential natural community [late-successional]" (NRSTG 1985). Condition classes are determined mainly by comparison of similarity of vegetation composition on a site with vegetation composition of a reference stand in a late succession stage. Condition is evaluated as poor (0-25% similarity); fair (26-50% similarity); good (51-75% similarity; and excellent (76-100% similarity) in vegetation composition between a site and a reference stand.

[b] Ecological condition was not evaluated for the following ecological sites: lakebed (5484 acres), rockland (5319 acres, and silty sodic bottom (100 acres).

[c] Includes a mosaic of mountain big sagebrush and low sagebrush.

[d] Includes a mosaic of mountain big sagebrush, low sagebrush, and bitterbrush vegetation types.

[e] Includes a mosaic of mountain big sagebrush, mountain shrub, and quaking aspen vegetation types. Ecological condition was not evaluated for the aspen type.

Table C-3. Correlation between 1969 and 1993 names of ecological sites and soil series, Hart Mountain NAR.

1969 name	1993 name	Soil series
Arid Loamy Terrace	Clayey 10-12" pz[a]	Ratto
	Loamy 10-12" pz	Corral
	Thin Surface 8-14" pz	Brace; Coglin
Arid North Exposure	North Slopes 10-12" pz	Harcany; Fitzwater; Riddleranch
	Shallow North 12-16" pz	Harcany; Fitzwater; Riddleranch
Droughty Bottomland Fan	Loamy Bottom	Jesse Camp
Droughty Terrace	Loamy 8-10" pz	McConnel
	Shallow Loam 8-10" pz	Pait
	Sodic Terrace 6-10" pz	Mesman
Dry Mountain Meadow	Dry Meadow	Degarmo
Gravelly Ridgetop	Gravelly Ridge 12-16" pz	Harcany
High Rolling Hills	Gravelly Ridge 16+" pz	Harcany
	Loamy 16-20" pz	Harcany
Intermittent Lake	Ponded Clay	Boulder Lake; Swalesilver
Juniper Tableland	Claypan 10-12" pz	Floke
	Claypan 12-16" pz	Ninemile
Juniper South Exposure	South Slopes 8-12" pz	Felcher
	South Slopes 12-16" pz	Fitzwater
Lakebed	Lakebed	Welch
Lakebed Terrace	Lake Terrace	Langslet
	Loamy 8-10" pz	Westside
	Silty 6-10" pz	Norad; Westside
Mahogany Rockland	Rocky Ridges 12-16" pz	Noname
Moist Bottomland Fan	None reported	Mudpot; Swalesilver
North Exposure	North Slopes 12-16" pz	Harcany; Westbutte
Platy Terrace	Loamy 12-16" pz	Fitzwater
Rolling Hills	Loamy 12-16" pz	Fitzwater
Semi-desert Terrace	Clayey 10-12" pz	Ratto
	Loamy 8-10" pz	Corral; Mesman; Ratto; Spangenburg
	Shallow loam 8-10" pz	Hager; Pait; Raz
	Thin surface 8-14" pz	Hager; Coglin
Semi-wet Meadow	Dry Meadow	Degarmo
	Wet Meadow	Welch
Shrubby North Complex	North Slopes 12-16" pz	Harcany
Aspen Grove	Aspen Grove	Not surveyed
Mountain Swale	Mountain Swale	Not surveyed
Snowpocket	None Reported	Not surveyed
Shrubby Terrace Complex	Newlands-Ninemile Complex	
Claypan Terrace	Claypan 12-16" pz	Ninemile
Shrubby Rolling Hills	Deep loamy 12-16" pz	Newlands

Table C-3. (continued)

1969 Name	1993 Name	Soil name
Steep North Exposure	North Slopes 12-16" pz	Fitzwater
Steep South Exposure	South Slopes 12-16" pz	Felcher; Fitzwater
Rocky Terrace	Thin Surface Claypan 10-16" pz	Floke; Freznik
Well-drained Bottom	Dry Meadow Wet Meadow	Degarmo Welch

[a] Precipitation zone (pz).

Table C-4. Characteristics of ecological sites of Hart Mountain NAR.[a]

Landform / Ecological site / Soil family / Late-successional vegetative association	Annual vegetation production[b] lbs/acre (range)	Total acres
Fans, footslopes, and terraces		
Clayey Playette		
Fine, montmorillonitic, mesic Xerollic Paleargid		
Wyoming big sagebrush/Squirreltail	500 (300-700)	137
Claypan 12-16" pz		
Clayey, montmorillonitic, frigid Lithic Argixeroll		
Low sagebrush/Idaho fescue-Bluebunch wheatgrass	800 (600-1000)	6430
Deep Loamy 12-16" pz		
Fine-loamy, mixed Argic Cryoboroll		
Mountain big sagebrush-Bitterbrush/Idaho fescue	1000 (800-1300)	9186
Loamy 10-12" pz		
Loamy, mixed, mesic, shallow Xerollic Haplargid		
Wyoming big sagebrush/Thurber's needlegrass	800 (600-1000)	677
Loamy 8-10" pz		
Clayey, montmorillonitic, frigid, shallow Xerollic Durargid		
Wyoming big sagebrush/Indian ricegrass-Thurber's needlegrass	700 (400-900)	4404
Low Sodic Terrace 6-10" pz		
Fine-loamy, mixed, mesic Aquollic Salorthid		
Shadscale-Black greasewood/Basin wild-rye	450 (300-600)	75
Shallow Loam 8-10" pz		
Fine-loamy, mixed, frigid Xerollic Durargid		
Wyoming big sagebrush/Bluebunch wheatgrass-Thurber's needlegrass	500 (300-700)	7061
Silty 6-10" pz		
Fine, montmorillonitic, frigid Duric Paleargid		
Winterfat-Nuttall's saltbush/Indian ricegrass	350 (200-500)	4145
Sodic Terrace 6-10" pz		
Fine-loamy, mixed, mesic Xerollic Natrargid		
Wyoming big sagebrush-Black greasewood-Spiny hopsage/Basin wild-rye	600 (400-800)	42
Hillsides, mountainsides, and mountaintops		
Loamy 12-16" pz		
Loamy-skeletal, mixed, frigid Aridic Haploxeroll		
Mountain big sagebrush/Idaho fescue	1000 (700-1400)	6947
Gravelly Ridge 12-16" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Low sagebrush/Idaho fescue	600 (400-800)	4245
Gravelly Ridge 16+" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Low sagebrush/Rough fescue-Idaho fescue	1000 (800-1200)	4445
Loamy 12-16" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Mountain big sagebrush/Idaho fescue	1000 (700-1400)	6064
Loamy 16-20" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Mountain big sagebrush/Rough fescue-Idaho fescue	1000 (800-1200)	6351
North Slopes 10-12" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Mountain big sagebrush/Idaho fescue	1200 (1000-1500)	4959
North Slopes 12-16" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Mountain big sagebrush/Idaho fescue	1400 (1000-1800)	4221
Shallow North 12-16" pz		
Loamy-skeletal, mixed Pachic Cryoboroll		
Low sagebrush/Idaho fescue	900 (700-1200)	8306
South Slopes 12-16" pz		
Loamy-skeletal, mixed, frigid Aridic Haploxeroll		
Mountain big sagebrush-Bitterbrush/Bluebunch wheatgrass	1100 (700-1400)	3159

Table C-4. (Continued)

Landform Ecological site Soil family Late-successional vegetative association	Annual production[b] lbs/acre (range)	Total acres
South Slopes 8-12" pz		
Loamy-skeletal, mixed, mesic Xerollic Camborthid		
Bitterbrush-Wyoming big sagebrush/Bluebunch wheatgrass	700 (500-1000)	4074
Tablelands		
Clayey 10-12" pz		
Clayey, montmorillonitic, frigid, shallow Xerollic Durargid		
Wyoming big sagebrush/Bluebunch wheatgrass	900 (700-1200)	18817
Claypan 10-12" pz		
Clayey, montmorillonitic, frigid Lithic Xerollic Haplargid		
Low sagebrush/Bluebunch wheatgrass	700 (400-900)	55189
Loamy 10-12" pz		
Fine-loamy, mixed, frigid Xerollic Durargid		
Wyoming big sagebrush/Thurber's needlegrass	800 (600-1000)	2133
Loamy 12-16" pz		
Loamy-skeletal, mixed, frigid Aridic Haploxeroll		
Mountain big sagebrush/Idaho fescue	1000 (700-1400)	1044
Shallow Loam 8-10" pz		
Fine-loamy, mixed, frigid Xerollic Durargid		
Wyoming big sagebrush/Bluebunch wheatgrass-Thurber's needlegrass	500 (300-700)	26145
Thin Surface 8-14" pz		
Fine, montmorillonitic, frigid Xerollic Paleargid		
Black sagebrush/Squirreltail	400 (300-500)	10144
Thin Surface Claypan 10-16" pz		
Clayey, montmorillonitic, frigid, shallow Abruptic Xerollic Durargid		
Low sagebrush/Sandberg's bluegrass	200 (100-300)	24086
Valley bottoms and basins		
Dry Floodplain		
Coarse-loamy, mixed, mesic Durixerollic Camborthid		
Basin big sagebrush/Basin wildrye-Creeping wildrye	3000 (1000-4500)	60
Dry Meadow		
Fine-loamy over sandy or sandy-skeletal, mixed frigid Cumilic Haplaquoll		
Thickspike wheatgrass-Lemmon's bluegrass-Nevada bluegrass	2000 ((700-2200)	1354
Lake Terrace		
Fine, montmorillonitic, frigid Aquic Camborthid		
Creeping wildrye-Squirreltail	500 (300-700)	21
Lakebed		
Fine-loamy, mixed, frigid Cumulic Haplaquolls		
Creeping spikerush-Baltic rush	1400 (1000-2000)	940
Loamy Bottom		
Fine-silty, mixed, frigid Xerollic Camborthid		
Basin big sagebrush/Basin wildrye	4500 (2000-6000)	570
Ponded Clay		
Fine, montmorillonitic, frigid Aquic Palexeralf		
Silver sagebrush/Nevada bluegrass-Creeping wildrye	1500 (1000-1800)	1974
Sodic Flat		
Fine-loamy, mixed, mesic Natric Camborthid		
Black greasewood/Inland saltgrass	300 (200-500)	9
Sodic Meadow		
Fine-loamy, mixed (calcareous), mesic Aeric Halaquept		
Sand dropseed-Inland saltgrass-Alkali bluegrass	1000 (700-1200)	43
Wet Meadow		
Fine, montmorillonitic (calcareous), frigid Fluvaquentic Haplaquoll		
Tufted hairgrass-Sedge spp.	2000 (1000-2500)	1724

[a] After USSCS (1993). Table includes acerage of ecological sites only if site was classified.
[b] Includes shrubs, grasses, and forbs. These values are interpretted to represent the production level associated with a site in good-excellent condition.

Table C-5 Shrub, grass and forb cover of seven range sites[a] and vegetation types, in late succession, on Hart Mountain NAR in 1968[b], 1979[b], 1987[b] and 1992[c]. Only range sites that were sampled in all years were used.

Vegetation Type	Shrub Cover (%)				Grass Cover (%)				Forb Cover (%)			
Range Site	68	79	87	92	68	79	87	92	68	79	87	92
Wyoming Big Sagebrush												
Semi-desert Terrace	29	17	22	22	8	10	8	2	4	7	3	2
Arid Loamy Terrace	24	13	14	25	8	10	8	8	<1	4	<1	2
Platy Terrace	24	16	17	22	21	8	13	9	5	6	8	3
Average for Veg. Type	**25**	**14**	**17**	**23**	**10**	**10**	**9**	**5**	**2**	**5**	**2**	**2**
Low Sagebrush												
Rocky Terrace	26	13	15	23	7	12	11	10	13	18	12	7
Claypan Terrace	23	16	16	27	10	10	9	12	9	9	5	8
Average for Veg. Type	**24**	**16**	**16**	**25**	**9**	**10**	**10**	**11**	**10**	**10**	**6**	**8**
Sagebrush-Bitterbrush												
Shrubby Terrace Complex	**45**	**34**	**40**	**40**	**28**	**14**	**11**	**15**	**10**	**8**	**6**	**3**
Mountain Big Sagebrush												
High Rolling Hills	**31**	**21**	**17**	**31**	**43**	**25**	**25**	**18**	**13**	**25**	**25**	**11**

[a] Range sites are subdivisions of vegetation types.

[b] Each vegetation sample from 1968, 1979 and 1987 consisted of estimating percent cover of shrubs, grasses, and forbs within a 50-foot radius plot; data were collected by the Soil Conservation Service, USDA (Anderson and Franzen 1979, Anderson 1986, Anderson and Franzen 1988).

[c] Each vegetation sample from 1992 consisted of measuring shrub cover along two 33-foot long tapes, and estimating grass and forb cover inside 10 subplots measuring 0.7 x 1.6 feet (Crawford et al. 1992). Data were collected by the Game Bird Research Program (Department of Fisheries and Wildlife, Oregon State University), and the U.S. Fish and Wildlife Service.

Table C-5. (continued)

Moss Cover (%)				Litter Cover (%)				Bare Ground (%)				Sample Size			
68	79	87	92[d]	68	79	87	92[d]	68	79	87	92[d]	68[b]	79[b]	87[b]	92[c]
3	2	3	-	5	9	19	-	58	40	40	-	2	2	2	16
10	2	9	6	13	11	16	12	60	25	30	65	4	4	3	14
0	<1	<1	-	20	20	20	-	20	45	30	-	1	1	1	8
8	**2**	**7**	-	**10**	**11**	**17**	-	**54**	**32**	**33**	-	**7**	**7**	**6**	**38**
0	8	5	2	13	15	20	25	33	10	20	33	2	2	1	24
1	3	5	7	13	14	18	26	35	46	44	47	6	8	7	13
1	**2**	**4**	**4**	**13**	**14**	**18**	**25**	**34**	**39**	**41**	**39**	**8**	**10**	**8**	**37**
2	**1**	**<1**	-	**33**	**30**	**30**	-	**35**	**34**	**45**	-	**4**	**4**	**2**	**4**
0	**3**	**3**	-	**23**	**15**	**32**	-	**10**	**15**	**14**	-	**4**	**6**	**4**	**9**

[d] Moss cover, litter cover, and bare ground were not measured in Oregon State University sampling efforts, and thus sample sizes are less than what is presented under the 'Sample Size' column. As such, data were unavailable for several range sites (denoted by '-'s). Sample sizes for Arid Loamy Terrace, Rocky Terrace and Claypan Terrace sites are 11, 14 and 11, respectively.

APPENDIX D
EVALUATION OF CONDITION OF RIPARIAN AREAS OF HART MOUNTAIN NAR

Introduction

Riparian habitats increasingly are evaluated as barometers for management because of their importance to a range of natural resources including fish and wildlife (Thomas et al. 1979c). Importance of western riparian areas as wildlife habitat is attributed to many factors including their inherent biological productivity, habitat complexity, and tendency for food, cover, and water for wildlife to be juxtaposed (Thomas et al. 1979c, Kauffman and Krueger 1984, Dobkin 1993). At Hart Mountain NAR, riparian areas comprise less than 2% of the land-base but collectively harbor more wildlife species than other habitats, which is consistent with patterns described for southeastern Oregon (Maser et al. 1984a, 1984b).

We evaluated riparian habitats in 1992 because of the general absence of baseline data for the Refuge and growing concern about the status and health of Refuge riparian zones (Reiswig 1989). The objective was to evaluate the physical and biological characteristics of riparian complexes. A complex is defined as "the unit of land which supports or may potentially support a similar grouping of community types" (Winward 1986, Winward and Padgett 1989). Complexes typically comprise discreet land units (valley bottom types) within a watershed, which typically support 6-10 major types of plant communities (Winward and Padgett 1989). This report describes methods and results from one component of the survey, evaluation of resource condition of riparian areas.

Study area

The study area included the perennial and semi-perennial reaches of 9 streams, which collectively drain 47% of Refuge land. Streams surveyed included Rock Creek, Guano Creek, Deer Creek, Warner Creek, Degarmo Creek, Potter Creek, Hart Creek, Juniper Creek, and Cooper Creek. Rock Creek, Deer Creek, and Guano Creek occur on the east side of Hart Mountain, drain into the Catlow Valley, and comprise the bulk of perennial stream and riparian habitat. Warner Creek discharges into Big Flat, a productive emergent wetland located on the east side of Hart Mountain. Other streams surveyed flow into the Warner Lakes basin. Riparian habitat not surveyed included all basin wetlands (e.g., playas), wetlands of the Shirk Ranch and Jacob's Reservoir, spring sites, and shrub and forested wetlands associated with side slopes and snowpockets of Hart Mountain.

The interaction of geology and climate on the Refuge has influenced the development of distinctive riparian landforms, which potentially support distinctive types of riparian vegetation (Minshall et al. 1989, Manning and Padgett 1990).

Headwater stream segments are characterized by steep gradients, V-shaped fluvial canyons, and vegetation types dominated by aspen, willow, and alder. Alluvial fans, a second riparian landform, occur along mountain footslopes below the mouths of V-shaped canyons. Potential vegetation of alluvial fans ranges from woody-riparian associated with steep stream gradients (>4%) and coarse soils to meadow associated with gentle gradients (<4%) and fine-textured soils. Alluvial valleys are a third and dominant riparian landform. Stream gradients are gentle, soils are fine-textured, and vegetation is dominated by graminoids and forbs.

Methods

In 1992, riparian habitats were evaluated on an extensive basis (i.e., entire stream systems within watersheds) using a variety of principles and methods developed by the U.S. Forest Service (Collins et al. 1992) and U.S Bureau of Land Management (Myers 1989), and adapted to conditions and management needs of the Refuge. Initial work consisted of description of watersheds, reaches, complexes, stream types, and riparian vegetation types on standard 7.5' scale maps developed by the U.S. Geological Survey. Evaluation forms were developed and methods field-tested.

Field surveys were conducted between June-October 1992. Each complex was walked in its entirety; riparian conditions were observed, described, and photographed; and Rosgen stream types were classified on the basis of estimates and measurements of stream channels and floodplain characteristics.

Plant communities associated with different stages of site progression, as defined by Leonard et al. (1992), were described and percentage composition was estimated (Collins et al. 1992). Consequently, we consulted available technical descriptions of riparian community types (Padgett 1981, Youngblood et al. 1985, Kovalchik 1987, Manning 1988, Evenden 1989, Padgett et al. 1989, Manning and Padgett 1990). These classifications appeared to suffice for >80% of riparian community types that occurred at Hart Mountain NAR. Communities not described in technical reports were preliminarily classified on the basis of criteria for species dominance reported by Youngblood et al. (1985). Undescribed types usually occurred in association with streams of lower elevations (i.e., Rock Creek); many were dominated by upland plant species that occurred on stream terraces of inactive floodplains. Field evaluation of occurrence and aerial extent of community types was used in part to describe and verify occurrence and dominance of vegetation types and progression stages within vegetation type reported in the FEIS.

After each complex was traversed and riparian characteristics were described, an observer evaluated resource condition of the complex. This evaluation was specifically developed to address information needs for the FEIS (Table D-1). Assessment of riparian condition involved evaluation of conditions described for 5 categories of information and selection of the rank value that best fit observed and expected riparian conditions described within categories. The standard of expected conditions was judged as the probable set of riparian conditions that would result during very late stages of site progression. Development of categories of information used in the rating was based on a synthesis of knowledge of the dynamics of riparian systems described in technical reports. Sources used to develop the condition rating included: Rosgen (1985), Van Havereen and Jackson (1985), and Myers (1985) for channel stability; Platts et al. (1987) and Myers (1985) for streambank erosion; Pfankuch (1975), Reed (1988), and Myers (1989) for streambank stability; Reed (1988) and Myers (1989) for water table status; and Busse (1989), Myers (1989), and Collins et al. (1992) for woody-riparian status. Assumptions associated with use of rating systems are addressed by Platts et al. (1987), Myers (1989), and Myers and Swanson (1991, 1992).

Results

A total of 3,867 acres was surveyed, representing about 95% of the area of stream-associated riparian zone and 57% of the area of riparian habitat of the Refuge (Table D-2). Within this area, potential dominant vegetation of valleys comprised sedge-rush-bluegrass (33%), quaking aspen (18%), willow (18%), mixed deciduous shrub (15%), bluegrass-ryegrass (14%), and other (2%) by percentage of stream-miles. Resource condition differed within and among riparian vegetation types (Table D-3). Low and moderate resource conditions were prevalent among all vegetation types, except mixed deciduous shrub. Low and moderate conditions comprised 72% of quaking aspen, 90% of willow, 79% of bluegrass-ryegrass, and 87% of sedge-rush-bluegrass, but only 39% of mixed deciduous shrub, by percentage of stream-miles.

Table D-1. Form for evaluation of riparian resource condition, Hart Mountain NAR, 1992[a].

Existing	Potential	CHANNEL STABILITY
1	1	More than 20% lateral channel movement and bank cutting; changing channels and severe scour evident; source of extreme sedimentation; major channel adjustments occurring; stage 2, 3, 4, 6, and 7 channels.
2	2	Frequent lateral channel movement (10-15%); moderate channel scour or channel change within streambed; major channel adjustments occurring; stage 2, 3, 4, 6 and 7 channels.
3	3	Some lateral channel movement and bank erosion (5-10%); minor channel scour or changing channel within streambed; evidence of recent erosion, but not major channel adjustments; stage 1, 5, and 8 channels.
4	4	None or negligible lateral channel movement, bank erosion (5% or less), scour, or changing channels; normal channel adjustments; stage 1, 5, and 8 channels.
		STREAMBANK EROSION
1	1	Soils exposed over more than 25% of streambank area.
2	2	Soils exposed over 16-25% of streambank area.
3	3	Soils exposed over 6-15% of streambank area.
4	4	Soils exposed over less than 5% of streambank area.
		STREAMBANK STABILITY
1	1	Streambank anchored by sagebrush and grass; bank comprised of fine-grained alluvial matter (e.g., sand-clay-silt).
2	2	Streambank anchored primarily by mixture of shallow-rooted grasses, rushes, or sedges; deep-rooted hydric plants infrequently observed; banks comprised of fine-grained alluvial matter.
3	3	Streambank anchored by (a) shallow-rooted grasses, rushes, or sedges <u>and</u> (b) deep-rooted hydric plants (sedges, willow, etc.) or coarse-grained alluvial matter (eg. cobbles, boulders).
4	4	Streambank anchored mainly by deep-rooted sedges, riparian shrubs-trees, or coarse-grained alluvial matter.
		WATER TABLE STATUS
1	1	Upland plants occupy >50% of valley bottom area.
2	2	Upland plants occupy 16-50% of valley bottom area.
3	3	Upland plants occupy 6-15% of valley bottom area.
4	4	Upland plants on valley bottom restricted to edges, if present at all.
		WOODY-RIPARIAN STATUS
1	1	Woody-riparian vegetation absent.
2	2	Scattered old riparian shrubs-trees; young plants infrequently seen.
3	3	Frequent occurrence of old and young riparian shrub-tree stands.
4	4	Riparian shrubs-trees form continuous corridor along channel.
Sum ____	____	

[a] Evaluation based on selecting appropriate rank for each rating category. Ranks were then summed by column and relative condition was calculated by dividing the sum of existing ranks by the sum of potential ranks. On a scale of 1-100, condition was graded as follows: <70 (low); 70-84 (moderate); 85-94 (high); and >95 (very high).

Table D-2. Characteristics of principle riparian systems of Hart Mountain NAR.

Stream	Watershed (acres)	Valley riparian (acres)	Valley riparian (miles)	Valley units (no.)[a]
Rock Creek	79,254	1,641	60	65
Guano Creek	21,887	1,848	23	47
Deer Creek	13,717	35	3	6
Warner Creek	7,219	230	4	8
Degarmo Creek	3,924	57	7	9
Hart Creek	2,147	17	4	5
Potter Creek	1,178	17	3	7
Juniper Creek	836	12	2	5
Cooper Creek	546	10	1	4
Total	130,708	3,867	107	156

[a] Synonymous with riparian complexes.

Table D-3. Percentage miles of resource condition classes of riparian vegetation types, Hart Mountain NAR.

	Resource condition			
Vegetation type	Low	Moderate	High	Very high
Quaking aspen	41	31	17	11
Mixed deciduous shrub	19	20	11	52
Willow	58	32	4	6
Bluegrass-ryegrass	50	29	13	8
Sedge-rush-bluegrass	78	9	13	0
Other types	82	0	0	18
Total	50	25	11	14

APPENDIX E
BOTANICAL RESOURCES OF HART MOUNTAIN NAR

Botanical resources of the Refuge were evaluated. The evaluation consisted review of Refuge records of plant occurrence; review of rare, threatened, and endangered species listed in the Oregon Natural Heritage Program database (ONHP 1993); review of a 1991 plant resource survey done by The Nature Conservancy; and development and analysis of summary information for use in the EIS.

Records of species occurrence were reviewed and lists of occurrence and status were developed for all records collected before 1994. The list was based on a compilation of (1) plant species found in the herbarium at Hart Mountain Refuge Headquarters and (2) sight and photo records of plant species described in various surveys and studies done by Refuge staff and cooperating individuals and organizations. This information was then logged into a computer database. Species listed in the database were assigned codes to describe the source of identification (herbarium specimen vs. sight record) and the likelihood of correct identification (professional botanist vs. graduate student). Hickman (1993) was reviewed to ascertain which species were subject to changes in taxonomic nomenclature. The list of plants (Table E-2) was modified during development of the FEIS to include recent changes in taxonomic nomenclature described by Hickman (1993). Table E-3 cross-references scientific names subject to changes in nomenclature (Hickman 1993).

Results revealed that a total of 499 plant species of 58 families are known to occur on the Refuge (Tables E-1, E-2). Forbs and graminoids (i.e., grasses, rushes, and sedges) dominate floral diversity and collectively compose 76% of species. Although a variety of plant families occur on the Refuge, 49% of species occur in 6 families including Asteraceae, Poaceae, Fabaceae, Scrophulariaceae, Cyperaceae, and Polygonaceae. As to accuracy of identification, 390 records were considered accurate, 85 records were considered moderately accurate, and 24 records were considered marginally accurate. More than 350 of the 499 species that occur on the Refuge are found in the herbarium at Refuge Headquarters.

A total of 8 species of plants found on the Refuge are listed as rare (i.e., small population size and limited distribution), threatened, or endangered by the Oregon Natural Heritage Program (ONHP 1993) (Table E-4). None of the 8 species are listed as threatened or endangered by federal or state standards nor are they under consideration for such a listing. However, these species warrant tracking by management because: (1) they are naturally rare on a local and regional level; (2) they are vulnerable to disturbance associated with some land-use practices because of their rarity; and (3) their status is not fully understood, however, they are believed to be rare and declining in abundance and distribution because of changes in land-use practices (ONHP 1993). Sites with rare plants were mapped, population size was estimated, and threats to persistence were listed in a survey done of Hart Mountain NAR by The Nature Conservancy in 1991. Prostrate buckwheat was the only species found to be threatened by land-use practices on the Refuge. A rock barricade was consequently erected during 1992 to protect the small population of prostrate buckwheat from mechanical damage caused by vehicles in a vehicle turn-out.

A total of 30 non-native, introduced species were found (Table E-5). Most of these non-natives are not considered a threat to native plants because many have occurred on the Refuge for more than 30 years and none apparently dominate sites where soils are temporarily disturbed. On the other hand, cheatgrass, whitetop, and mediterranean sage are considered noxious weeds that warrant special attention in terms of planning of prescribed burning actions and weed control activities. Refer to Append J, Part I, for discussion the influence of disturbance on interactions between non-native and native species.

A Research Natural Area is "a site where natural features are preserved for scientific purposes and natural processes are allowed to dominate." (Greene and Copeland 1984). The purpose of such sites, which are located exclusively on federal land, is to foster education and scientific research of ecosystem components, such as wildlife communities, and natural processes, such as nutrient cycling. At Hart Mountain NAR, the Poker Jim Research Natural Area (PJRNA) was established in 1972. Location and general site characteristics are described by Greene and Copeland (1984). As with other RNAs, the Poker Jim RNA was established based on the occurrence and distribution of certain natural elements (plant communities characteristic of juniper savannah in the PJRNA), that are considered representative for the region and exist in a relatively undisturbed, natural condition (Greene and Copeland 1984).

Three new sites, Cooper Canyon, Desert Lake, and Warner Creek would be studied for potential RNA designation and the PJRNA would be expanded under Alternative D of the EIS. Preliminary study of these sites indicates that each harbors terrestrial plant communities and aquatic systems that are unrepresented or poorly represented in the RNA program in Oregon (Table E-6) (Vander Schaaf 1992, NHAC 1993, Refuge Files). The delineation of boundaries of each proposed RNA and the modification to the boundary of the PJRNA was based on (1) the need to include sufficient area to represent communities and facilitate ecosystem functions required to maintain communities; and (2) correspondence with natural landscape boundaries such as watershed boundaries where feasible. Upon implementation of Alternative D, biological resources of each proposed RNA would be inventoried, site geographic characteristics would be described, potential management needs would be identified, and a report would be developed that describes RNA resources and evaluates the utility of RNA designation. Provided that an proposed RNA met the sufficiency criteria described in the Refuge Manual (USFWS 1982) and the Natural Heritage Plan (NHAC 1993), the process of official authorization of the RNA would be initiated and completed.

Table E-1. Summary of information on status of plant species of Hart Mountain NAR.

Lifeform	Native[a] species	Introduced species	Total species
Ferns	2	0	2
Forbs	333	17	330
Grasses	46	11	57
Rushes	4	0	5
Sedges	23	0	23
Shrubs	49	0	54
Trees	6	0	6
Vines	2	0	2
Total	471	28	499

[a] Species known to occur except ornamentals and fruit trees. Complete inventory would probably yeild 600-700 native species on Refuge.

Table E-2. List of vascular plant species of Hart Mountain NAR, and their scientific names[a].

Lifeform, family, and scientific name	Common name
Ferns	
Polypodiaceae	
Cystopteris fragilis	Brittle bladder-fern
Woodsia oregana	Woodsia
Forbs	
Alismataceae (Water-plantain)	
Machaerocarpus californicus	Fringed water plantain
Apiaceae (Parsley)	
Cicuta douglasii	Western water hemlock
Ligusticum grayi	Gray's licorice-root
Lomatium cous	Cous' biscuit-root
L. bicolor	Slender-fruit lomatium
L. donnellii	Donnell's lomatium
L. foeniculaceum	Fennel-leaved desert-parsley
L. hendersonii	Henderson's lomatium
L. macrocarpum	Large-fruit lomatium
L. nevadense	Nevada desert-parsley
L. triternatum	Nine-leaf lomatium
L. vaginatum	Broadsheath lomatium
Osmorhiza chilensis	Mountain sweet-cicely
Perideridia gairdneri	Gairdner's yampah
Sphenosciadium capitellatum	Woolly-head parsnip
Asclepiadaceae (Milkweed)	
Asclepias speciosa	Showy milkweed
Asteraceae (Aster)	
Achillea millefolium	Yarrow
Agoseris aurantiaca	Orange agoseris
A. glauca	Mountain dandelion
A. grandiflora	Large-flowered agoseris
A. heterophylla	Annual agoseris
Antennaria dimorpha	Low pussy-toes
A. luzuloides	Woodrush pussy-toes
A. rosea	Rosy pussy-toes
Arnica amplexicaulis	Streambank arnica
Arnica chamissonis	Leafy arnica
A. cordifolia	Heart-leaved arnica
A. fulgens	Showy arnica
A. longifolia	Seep-spring arnica
A. sororia	Twin arnica
A. dracunculus	Tarragon
A. ludoviciana	Louisiana sagebrush
Aster foliaceus	Leafy aster
A. occidentalis	Western aster
A. scopulorum	Lava aster
Balsamorhiza hirsuta	Hairy balsamroot
B. hookeri	Hooker's balsamroot

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
B. sagittata	Arrowleaf balsamroot
B. serrata	Serrate balsamroot
Blepharipappus scaber	Blepharipappus
Chaenactis douglasii	Hoary false-yarrow
Cirsium arvense	Canada thistle
C. utahense	Utah thistle
C. vulgare	Bull thistle
Crepis acuminata	Tapertip hawksbeard
C. atrabarba	Slender hawksbeard
C. bakeri	Baker's hawksbeard
C. modocensis	Siskiyou hawksbeard
C. occidentalis	Western hawksbeard
Dimeresia howellii	Dimeresia
Eatonella nivea	White eatonella
Erigeron austiniae	Dwarf yellow fleabane
E. bloomeri	Scabland fleabane
E. chrysopsidis	Dwarf yellow fleabane
E. corymbosus	Long-leaf fleabane
E. divergens	Spreading fleabane
E. eatonii	Eaton's daisy
E. filifolius	Thread-leaf fleabane
E. linearis	Line-leafed fleabane
E. pumilus	Shaggy fleabane
Eriophyllum lanatum	Smally woolly eriophyllum
Eupatorium occidentale	Western eupatorium
Hieracium scouleri	Woolly-weed
Iva axillaris	Poverty weed
Lactuca serriola	Prickly lettuce
Layia glandulosa	Tidytips
Lygodesmia spinosa	Skeletonweed
Machaeranthera canescens	Hoary aster
Madia glomerata	Mountain tarweed
Microseris troximoides	False-agoseris
Psilocarphus brevissimus	Dwarf woolly-heads
Pyrrocoma carthamoides	Large-flowered pyrrocoma
P hirta	Sticky pyrrocoma
P. lanceolata	Lance-leaf pyrrocoma
Senecio canus	Woolly groundsel
S. hydrophilus	Giant senecio
S. hydrophiloides	Marsh butterweed
S. integerrimus	Western groundsel
S. serra	Butterweed groundsel
S. sphaerocephalus	Mountain marsh-butterweed
Solidago canadensis	Canada goldenrod
Stenotus acaulis	Stemless stenotus
Stenotus stenophyllus	Narrow-leaf stenotus
Stephenomaria tenuifolia	Narrow-leaved goldenweed
Taraxacum officinale	Common dandelion

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Tragopogon dubius	Yellow salsify
Trimorpha lonchophylla	Spearleaf trimorpha
Boraginaceae (Bluebell)	
Amsinckia tessellata	Tessalate fiddleneck
Cryptantha ambigua	Obscure cryptantha
C. intermedia	Common cryptantha
C. torreyana	Torrey's cryptantha
C. watsonii	Watson's cryptantha
Hackelia micrantha	Blue stickseed
Heliotropium curassavicum	Heliotrope
Lappula redowskii	Western stickseed
Lithospermum ruderale	Western gromwell
Mertensia longiflora	Small bluebells
M. oblongifolia	Leafy bluebells
M. viridis	Green bluebells
Plagiobothrys scouleri	Scouler's popcorn-flower
Porterella carnosula	Porterella
Brassicaceae (Mustard)	
Arabis holboellii	Holboell's rockcress
A. nuttallii	Nuttall's rockcress
A. sparsiflora	Elegant rockcress
Barbarea vulgaris	Bitter wintercress
Camelina microcarpa	Littelpod falseflax
Cardaria draba	Hoary pepperwort
Descurainia richardsonii	Mountain tansymustard
D. sophia	Flixweed
Erysimum repandum	Spreading wallflower
Lepidium perfoliatum	Clasping pepperweed
Lesquerella occidentalis	Western bladderpod
Phoenicaulis cheiranthoides	Daggerpod
Polyctenium fremontii	Desert combleaf
Rorippa sinuata	Spreading yellowcress
Sisymbrium altissimum	Tumble-mustard
Smelowskia fremontii	Fremont's smelowskia
Campanulaceae (Harebell)	
Downingia elegans	Common downingia
D. laeta	Great Basin downigia
D. yina	Cascade downingia
Capparidaceae (Caper)	
Cleome platycarpa	Golden spiderflower
Caryophyllaceae (Pink)	
Arenaria aculeata	Prickly sandwort
A. congesta	Capitate sandwort
A. kingii	King's sandwort
Silene douglassi	Douglas' silene
Silene menziesii	Menzies' silene
S. scaposa	Scapose silene
Stellaria calycantha	Northern starwort

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Stellaria longipes	Longstalk starwort
Chenepodiaceae (Goosefoot)	
Chenopodium album	White lambsquarter
C. fremontii	Fremont's goosefoot
C. leptophyllum	Slimleaf goosefoot
Monolepsis nuttalliana	Patata
Salsola tragus	Russian thistle
Convulvulaceae (Morning-glory)	
Calystegia occidentalis	Pale morning-glory
Crassulaceae (Stonecrop)	
Sedum lanceolatum	Lance-leaved stonecrop
Fabaceae (Pea)	
Astragalus adsurgens	Standing milkvetch
A. agrestis	Field milkvetch
A. canadensis	Canada milkvetch
A. curvicarpus	Curvepod milkvetch
A. filipes	Basalt milkvetch
A. lentiginosus	Freckled milkvetch
A. malacus	Shaggy milkvetch
A. miser	Weedy milkvetch
A. obscurus	Arcane milkvetch
A. purshii	Pursh's milkvetch
A. whitneyi	Balloon milkvetch
Lupinus argenteus	Silvery lupine
L. brevicaulis	Sand lupine
L. latifolius	Broadleaf lupine
L. laxiflorus	Spurred lupine
L. lepidus	Prairie lupine
L. polyphyllus	Bigleaf lupine
L. pusillus	Rusty lupine
L. saxosus	Rock lupine
L. sericeus	Silky lupine
Melilotus officinalis	Yellow sweet-clover
Trifolium cyathiferum	Cup clover
T. eriocephalum	Woolly-head clover
T. gymnocarpon	Hollyleaf clover
T. longipes	Long-stalk clover
T. macrocephalum	Big-head clover
T. kingii	King's clover
T. variegatum	White-tip clover
T. wormskjoldii	Springbank clover
Vicia americana	American vetch
Gentianaceae (Gentian)	
Gentiana calycosa	Explorer's gentian
Gentianopsis simplex	One-flowered gentian
Swertia albicaulis	Shiny swertia
Geraniaceae (Geranium)	
Erodium circutarium	Filaree

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Geranium bicknellii	Bicknell's geranium
G. viscosissimum	Sticky purple geranium
Hydrophyllaceae (Waterleaf)	
Hesperochiron californicus	California hesperochiron
Hydrophyllum capitatum	Dwarf waterleaf
Phacelia hastata	Whiteleaf phacelia
P. heterophylla	Varileaf phacelia
P. linearis	Threadleaf phacelia
P. lutea	Yellow phacelia
P. ramosissima	Branched phacelia
P. sericea	Silky phacelia
Hypericaceae (St. John's Wort)	
Hypericum formosum	Western St. John's wort
Iridaceae (Iris)	
Iris missouriensis	Western blue flag
Sisyrinchium inflatum	Purple-eyed grass
Sisyrinchium angustifolium	Blue-eyed grass
Lamiaceae (Mint)	
Agastache urticifolia	Nettle-leaf horse-mint
Marrubium vulgare	Horehound
Mentha arvensis	Field mint
Salvia aethiopis	Mediterranean sage
Scutellaria nana	Dwarf skullcap
Lemnaceae (Duckweed)	
Lemna trisulca	Star duckweed
Liliaceae (Lily)	
Allium acuminatum	Hooker's onion
A. macrum	Rock onion
A. parvum	Dwarf onion
A. platycaule	Broad-stemmed onion
A. tolmiei	Tolmei's onion
Calochortus macrocarpus	Sagebrush mariposa
Camassia quamash	Common camas
Fritillaria atropurpurea	Chocolate lily
F. pudica	Yellow bell
Leucocrinum montanum	Sand lily
Smilacina racemosa	False solomon's seal
S. stellata	Star-flowered solomon's seal
Triteleia hyacinthina	Hyacinth triteleia
Veratrum californicum	California false hellebore
Zigadenus paniculatus	Panicled death camas
Z. venenosus	Meadow death camas
Linaceae (Flax)	
Linum perenne	Wild blue flax
Loasaceae (Blazing-star)	
Mentzelia albicaulis	White-stemmed mentzelia
M. laevicaulis	Blazing-star mentzelia

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Malvaceae (Mallow)	
Sidalcea oregana	Oregon checker-mallow
Marsilaceae (Pepperwort)	
Marsilea vestita	Pepperwort
Onagraceae (Evening-primrose)	
Camissonia andina	Obscure sun cup
C. boothii	Booth's sun cup
C. contorta	Contorted-pod sun cup
C. tanacetifolia	Tansyleaf sun cup
Clarkia rhomboidea	Common clarkia
Epilobium brachycarpum	Autumn willow-herb
E. ciliatum	Watson's willow-herb
E. glaberrimum	Smooth willow-herb
E. minutum	Small-flowered willow-herb
Epilobium stricta	Brook willow-herb
Gayophytum decipiens	Deceptive groundsmoke
G. diffusum	Spreading groundsmoke
G. racemosum	Racemed groundsmoke
G. ramosissimum	Hairstem groundsmoke
Oenothera breviflora	Short-flowered evening-primrose
O. caespitosa	Desert evening-primrose
O. flava	Long-tubed evening-primrose
Orchidaceae (Orchid)	
Cypripedium montanum	Mountain lady's-slipper
Corallorhiza maculata	Spotted coral-root
Piperia unalascensis	Alaska rein-orchid
Platanthera leucostachys	White bog orchid
Orobanchaceae (Broomrape)	
Orobanche corymbosa	Flat-topped broomrape
O. fasiciculata	Clustered broomrape
Paeoniaceae (Peony)	
Paeonia brownii	Brown's peony
Papaveraceae (Poppy)	
Canbya aurea	Golden canbya
Polemoniaceae (Phlox)	
Collomia grandiflora	Large-flowered collomia
C. linearis	Narrow-leaf collomia
C. tinctoria	Yellow-staining collomia
Eriastrum sparsiflorum	Eriastrum
Gilia leptomeria	Great Basin gilia
G. sinuata	Sinuate gilia
G. tenerrima	Delicate gilia
Ipomopsis aggregata	Scarlet gilia
I. congesta	Ballhead gilia
Linanthus harknessii	Harkness' linanthus
Navarretia breweri	Yellow-flowered navarretia
N. intertexta	Needle-leaf navarretia
Phlox diffusa	Spreading phlox

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
P. gracilis	Annual phlox
P. hoodii	Hood's phlox
P. longifolia	Long-leaf phlox
P. muscoides	Moss phlox
Polemonium micranthum	Annual polemonium
Polygonaceae (Buckwheat)	
Eriogonum caespitosum	Mat buckwheat
E. douglasii	Douglas' buckwheat
E. elatum	Tall buckwheat
E. heracleoides	Wyeth's buckwheat
E. niveum	Snow buckwheat
E. ovalifolium	Cushion buckwheat
E. prociduum	Prostrate buckwheat
E. sphaerocephalum	Rock buckwheat
E. strictum	Strict buckwheat
E. umbellatum	Sulfur buckwheat
E. vimineum	Broom buckwheat
Polygonum aviculare	Prostrate knotweed
P. bistortoides	American bistort
P. douglasii	Douglas' knotweed
P. kelloggii	Kellogg's knotweed
P. parryi	Parry's knotweed
Rumex conglomeratus	Clustered dock
R. crispus	Curly dock
R. cuneifolius	Wedgeleaf dock
R. maritimus	Seaside dock
R. occidentalis	Western dock
R. salicifolius	Willow dock
Portulacaceae (Purslane)	
Claytonia perfoliata	Miner's lettuce
Lewisia rediviva	Bitterroot
Montia chamissoi	Chamisso's montia
M. fontana	Water chickweed
M. linearis	Narrow-leaved montia
Potamogetonaceae (Pondweed)	
Potamogeton filiformis	Slender-leaved potamogeton
P. pectinatus	Fennel-leaved potamogeton
P. richardsonii	Richardson's potamogeton
Primulaceae (Primrose)	
Dodecatheon conjugens	Desert shooting star
Ranunculaceae (Buttercup)	
Aconitum columbianum	Monkshood
Aquilegia formosa	Crimson columbine
Delphinium andersonii	Desert larkspur
D. nuttallianum	Little larkspur
Ranunculus alismaefolius	Water-plantain buttercup
R. aquatilis	White water-buttercup
R. cymbalaria	Shore buttercup

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
R. glaberrimus	Sagebrush buttercup
R. testiculatus	Hornseed buttercup
Rosaceae (Rose)	
Geum macrophyllum	Largeleaved avens
G. triflorum	Prairiesmoke avens
Horkelia fusca	Tawny horkelia
Potentilla arguta	Tall cinquefoil
P. biennis	Biennial cinquefoil
P. diversifolia	Diverse-leaved cinquefoil
P. glandulosa	Dwarf western cinquefoil
P. gracilis	Slender cinquefoil
Rubiaceae (Madder)	
Galium aparine	Cleavers
G. multiflorum	Shrubby bedstraw
Kelloggia galioides	Kelloggia
Saxifragaceae (Saxifrage)	
Heuchera grossulariifolia	Gooseberryleaved alumroot
H. parviflora	Common alumroot
H. rubescens	Alumroot
Lithophragma bulbifera	Bulbiferous fringecup
L. parviflora	Smallflower fringecup
Saxifraga oregana	Bog saxifrage
S. rhomboidea	Diamondleaf saxifrage
Scrophulariaceae (Figwort)	
Castilleja angustifolia	Northwest paintbrush
C. applegatei	Applegate's paintbrush
C. hispida	Harsh paintbrush
C. linariaefolia	Narrow-leaved paintbrush
C. pilosa	Hairy paintbrush
C. thompsonii	Thompson's paintbrush
Collinsia parviflora	Small-flowered blue-eyed mary
Limosella aquatica	Mudwort
Mimetanthe pilosa	Downy monkey-flower
Mimulus guttatus	Yellow monkey-flower
M. nanus	Dwarf monkey-flower
M. primuloides	Primrose monkey-flower
M. suksdorfii	Suksdorf's monkey-flower
Orthocarpus imbricatus	Mountain owl-clover
O. luteus	Yellow owl-clover
Penstemon deustus	Hot rock penstemon
P. gairdneri	Gairdner's penstemon
P. humilis	Lowly penstemon
P. laetus	Gay penstemon
P. procerus	Tiny-bloom penstemon
P. rydbergii	Rydberg's penstemon
P. speciosus	Showy penstemon
Scrophularia lanceolata	Lance-leaf figwort
Verbascum thapsus	Common mullein

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Veronica americana	American brooklime
V. peregrina	Purslane speedwell
V. persica	Persian speedwell
Solanaceae (Nightshade)	
Nicotiana attenuata	Coyote tobacco
Typhaceae (Cattail)	
Typha latifolia	Common cattail
Urticaceae (Nettle)	
Urtica dioica	Stinging nettle
Valerianaceae (Valerian)	
Plectritis macrocera	Long-horn plectritis
Violaceae (Violet)	
Viola adunca	Early blue violet
V. beckwithii	Beckwith's violet
V. nuttallii	Nuttall's violet
V. purpurea	Goosefoot violet
V. sororia	Northern bog violet
V. trinervata	Sagebrush violet
Grasses	
Poaceae	
Achnatherum hymenoides	Indian ricegrass
A. lemmonii	Lemmon's needlegrass
A. thurberianum	Thurber's needlegrass
A. webberi	Webber's ricegrass
A. cristatum	Crested wheatgrass
Agrostis exarata	Spike bentgrass
A. interrupta	Interrupted bentgrass
A. oregonensis	Oregon bentgrass
A. scabra	Winter bentgrass
A. stolonifera	Redtop
Alopecurus aequalis	Little meadow-foxtail
Beckmannia syzigachne	Sloughgrass
Bromus carinatus	Mountain brome
B. inermis	Smooth brome
B. tectorum	Cheatgrass
Calamagrostis canadensis	Bluejoint reedgrass
Dactylus glomerata	Orchard-grass
Danthonia califonica	California oatgrass
Deschampsia cespitosa	Tufted hairgrass
D. elongata	Slender hairgrass
Distichlis stricta	Alkali saltgrass
Elymus glaucus	Blue wildrye
E. elymoides	Squirreltail
E. lanceolatus	Thickspike wheatgrass
E. multisetus	Big squirreltail
E. trachycaulus	Slender wheatgrass
Festuca idahoensis	Idaho fescue

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
F. scabrella	Rough rescue
Glyceria elata	Tall mannagrass
G. striata	Fowl mannagrass
Hesperochloa kingii	Spike fescue
Hesperostipa comata	Needle-and-thread
Hordeum brachyantherum	Meadow barley
H. depressum	Low barley
H. jubatum	Foxtail barley
Koeleria macrantha	Prairie junegrass
Leymus cinereus	Basin wildrye
L. triticoides	Creeping wildrye
Melica bulbosa	Oniongrass
M. fugax	Little oniongrass
M. stricta	Nodding melic
Muhlenbergia richardsonis	Mat muhly
Pascopyrum smithii	Smith's wheatgrass
Phalaris arundinacea	Reed canarygrass
Phleum alpinum	Alpine timothy
P. pratense	Timothy
P. annua	Annual bluegrass
P. bulbosa	Bulbous bluegrass
P. cusickii	Cusick's bluegrass
P. leibergii	Leiberg's bluegrass
P. pratensis	Kentucky bluegrass
P. secunda	One-sided bluegrass
P. wheeleri	Wheeler's bluegrass
Polypogon monspeliensis	Rabbitfoot polypogon
Pseudoroegneria spicatum	Bluebunch wheatgrass
Puccinellia nuttaliana	Nuttall's alkaligrass
Torreyochloa pallida	Weak mannagrass
Rushes	
Juncaceae	
Juncus balticus	Baltic rush
J. bufonius	Toad rush
J. ensifolius	Dagger-leaf rush
J. longistylis	Long-styled rush
J. nevadensis	Nevada rush
Sedges	
Cyperaceae	
Carex aquatilis	Aquatic sedge
C. athrostochya	Slenderbeaked sedge
C. deweyana	Dewey's sedge
C. douglasii	Douglas' sedge
C. hoodii	Hood's sedge
C. lanuginosa	Woolly sedge
C. lasiocarpa	Slender sedge

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
C. leporina	Hare sedge
C. limnophila	Pond sedge
C. microptera	Small-winged sedge
C. nebrascensis	Nebraska sedge
C. petasata	Liddon's sedge
C. praegracilis	Clustered field sedge
C. rossii	Ross' sedge
C. rostrata	Beaked sedge
C. scopulorum	Holm's Rocky Mountain sedge
C. simulata	Short-beaked sedge
C. vallicola	Valley sedge
Eleocharis macrostachya	Creeping spikerush
E. pauciflora	Few-flowered spikerush
Scirpus acutus	Hardstem bulrush
S. cernuus	Low clubrush
S. microcarpus	Small-fruited bulrush
Shrubs	
Asteraceae (Aster)	
Artemisia arbuscula	Low sagebrush
A. cana	Silver sagebrush
A. longiloba	Early low sagebrush
A. nova	Black sagebrush
A. spinescens	Bud sagebrush
A. tridentata	Big sagebrush
Chrysothamnus humilis	Truckee green rabbitbrush
C. nauseosus	Gray rabbitbrush
C. viscidiflorus	Green rabbitbrush
Ericameria suffruticosa	
Tetradymia canescens	Gray horsebrush
T. glabrata	Littleleaf horsebrush
T. spinosa	Spiny horsebrush
Berberidaceae (Barberry)	
Berberis aquifolium	Creeping Oregongrape
Betulacaeae (Birch)	
Betula occidentalis	Water birch
Caprifoliaceae (Honeysuckle)	
Sambucus mexicana	Blue elderberry
Symphoricarpos longiflorus	Long-flowered snowberry
S. oreophilus	Mountain snowberry
Chenepodiaceae (Goosefoot)	
Atriplex confertifolia	Shadscale
A. nuttallii	Saltsage
Grayia spinosa	Spiny hopsage
Krascheninnikovia lanata	Winterfat
Sarcobatus vermiculatus	Black greasewood
Cornaceae (Dogwood)	
Cornus sericea	Creek dogwood

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Cupressaceae (Cypress)	
Juniper communis	Common juniper
Grossulariaceae (Currant)	
Ribes aureum	Golden currant
R. cereum	Squaw currant
R. hudsonianum	Stinking currant
R. inerme	Whitestem gooseberry
R. lacustre	Prickly currant
R. montigenum	Mountain gooseberry
R. viscosissimum	Sticky currant
Lamiaceae (Mint)	
Monardella odoratissima	Monardella
Polemoniaceae (Phlox)	
Leptodactylon pungens	Prickly phlox
Polygonaceae (Buckwheat)	
Eriogonum microthecum	Slenderbush buckwheat
Ranunculaceae (Buttercup)	
Actaea rubra	Baneberry
Rhamnaceae (Buckthorn)	
Ceanothus velutinus	Snowbrush ceonothus
Rosaceae (Rose)	
Amelanchier alnifolia	Western serviceberry
Cercocarpus ledifolius	Curl-leaf mountain mahogany
Chamaebatiaria millefolium	Desert sweet
Holodiscus dumosus	Gland ocean-spray
Potentilla fruticosa	Shrubby cinquefoil
Prunus emarginata	Bittercherry
P. virginiana	Common chokecherry
Purshia tridentata	Antelope bitterbrush
Rosa woodsii	Wood's rose
Salicaceae (Willow)	
Salix bebbiana	Bebb's willow
S. boothii	Booth's willow
S. exigua	Coyote willow
S. geyeriana	Geyer's willow
S. lasiandra	Pacific willow
S. lasiolepis	Arroyo willow
S. lemmonii	Lemmon's willow
S. scouleriana	Scouler's willow
Trees	
Betulacaeae (Birch)	
Alnus incana	Mountain alder
Cupressaceae (Cypress)	
J. occidentalis	Western juniper
Pinaceae (Pine)	
Abies concolor	White fir
Pinus ponderosa	Ponderosa pine

Table E-2. (Continued)

Lifeform, family, and scientific name	Common name
Salicaceae (Willow)	
Populus tremuloides	Quaking aspen
P. balsamifera	Black cottonwood
Vines	
Ranunculaceae (Buttercup)	
Clematis ligusticifolia	Western clematis
Solanaceae (Nightshade)	
Chamaesaracha nana	Dwarf chamaesracha

Table E-3. Changes in scientific names of plants found in Table E-2.[a]

Family New scientific name (authority)	Old scientific name (authority)
Apiaceae	
Lomatium bicolor (S. Watson) J. Coulter & Rose	Lomatium leptocarpum (Torrey & A. Gray)
Asteraceae	
Achillea millefolium (L.)	Achillea lanulosa (Nutt.)
Antennaria rosea (E. Greene)	Antennaria microphylla (Rydb.)
Ericameria suffruticosa (Nutt.) G. Nesom	Haplopappus suffruticosus (Nutt.) Gray
Erigeron austiniae (E. Greene)	Erigeron chrysopsidis (A. Gray)
Pyrrocoma carthamoides (Hook.)	Haplopappus carthamoides (Hook.) A. Gray
Pyrrocoma hirta (Gray)	Haplopappus hirtus (Gray)
Senecio hydrophiloides (Rydb.)	Senecio foetidus (Howell)
Stenotus acaulis (Nutt.)	Haplopappus acualis (Nutt.) A. Gray
Stenotus stenophyllus (A. Gray) E. Greene	Haplopappus stenophyllus (A. Gray)
Trimorpha lonchophylla (Hook.) G. Nesom	Erigeron lonchophyllus (Hook.)
Berberidaceae	
Berberis aquifolium (Pursh)	Berberis repens (Lindley)
Caprifolieaceae	
Sambucus mexicana (C. Presl)	Sambucus caerulea (Raf.)
Chenopodiaceae	
Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smith	Eurotia lanata (Pursh) Moq.
Salsola tragus (L.)	Salsola kali (L.)
Convolvulaceae	
Calystegia occidentalis (A. Gray) Brummitt	Convolvulus polymorphus (E. Greene)
Cornaceae	
Cornus sericea (L.)	Cornus stolonifera (Michaux)
Cyperaceae	
Carex deweyana (Schwein.)	Carex leptopoda (Mackenzie)
Carex microptera (Mackenzie)	Carex festivella (Mackenzie)
Eleocharis macrostachya (Britton)	Eleocharis palustris (L.) Roemer & Schultes
Fabaceae	
Lupinus argenteus (Pursh)	Lupinus caudatus (Kellogg)
Lupinus lepidus (Douglas)	Lupinus lobbii (E. Greene)
Trifolium kingii (S. Watson)	Trifolium productum (E. Greene)
Gentianaceae	
Gentianopsis simplex (A. Gray) Iltis	Gentiana simplex (A. Gray)
Lilaceae	
Triteleia hyacinthina (Lindley) E. Greene	Brodiaea hyacinthina (Lindley) Baker
Onagraceae	
Epilobium brachycarpum (C. Presl)	Epilobium paniculatum (Torrey & A. Gray)
Epilobium ciliatum (Raf.)	Epilobium watsonii (Barbey) Jepson
Epilobium torreyi (S. Watson) P. Hoch & Raven	Boisduvalia stricta (A. Gray) E. Greene)
Camissonia andina	Oenathera andina (Nutt.)
Camissonia boothii (Douglas) Raven	Oenathera boothii (Douglas)
Camissonia tanacetifolia (Torrey & A. Gray) Raven	Oenathera tanacetifolia (Torrey & A. Gray)
Orchidaceae	
Platanthera leucostachys (Lindley)	Habenaria dilatata (Pursh) Hook.
Piperia unalascensis (Sprengel) Rydb.	Habenaria unalascensis (Sprengel) S. Watson
Poaceae	
Achnatherum hymenoides (Roemer & Schultes) Barkworth	Oryzopsis hymenoides (Roemer & Schultes) Ricker

Table E-3. (Continued)

Family New scientific name (authority)	Old scientific name (authority)
Achnatherum lemmonii (Vasey) Barkworth	Stipa columbiana (Macoun)
Achnatherum occidentalis (Thurber) Barkworth	Stipa occidentalis (Thurber)
Achnatherum thurberiana (Piper) Barkworth	Stipa thurberiana (Piper)
Achnatherum webberi (Thurb.) Barkworth	Oryzopsis webberi (Thurb.) Benth.
Bromus carinatus (Hook. & Arn.)	Bromus marginatus (Steudel)
Elymus elymoides (Raf.) Swezey	Sitanion hystrix (Nutt.) J.G. Smith
Elymus lanceolatus (Scribner & J.G. Smith) Gould	Agropyron caninum (L.) Beauv.
Elymus lanceolatus (Scribner & J.G. Smith) Gould	Agropyron dasystachyum (Hook.) Vasey
Elymus multisetus (J.G. Smith) Burtt Davy	Sitanion jubatum (J.G. Smith)
Elymus trachycaulus (Link) Shinn.	Agropyron trachycaulum (Link) Malte
Elytrigia repens (L.) Nevski	Agropyron repens (L.) Beauv.
Hesperostipa comata (Trin. & Rupr.) Barkworth	Stipa comata (Trin. & Rupr.)
Koeleria macrantha (Ledeb.) J.A. Schultes	Koeleria cristata (L.) Pers.
Leymus cinereus (C. Presl) A. Love	Elymus cinereus (Scribner & Merr.)
Leymus triticoides (Buckley) Pilger	Elymus triticoides (Buckley)
Pascopyrum smithii (Rydb.) A. Love	Agropyron smithii (Rydb.
Poa secunda (J. Presl)	Poa ampla (Merr.)
Poa secunda (J. Presl)	Poa canybi (Scribner) Howell
Poa secunda (J. Presl)	Poa juncifolia (Scribner)
Poa secunda (J. Presl)	Poa nevadensis (Scribner)
Poa secunda (J. Presl)	Poa sandbergii (Vasey)
Poa secunda (J. Presl)	Poa scabrella (Thurb.) Vasey
Pseudoroegneria spicata (Pursh) A. Love	Agropyron spicatum (Pursh) Scribner
Torreyochloa pallida (J. Presl) Church	Puccinellia pauciflora (J. Presl) Munz
Polemoniaceae	
Ipomopsis aggregata (Pursh) V. Grant	Gilia aggregata (Pursh) Spreng.
Ipomopsis congesta (Hook.) V. Grant	Gilia congesta (Hook.)
Phlox gracilis (E. Greene)	Microsteris gracilis (Hook.) V. Grant
Polygonaceae	
Rumex salicifolius (J.A. Weinm.)	Rumex triangulivalvis (Danser) Rech.
Portulacaceae	
Claytonia perfoliata (Donn)	Montia perfoliata (Donn) Howell
Ranunculaceae	
Delphinium andersonii (A. Gray)	Delphinium menziesii (D.C. Eaton)
Salicaceae	
Populus balsamifera (L.)	Populus trichocarpa (Torrey & A. Gray)
Urticaceae	
Urtica dioica (L.)	Urtica holosericea (Nutt.)
Violaceae	
Viola sororia (Willd.)	Viola nephrophylla (E. Greene)

[a] After Hickman (1993).

Table E-4. Sensitive plant species of Hart Mountain NAR.[a]

(1) Candidate for federal threatened and endangered status (ONHP list 1).

Prostrate buckwheat (*Eriogonum prociduum*)

(2) Threatened and endangered in Oregon; stable elsewhere (ONHP list 2).

Long-flowered snowberry (*Symphoricarpos longiflorus*)

(2) Review list; may qualify as threatened and endangered with more information (ONHP list 3).

Shiny frasera (*Frasera albicaulis*)
Thompson's paintbrush (*Castilleja thompsonii*)

(3) Species of concern (ONHP list 4).
Cypripedium montanum (*Mountain lady's-slipper*)
Great Basin downingia (*Downingia laeta*)
Nodding melic (*Melica stricta*)
Rock onion (*A. macrum*)

[a] Species known to occur at Hart Mountain NAR and listed in Oregon Natural Heritage Program database as sensitive (ONHP 1993).

Table E-5. Introduced plant species of Hart Mountain NAR.[a]

Scientific name (common name)	Comments
Grasses	
Agropyron trachycaulum (Bearded wheatgrass)	Locally common in large meadows and Shirk Ranch
A. cristatum (Crested wheatgrass)	Rare except for vicinity of Refuge Headquarters
Agrostis interrupta (Interrupted apera)	Collected from riparian meadow near Hot Springs Camp
A. stolonifera (Redtop)	Common where sedges have been displaced along mt. creeks
Bromus inermis (Smooth brome)	Locally common in large meadows and Shirk Ranch
B. tectorum (Cheatgrass)	Common where soil disturbed and native plants displaced
Dactylus glomerata (Orchard-grass)	Collected from riparian meadow near Hot Springs Camp
Phalaris arundinacea (Reed canarygrass)	Locally common in meadows and steep mountain creeks
Phleum pratense (Timothy)	Abundant in some large meadows and Shirk Ranch
Poa bulbosa (Bulbous bluegrass)	Along roads in riparian zones
P. pratensis (Kentucky bluegrass)	Abundant in meadow and aspen riparian > 5500'
Polypogon monspeliensis (Rabbitfoot polypogon)	Collected from vicinity of hot springs, Rock Creek
Forbs	
Barbarea vulgaris (Bitter wintercress)	No data available; probably along roads
Cardaria draba (Whitetop)	Along roads and in meadow around Refuge headquarters
Cirsium arvense (Canada thistle)	Disturbed wetland meadows
Descurainia sophia (Flixweed)	Along roads and in burns of low elevation
Erodium circutarium (Filaree)	Wyoming big sagebrush on west side of mountain
Erysimum repandum (Spreading wallflower)	Along roads and around headquarters
Lactuca serriola (Prickly lettuce)	Uncommon; in deep soils of low elevations
Lepidium perfoliatum (Clasping pepperweed)	Uncommon; along roads < 5800'
Marruvium vulgare (Horehound)	Uncommon but widespread; headquarters, Shirk Ranch, etc.
Melilotus officinalis (Yellow sweet-clover)	Rare; grade road; common in Warner Valley
Ranunculus testiculatus (Hornseed buttercup)	Locally abundant at refuge headquarters, similar sites
Salsoli iberica (Russian thistle)	Uncommon along roads of lower elevations (< 5500')
Salvia aethiopis (Mediterranean sage)	Common in Wy. big sagebrush; base of mt. (eg., CCC)
Sisymbrium altissimum (Tumbleweed)	Uncommon; roads and burns in Wyoming big sagebrush
Taraxacum officinale (Common dandelion)	Widespread and common in dry meadows
Tragopogon dubius (Yellow salsify)	Widespread and fairly common in dry meadows

Table E-6. Partial list of plant communities and ecosystem elements that occur in existing and proposed Research Natural Areas (RNA) of Hart Mountain NAR.

RNA, ecosystem type, community type[a] or ecosystem element (element no.)
Cooper Canyon
Riverine
First order stream, high gradient reach, sagebrush zone (1)
Mountain alder-Creek dogwood
Quaking Aspen/Creek dogwood
Quaking aspen/Scouler's willow
Water Birch/Salix spp.
Terrestrial
Low sagebrush/Idaho fescue
Mountain big sagebrush/Bluebunch wheatgrass
Mountain big sagebrush/Idaho fescue
Mountain big sagebrush/Western needlegrass
Wyoming big sagebrush/Bluebunch wheatgrass
Desert Lake
Palustrine
Creeping spikerush
Great Basin downingia
Leafy arnica
Silver sagebrush/Mat muhly (26)
Silver sagebrush/Nevada bluegrass (25)
Terrestrial
Low sagebrush/Bluebunch wheatgrass (20)
Low sagebrush/Sandberg's bluegrass (23)
Low sagebrush/Thurber's needlegrass (22)
Poker Jim
Terrestrial
Big sagebrush/Bluebunch wheatgrass
Low sagebrush/Bluebunch wheatgrass
Western juniper/Big sagebrush/Bunchgrass spp.
Western juniper/Low sagebrush/Bunchgrass spp.
Warner Creek
Forested (wetland)
Quaking aspen/Mesic forb
Quaking aspen/Blue wildrye (40)
Riparian community dominated by quaking aspen and Scouler's willow (39)
Palustrine
Baltic rush
Basin wildrye
Creeping spikerush
Cusick's bluegrass
Douglas' sedge
Kentucky bluegrass
Iris/Dry graminoid

Table E-6. (Continued)

RNA, ecosystem type, community type[a] or ecosystem element (element no.)
Leafy arnica
Mat muhly
Meadow barley
Nebraska sedge (21)
Nevada bluegrass
Saltgrass
Short-beaked sedge
Slender wheatgrass
Timothy
Woolly sedge
Riverine
Black cottonwood/Kentucky bluegrass
Creek dogwood
First order stream, high gradient reach, sagebrush zone, with willow (2)
Louisiana sage/Gravel bar
Quaking aspen/Mesic forb
Mesic forb meadow
Reed canarygrass
Salix spp.[b]/Mesic forb
Salix spp.[c]/Dry graminoid
Salix spp.[b]/Stinking currant
Salix spp.[b]/Bench
Salix spp.[b]/Creek dogwood
Stinking currant
Stinging nettle
Weak alkaligrass
Whitestem gooseberry
Terrestrial
Low sagebrush/Idaho fescue
Low sagebrush/Rough fescue-Idaho fescue (24)
Mountain big sagebrush/California brome
Mountain big sagebrush/Idaho fescue (18)
Mountain big sagebrush/Rough fescue
Mountain big sagebrush/Western needlegrass (14)
Mountain mahogany
Mountain mahogany/Idaho fescue (34)
Mountain mahogany/Mountain big sagebrush-bitterbrush (33)
Mountain mahogany/Mountain snowberry/Idaho fescue (35)
Mountain mahogany-Western juniper (29)
Shrubby cinquefoil
Snowbrush (38)
Western juniper/Idaho fescue
Western juniper/Mountain big sagebrush/California brome
Western juniper/Mountain big sagebrush/Idaho fescue (5)

Table E-6. (Continued)

Footnotes

[a] Community type defined as an "...astract grouping of all communities (stands) based on floristic and structural similarities in both overstory and undergrowth layers...Naming the community type follows the frequently used system of a binomial with the dominant overstory species separated from the dominant, most diagnostic indicator of the undergrowth union by a slash" (Padgett et al. 1989).
[b] Includes Bebb's willow, Lemmon's willow, Scouler's willow.
[c] Includes Lemmon's willow, Pacific willow.

APPENDIX F
INFLUENCE OF DIVERSITY WITHIN AND AMONG VEGETATION TYPES ON QUALITY OF WILDLIFE HABITAT

Many factors determine the quality of wildlife habitat at Hart Mountain NAR, including the occurrence, composition, distribution, and abundance of different vegetation types, and contrast within and among vegetation types and succession stages (Thomas 1979, Thomas et al. 1979b, Dealy et al. 1981).

HABITAT DIVERSITY AMONG SUCCESSION AND PROGRESSION STAGES OF VEGETATION TYPES

How vegetation types and succession stages are patterned on a landscape determines habitat diversity, which influences wildlife-habitat relationships, featured species, and species richness. For example, uplands comprised of a mosaic of vegetation types or succession stages within type usually provide a greater range of food and cover resources compared to areas comprised of a single vegetation type or succession stage (Leckenby et al. 1982). The purpose of this section is to describe methods and results from an analysis of habitat diversity, the relative amount of contrast within and among vegetation types, succession stages, and progression stages in an area.

Habitat diversity was evaluated with procedures developed by Patton (1992) and modified by Thomas et al. (1979b) for description and management of wildlife habitats in southeastern Oregon. A 3-step process was used to estimate indices of habitat diversity: (1) succession and progression stages of vegetation types were mapped for the entire Refuge at a 7.5′ scale; (2) edge distance was measured for succession and progression stages of vegetation types for one-hundred, 640-acre randomly selected polygons; and (3) observations were summarized, habitat diversity indices were estimated, and indices were averaged within and among geographic regions (Map F-1). Because geographic regions differed in size, total sample size used to estimate indices differed among geographic regions. Sample size was therefore related to the aerial extent of geographic regions.

Habitat diversity differed substantially among geographic regions of the Refuge (Table F-1). Change in total diversity among regions corresponded to changes in the occurrence and variety of vegetation types within region. For example, the desert region averaged fewer vegetation types (2) than the Intermediate Hills (6). Difference in inherent diversity are attributed to factors such as changes in elevation, temperature, annual precipitation, slope, and aspect, which influence the distribution of vegetation types (USSCS 1993). Induced diversity, the number of succession and progression stages, comprised a minor portion of total diversity compared to inherent diversity. Low induced diversity was attributed primarily to the absence of interspersion in succession stages of upland habitats, especially in desert and tableland regions, which collectively compose 60% of the Refuge land-base.

Historically fire was the principal factor that influenced induced and total diversity on the Refuge (Kauffman 1990, Morton 1993). Since Euro-American settlement, grazing by livestock and fire suppression increasingly influenced habitat diversity (Shinn 1978, Heady 1983, Kauffman 1990, Pyle 1991a). Induced diversity consequently increased in riparian wetlands as the number of progression stages increased (Gebhardt et al. 1989, Pyle and Brown 1991). Because riparian wetlands dominated by very late progression stages provide the most biologically productive habitat for the most wildlife species, increase in induced diversity probably reduced habitat available to wildlife associated with wetlands.

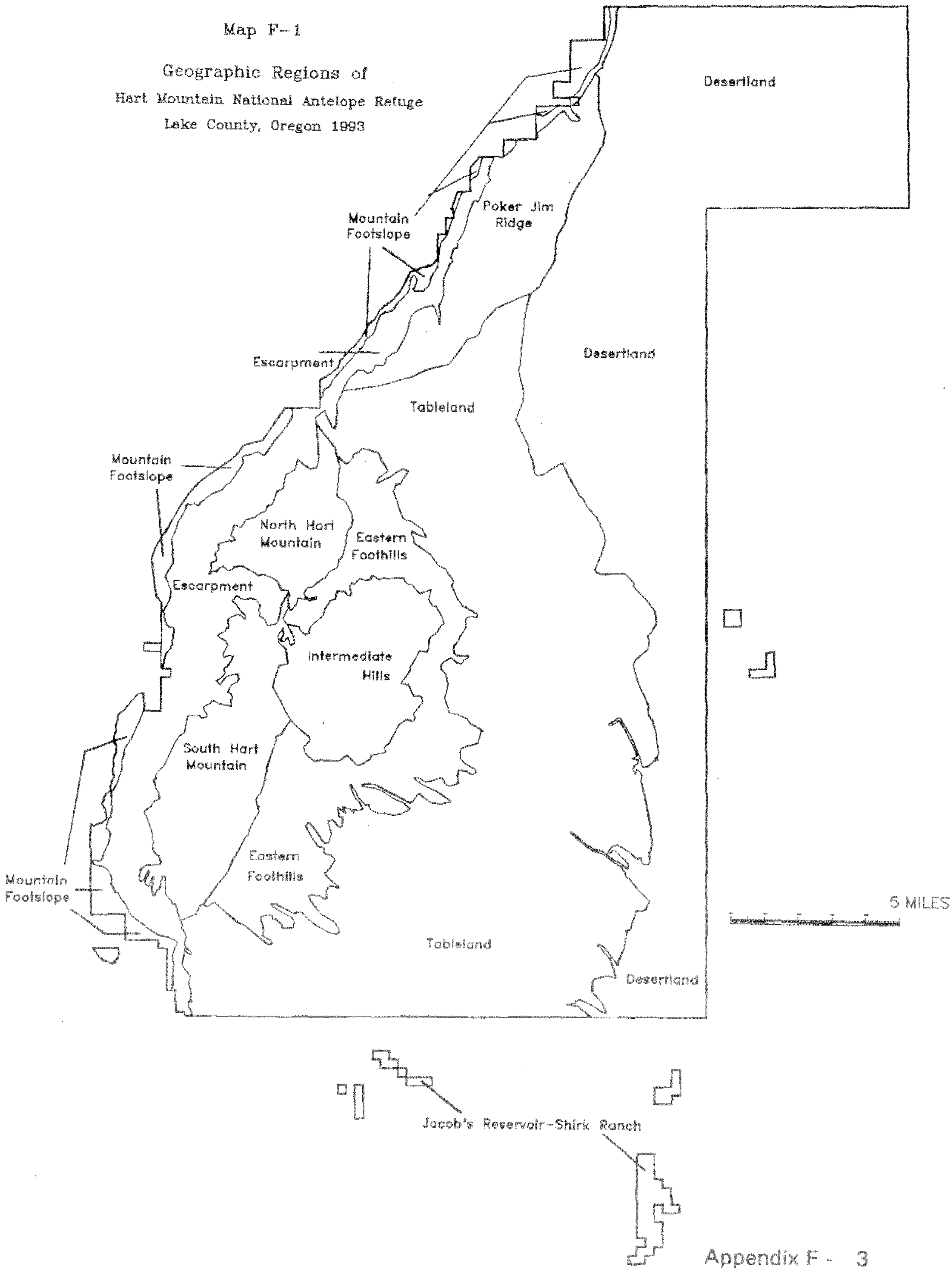
Historically, amount of induced diversity also was influenced by increase in aerial extent of shrub and tree-dominated stages of late and very late succession in uplands (Deming 1961b, Dealy et al. 1978, Winward 1991). Wildlife associated with shrub and tree-dominated landscapes apparently flourished, but wildlife associated with grassland-dominated landscapes probably diminished (Gruell 1986, see Appendix H for relationship of species to succession stages). Mosaics of succession stages in uplands collectively provide the most habitat for the greatest number of species (Thomas et al. 1979). In conclusion, factors that increase habitat diversity in uplands and reduce habitat diversity (to very late progression stages) in riparian wetlands would enhance most featured species and wildlife diversity.

Table F-1. Diversity indices for selected geographic regions of Hart Mountain NAR, 1992.

Geographic region	Sample size ($\underline{n}$)	Inherent diversity ($\bar{x}$)	Induced diversity ($\bar{x}$)	Total diversity ($\bar{x}$)	No. vegetation types ($\bar{x}$)	No. structural[a] stages ($\bar{x}$)
Desertland	29	33	8	41	2	2
Tableland	27	31	11	43	2	3
Desertland-Tableland	68	39	9	48	2	3
Poker Jim Ridge	6	59	36	95	3	4
Eastern foothills	15	141	34	175	5	6
Intermediate Hills	5	215	16	231	6	7
South Mountain-Escarpment	7	182	7	189	7	8
Hart Mountain[b]	12	159	24	183	6	7
Entire main Refuge	100	70	15	85	3	4

[a] Number of succession stages in uplands and progression stages in wetlands.

[b] Includes North Hart Mountain, South Hart Mountain, and the escarpment.


Map F-1
Geographic Regions of
Hart Mountain National Antelope Refuge
Lake County, Oregon 1993
Desertland
Poker Jim Ridge
Mountain Footslope
Desertland
Escarpment
Tableland
Mountain Footslope
North Hart Mountain
Eastern Foothills
Escarpment
Intermediate Hills
South Hart Mountain
Eastern Foothills
Mountain Footslope
5 MILES
Tableland
Desertland
Jacob's Reservoir-Shirk Ranch

HABITAT DIVERSITY WITHIN SUCCESSION AND PROGRESSION STAGES OF VEGETATION TYPES

Quality of food and cover influences productivity and occurrence of wildlife species within succession and progression stages of vegetation types. Quality of structure is influenced by many factors including livestock grazing, prescribed burning, and haying (Kirsch et al. 1978, Cornely et al. 1984, Starkey 1985, Bock et al. 1993). On the Refuge, livestock grazing and fire suppression are primary short-term and long-term influences on quality of cover within succession and progression stages (Pyle 1991a, 1991b, Pyle and Brown 1991, Morton 1993). Overgrazing during the early settlement period and fire suppression caused a long-term reduction in cover of herbaceous plants found in late succession Wyoming big sagebrush habitats of the Refuge (Rouse 1958, Deming 1961b, USSCS 1969, Pyle 1991a, DeLong 1993a). Despite the general absence of livestock use, cover of herbaceous plants has not increased because of sagebrush competition and fire suppression (Sneva et al. 1984, Kauffman 1990, Pyle 1991b, Winward 1991). Consequently, many late succession stands are in low ecological condition with respect to upland wildlife because of reduced food and cover availability (Deming 1961, Pyle 1991a, Crawford et al. 1992).

In wetlands, livestock grazing historically was the primary factor that influenced availability of food and cover within progression stages of vegetation types. Intensive, frequent livestock use can induce large-scale changes and cause riparian sites to progress from more to less biologically productive states (Thomas et al. 1979b, Kauffman and Krueger 1984, Gebhardt et al. 1989, Platts 1989, Leonard et al. 1992). Livestock use also can cause short-term alteration of habitat quality by reducing the amount, density, and height of annual growth and residual cover of herbaceous vegetation in riparian and emergent wetlands (Kirsch et al. 1978, Kauffman et al. 1982, Kauffman and Krueger 1984). At Hart Mountain NAR, site progression has been reported in riparian wetlands (Reiswig 1989, Pyle and Brown 1991) and short-term cover reductions have been reported in riparian and emergent wetlands (Refuge files, Reiswig 1989, Pyle 1990). For a review of wildlife associated with different stages of site progression in wetlands see Chapter 3 of Volume I of the DEIS (Affected Environment).

Changes associated with annual and residual cover have several influences on wildlife, in part, because many wildlife species tend to concentrate activities in and adjacent to riparian and emergent wetlands (Kirsch et al. 1978, Thomas et al. 1979c, Hanley and Page 1981, Cornely et al. 1983, Kauffman and Krueger 1984, Klebenow 1985, Evans 1986, Bock et al. 1993). Adverse effects on ducks were reported by Kirsch et al. (1978), who found that annual grazing and haying reduced productivity of dabblers that nested in and adjacent to emergent wetlands. Many authors reported adverse changes to small mammal communities, including declines in diversity and changes in composition associated with reduction in cover of herbaceous plants after haying and livestock grazing in riparian and emergent wetlands (Hanley and Page 1981, Kauffman et al. 1982, Cornely et al. 1983, Medin and Clary 1989). Klebenow (1985) and Evans (1986) suggested that use of riparian meadows by sage grouse was improved by increased forb availability after short-term, high-intensity use by livestock.

In summary, short and long-term effects of different cover manipulations differ among species associated with wetland habitats. At Hart Mountain NAR, livestock were the traditional means of cover manipulation in riparian and emergent wetlands (Rouse 1958, USFWS 1969, Anderson et al. 1990a). Adverse effects of livestock use predominate based on (1) evidence afforded by site progression in riparian vegetation types and (2) the consistent tendency of livestock to overuse herbaceous cover within progression stages of riparian and emergent wetlands (Refuge files, Reiswig 1989, Pyle and Brown 1991).

APPENDIX G

INFORMATION TABLES FOR FEATURED WILDLIFE SPECIES

Table G-1. Numbers of pronghorn seen during mid-summer surveys, and composition of population, Hart Mountain NAR, 1955-1993.

Year	Number Seen	Bucks/ 100 does	Fawns/ 100 does	Fawns/ 100 adults
1955	202	47	26	18
1956	133	50	72	48
1957	371	42	107	76
1958	470	21	70	58
1959	557	37	51	37
1960	421	46	50	34
1961	200	41	68	48
1962	337	40	64	46
1963	423	54	87	57
1964	359	45	66	45
1965	200	65	59	36
1966	412	39	30	22
1967	371	36	41	30
1968	340	33	22	17
1969	138	53	24	16
1970	314	49	46	31
1971	187	42	14	10
1972	316	20	42	35
1973	478	20	23	19
1974	283	29	23	18
1975	303	17	41	35
1976	812	31	77	59
1977	588	25	24	19
1978	427	12	14	12
1979	384	6	23	22
1980	711	36	13	10
1981	771	42	29	20
1982	613	31	20	15
1983	767	41	23	16
1984	699	46	34	23
1985	427	31	34	26
1986	435	30	55	42
1987	930	43	51	36
1988	1161	71	51	30
1989	1127	30	29	22
1990	1933	25	27	22
1991	1593	61	18	11
1992[a]	616	54	44	-
1993	1195	36	14	10

[a] Ground survey; total population not sampled.

Table G-2. Numbers of pronghorn seen during mid-winter, by geographic area, Sheldon-Hart Mountain Biological Unit, 1969-1993[a].

Year	Sheldon NWR	Sagehen	Hart Mt. NAR	West Beatty's Butte	Unit total
1969	1765	0	0	--	--
1970	1524	569	114	--	--
1971	1694	510	103	--	--
1972	1481	0	39	--	--
1973	825	721	90	--	--
1974	803	766	209	--	--
1975	1361	493	174	--	--
1976	568	630	346	--	--
1977	403	1121	422	--	--
1978	2015	0	358	--	--
1979	2800	0	270	--	--
1980	860	633	174	0	1667
1981	717	696	212	0	1625
1982[b]	1827	62	--	--	--
1983	1930	0	414	0	2344
1984	2374	158	534	0	3066
1985	2337	127	731	0	3195
1986	1524	878	668	0	3070
1987	1281	1196	913	0	2568
1988	2876	483	693	0	4052
1989	2390	1095	80	722	4287
1990	1137	1593	1683	309	4722
1991	337	1762	2111	258	4468
1992	408	1532	1538	652	4130
1993	1980	0	0	1548	3528

[a] Unit consisted of Sheldon NWR (Big Springs and Gooch Tables, Nevada) subunit, Sagehen subunit, Oregon, Hart Mountain NAR subunit, Oregon, and West Beatty's Butte subunit, Oregon. Areas not surveyed included western Sheldon NWR and the Massacre-Macy Lake subunit, Nevada. Winter surveys conducted by Oregon Department of Fish and Wildlife.

[b] Hart Mountain Biological Unit not surveyed.

Table G-3. Information on the annual rifle hunt of pronghorn bucks, Hart Mountain NAR, 1968-1993[a].

	Characteristic						
Year	Season duration	Total hunters	Total hours hunted	Total harvest	Hours/ hunter	Hunter success (%)	Green[b] score (in.)
1968	8/17-21	10	-	9	-	90	74 5/8
1969	8/16-20	16	-	15	-	94	70 3/8
1970	8/15-19	15	-	15	-	100	73
1971	8/14-18	14	-	11	-	79	69 4/8
1972	8/19-23	15	-	15	-	100	69 7/8
1973	8/18-22	16	-	13	-	81	68 4/8
1974	8/17-21	15	-	14	-	93	69 2/8
1975	8/16-20	15	350	11	23	73	68 5/8
1976	-	16	-	16	-	100	-
1977	-	15	-	15	-	100	74 2/8
1978	8/19-23	15	337	15	22	100	67 3/8
1979	8/18-22	14	222	13	16	93	70 3/8
1980	8/16-20	15	211	14	14	93	76 1/8
1981	8/15-19	18	176	18	10	100	72 2/8
1982	8/14-18	16	210	15	13	94	72 4/8
1983[c]	8/20-24	18	280	16	16	89	73 3/8
1984	8/18-23	17	400	15	24	88	73 3/8
1985	8/17-23	18	298	18	17	100	72 3/8
1986	8/16-22	20	621	17	31	85	72 2/8
1987	8/15-21	20	432	20	22	100	72 2/8
1988	8/20-26	20	352	20	18	100	71 2/8
1989	8/19-25	20	480	17	24	85	-
1990	8/18-24	20	358	17	18	85	-
1991	8/17-23	20	304	19	15	95	-
1992	8/15-21	19	438	18	23	95	-
1993	8/14-20	20	216	20	10	100	-

[a] Hunting became a legally established activity in 1968 on the refuge.

[b] Boone and Crockett green scores measured by refuge staff.

[c] Hunting was excluded from a circular zone (3 mile radius) around refuge headquarters after 1982.

Table G-4. Age, sex and ratios of California bighorn sheep on Hart Mountain NAR, Oregon. Counted by Refuge personnel and Oregon Dept. of Fish and Wildlife, 1954-1993.

Year	Rams	Ewes	Lambs	Unclass.	Total	Rams/ 100 ewes	Lambs/ 100 ewes
1954	4	16	-	-	20	25	-
1955	4	16	8	-	28	25	50
1956	8	17	11	-	36	47	65
1957	13	23	14	-	50	57	61
1958	8	13	6	27	54	62	46
1959	8	12	6	35	61	67	50
1960	19	15	7	28	69	127	47
1961	9	9	8	40	66	100	89
1962	11	25	12	14	62	44	48
1963	4	28	21	27	80	14	75
1964	15	30	19	14	78	50	63
1965	20	27	17	52	116	74	63
1966	26	52	16	7	101	50	31
1967	15	45	17	4	81	33	38
1968	27	22	11	28	88	123	50
1969	15	32	13	18	78	47	41
1970	23	15	8	13	59	153	53
1971	16	11	6	59	92	145	55
1972	13	18	5	23	59	72	28
1973	14	9	4	18	45	156	44
1974	12	22	9	95	138	55	41
1975	12	58	28	91	189	21	48
1976	47	45	23-44	-	115-136	104	51-98
1977	61	89	46	-	196	69	52
1978	20	18	9	33	80	111	50
1979	50	99	38	-	187	51	38
1980	73	136	56	-	265	54	41
1981	90	151	61	38	340	60	40
1982	125	201	39	13	365	66	21
1983	155	188	72	-	415	82	38
1984	84	161	64	-	309	52	40
1985	47	211	60	-	318	22	28
1986	87	159	59	-	305	55	37
1987	102	165	73	27	367	62	35
1988	101	107	54	40	302	94	50
1989	135	150	65	-	350	90	43
1990	109	147	54	-	410	74	37
1991	90	77	35	7	209	126	45
1992	133	118	31	-	282	113	26
1993	191	149	55	-	395	127	37

Notes for Table G-4

Highest and most accurate numbers used from surveys.

1954-1975: ODFW counts; no Refuge data.
1976: ODFW lamb count was 23. Kornet (1978) calculated 44 lambs from 32 yearlings she counted in June 1977 (1976 lambs) plus 12 lambs that were trapped and transplanted over the winter of 1976-77.
1977: Kornet count.
1978-1980: ODFW counts.
1981: Refuge count.
1982: ODFW count.
1983: Lamb numbers from Cottam (1984); remainder of count Refuge.
1984: Refuge count, yearlings lumped with ewes.
1985: ODFW, March count. Refuge data showed 44 yearlings that we lumped with ewes. The 74 lambs are not production for 1985, but over-winter survival for the 1984 lamb cohort. Lamb/ewe ratio calculated from 60 yearlings counted in March 1986, which were 1985 lambs.
1986-1987: ODFW, March count. Lamb numbers from Refuge summer count.
1988: ODFW and Refuge June count. Ewe numbers from March count.
1989: ODFW and Refuge summer count. Summary of two flight counts done on same day; highest numbers used; 16% difference between counts.
1990-1993: ODFW, March count.

Table G-5. Numbers by age and sex of California bighorn sheep removed from Hart Mountain NAR by hunting and trapping, 1960-1993.

	Hunt		Trapped/Transplanted				
	Tags	Harvest	Rams	Ewes	Lambs	Morts	Totals
1960	0	0	1	2	1	0	4
1961	0	0	4	3	0	0	7
1962	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0
1965	6	5	4	9	4	0	22
1966	3	3	0	0	0	0	3
1967	0	0	0	0	0	0	0
1968	3	1	2	3	3	0	9
1969	3	2	0	0	0	0	2
1970	6	5	0	0	0	0	5
1971	3	1	4	12	5	0	22
1972	5	4	0	0	0	0	4
1973	0	0	0	0	0	0	0
1974	5	1	0	1	1	0	3
1975	5	3	1	1	1	0	6
1976	8	5	2	5	11	0	23
1977	8	4	1	3	1	1	10
1978	8	7	2	8	4	2	23
1979	12	6	0	0	0	0	6
1980	8	7	1	5	3	1	17
1981	12	11	0	4	0	0	15
1982	12	12	0	0	0	0	12
1983	18	18	10	30	12	0	70
1984	18	17	3	17	1	0	38
1985	18	15	0	0	0	0	15
1986	16	16	1	1	0	1	19
1987	16	14	11	60	15	2	102
1988	12	12	7	29	7	2	57
1989	12	11	10	33	3	2	59
1990	12	11	6	33	9	3	62
1991	14	14	9	40	9	4	76
1992	14	14	10	37	13	1	75
1993	25	25	4	29	10	2	70
TOTALS	282	244	93	365	113	21	836

Table G-6. Numbers of mule deer seen during November surveys, and composition of population, Hart Mountain NAR, 1967-93.

Year	Number seen	Bucks/ 100 does	Fawns/ 100 does	Fawns/ 100 adults
1967	134	62	35	22
1968	186	23	32	26
1969	136	52	91	60
1970	155	23	76	61
1971	114	37	86	63
1972	159	31	84	64
1973				
1974	201	25	81	65
1975	169	28	88	69
1976	212	29	78	61
1977	211	21	64	53
1978	141	35	48	36
1979	319	33	51	39
1980	289	20	76	63
1981	204	27	75	59
1982	268	28	74	58
1983	329	25	96	77
1984	222	38	73	53
1985	203	20	45	37
1986	271	28	60	47
1987	478	22	69	56
1988	358	27	17	14
1989	465	22	43	35
1990	332	23	27	23
1991	261	28	24	19
1992	328	24	32	26
1993	308	27	35	27

Table G-7. Numbers of mule deer seen during March surveys, composition of fawns in the population, and winter mortality rate (%) of fawns, Hart Mountain NAR, 1967-1993.

	Adults seen		Fawns seen		Fawns/ 100 adults		
Year	Fall	Spring	Fall	Spring	Fall	Spring	Winter mortality
1970	85	24	51	26	60	108	
1971	96		59		61		
1972	70	47	44	35	63	74	
1973	97	43	62	33	64	77	
1974		51		29		57	
1975	122	39	79	21	65	54	17
1976	100	69	69	34	69	49	29
1977	132	98	80	71	61	72	
1978	138	94	73	49	53	52	2
1979	104		37		36		
1980	223	79	86	45	39	57	
1981	177	107	112	49	63	46	27
1982	128	122	76	69	59	57	3
1983	170	177	98	47	58	27	53
1984	186	83	143	53	77	64	17
1985	134	157	71	69	53	44	17
1986	148		55		37		
1987	184		87		47		
1988	306		172		56		
1989	307	168	42	14	14	8	43
1990	347	130	122	41	35	30	14
1991	220	242	41	35	19	14	26
1992	260	154	68	24	26	16	38
1993	242	124	66	39	27	31	

Table G-8. Productivity of sage grouse, Hart Mountain NAR, 1954-1993[1].

	Characteristic						
Year	Hens	Brood hens	Dry hens	Total chicks	Chicks/ hen	% Hens w/broods	Chicks/ brood
1954	165	101	64	515	3.12	61	5.15
1955	--	--	--	--	--	--	--
1956	51	25	26	125	2.45	49	4.19
1957	87	84	3	485	5.57	96	5.77
1958	230	175	55	912	3.96	74	5.33
1959	625	75	550	274	0.44	12	3.65
1960	87	34	53	136	1.56	39	4.00
1961	82	39	43	174	2.12	48	4.46
1962	96	39	57	178	1.85	41	4.56
1963	161	97	64	502	3.12	60	5.17
1964	--	--	--	--	--	--	--
1965	164	97	67	276	1.68	59	2.84
1966	94	23	71	77	0.82	24	3.35
1967	122	52	70	235	1.93	43	4.52
1968	62	18	44	79	1.27	29	4.39
1969	--	--	--	--	--	--	--
1970	28	19	9	89	3.18	68	4.68
1971	17	7	10	15	0.88	41	2.14
1972	33	25	8	75	2.27	76	3.00
1973	--	--	--	--	--	--	--
1974	--	--	--	--	--	--	--
1975	31	23	8	80	2.58	74	3.48
1976	21	15	6	53	2.52	71	3.53
1977	32	16	16	55	1.72	50	3.44
1978	29	7	24	27	0.93	24	2.43
1979	42	29	12	110	2.62	70	3.79
1980	--	--	--	--	--	--	--
1981	--	--	--	--	--	--	--
1982	--	--	--	--	--	--	--
1983	--	--	--	--	--	--	--
1984	--	--	--	--	--	--	--
1985	52	16	36	31	0.60	31	1.94
1986	42	34	8	130	3.09	80	3.82
1987	73	52	21	188	2.57	71	3.61
1988	55	43	12	135	2.45	78	3.14
1989	117	37	80	109	0.93	32	2.95
1990	78	13	65	35	0.45	17	2.69
1991	34	4	30	9	0.26	12	2.25
1992	113	28	85	117	1.03	25	4.18
1993	32	1	31	3	0.09	3	3.00

[1] Dashed lines (--) indicate absence of a systematic survey.

APPENDIX H
WILDLIFE SPECIES RICHNESS

Page

Part 1. **Sensitive Wildlife Species**

The U.S. Fish and Wildlife Service is charged with administration of the Endangered Species Act of 1973. Oregon Department of Fish and Wildlife is charged with administration of the Oregon Endangered Species Act (1987) with respect to animals. Refuges are legally obligated to comply with both laws. Additionally, Region 1 policy of the Service dictates that the status of candidate species be given special attention in terms of planning and mitigation of management actions. Evaluation of these laws and policies resulted in the development of goal 2 of Hart Mountain NAR: "Manage for threatened and endangered species of plants and animals in their natural ecosystems."

The following discussion describes results from an analysis of threatened and endangered animal species of Hart Mountain NAR. Plant species are dealt with in Appendix E. The list of vertebrated of the Refuge was reviewed, Heritage Program status classifications were evaluated (ONHP 1993), and a list of sensitive species was compiled. The scope of this treatment deals only with wildlife species classified in 1 or more of the following categories:

(1) A species is legally classified as threatened and endangered at the federal and state level;

(2) A species is a C1 or C2 candidate for classification as threatened or endangered species at the federal level;

(3) A species is listed as critically sensitive by the state of Oregon (ONHP 1993).

Seventeen of 302 wildlife species are classified as sensitive (Table H-1). Eleven species breed on the Refuge and the remainder are classified as transients and winter residents (Table H-2). Abundance differs among species. Only 1 species, bighorn sheep, is considered common. Six are considered fairly common, 5 are considered uncommon, 4 are considered rare, and 1 is considered extremely rare. Habitat management actions are likely to have the greatest influence on species that depend on the habitat resources the most--namely common, uncommon, and fairly common permanent and summer residents.

Analysis of species richness disclosed trends consistent with the larger analysis done for 302 vertebrates (Chapter 3). Richness of sensitive species apparently is associated with (1) the distribution, abundance, and condition of wetlands; (2) complexity of vegetation structure within and among upland and wetland vegetation types; and (3) the diversity of succession stages present in upland vegetation types. Management actions that increase the diversity of succession stages will increase habitat suitability for 5 sensitive species that breed or feed in uplands currently dominated by shrubs and juniper. Management directed to maintain natural age distributions of pine trees in pine stands will benefit northern goshawk and flammulated owl.

In wetlands, management directed to reduce erosion of stream channels, restore water tables, increase the distribution of wetland vegetation (e.g., late and very late progression stages) will increase habitat suitability for 11 of 13 sensitive species that depend on healthy riparian areas for breeding or feeding purposes. Two other species, pygmy rabbit and loggerhead shrike, would decline in riparian sites where management substantially reduced the cover of basin big sagebrush and silver sagebrush associated with degraded conditions in low gradient reaches of streams. On the other hand, these species are extensively distributed in other habitats including greasewood, salt desert shrub, Wyoming big sagebrush, and juniper woodland.

Table H-1. Annotated list of sensitive species of vertebrate wildlife at Hart Mountain NAR. Unreferenced comments based on analysis of Refuge records.

Species	Status[a]	Comments
Catlow tui chub	C2/V	Occurs in Rock Creek, Hart Mt. NAR, and other perennial streams of the Catlow Basin. Population fluctuates in response to availability of perennial water supply in low gradient reaches.
Sheldon tui chub	C2/C	Population that establishes at Shirk Ranch during consecutive years of above average precipitation derives from Fish Creek, Sheldon NWR, Nevada. Population limited by absence of sufficient water supply during drought periods.
Catlow redband trout	C2/V	Occurs in Rock Creek, Hart Mt. NAR, and other perennial streams of the Catlow Basin. Population fluctuates in response to stream condition and drought-induced reduction in stream-flow.
White-faced ibis	C2/V	Wetlands of Shirk Ranch used for feeding purposes in mid-1980s. Does not breed because of absence of extensive bulrush-cattail vegetation.
Bald Eagle	LT/LT	Small numbers associated mainly with low gradient wetlands during spring and fall migration.
Ferruginous hawk	C2/C	An estimated 4 pairs nest annually in juniper along the ecotone of juniper woodland and low sagebrush of Poker Jim Ridge and the tableland geographic regions.
Northern goshawk	C2/C	Different pairs recorded nesting in pines at Blue Sky and aspen of upper Rock Creek during the late 1980s-early 1990s. Summer population limited mainly by defecient area covered by aspen and defecient size of aspen stands.
Peregrine falcon	LE/LE	Small numbers occur in association with alluvial floodplains and the habitat of the escarpment during fall, winter, and spring. A survey done by ODFW found no peregrines nesting on the Refuge in 1987 (Thee 1987).
Western sage grouse	C2/V	Refer to species account in Chapter 3, Volume I of the FEIS.
Upland sandpiper	U/C	Single record of occurrence from the 1940s. Nearest viable breeding population occurs in association with large riparian wetlands comprised primarily of sedge-rush-bluegrass of the southern Blue Mountains (Herman et al. 1984).
Black tern	C2/-	Nests in small numbers at Big Flat and Shirk Ranch when these sites are flooded and maintain large amounts of water through summer.
Yellow-billed cuckoo	-/C	Observed on average of once every 5 years (Refuge files). Possibly nested in Lake County historically (Littlefield 1989).
Flammulated owl	-/C	Mewaldt (1982) ascertained that flammulated owls regularly used the pine stand at Blue Sky in May and September. However, no owls were found there during the breeding season (Mewaldt 1982, Goggans 1987). Stand may be deficient in size and appropriate structural features (e.g., cavities) to support viable breeding population.
Loggerhead shrike	C2/U	Fairly common summer resident that breeds in association with black greasewood, Wyoming big sagebrush, basin big sagebrush, and juniper savannah. Refuge population has not been surveyed systematically.
Preble's shrew	C2/-	One specimen was trapped in the late 1980s on the Refuge. Probably occurs regularly in communities composed of mesic shrubs and riparian wetlands (Ports and George 1990).

Table H-1. (Continued)

Species	Status[a]	Comments
Pygmy rabbit	C2/V	Thought to be widespread, however, no systematic surveys have been conducted. A few colonies that occurred on Refuge were studied by Weiss and Verts (1984). Rabbits were associated with the occurrence of deep-fine textured soils and sagebrush cover >20%. Surveys done on Sheldon NWR in 1993 indicate that the species is associated with deep-soiled habitats that support big sagebrush in upland and alluvial sites.
California bighorn sheep	C2/-	Refer to species account in Chapter 3, Volume I of the FEIS.

[a] Federal designations include legally endangered (LE); legally threatened (LT); category 2 candidate for threatened and endangered listing (C2); and no designation (-). Oregon designations include sensitive critical (SC); sensitive vulnerable (SV); status undetermined (U); and no designation (-).

Table H-2. Classification[a] of sensitive species of vertebrate wildlife by status, breeding-feeding assemblage, range, abundance by season, and versatility index, Hart Mountain NAR.

	Assemblages		Abundance by season				Versatility index		
Status and species	Br-Fe	Range	Sp	Su	Fa	Wi	Br	Fe	To
Permanent residents									
Catlow redband trout	1-1	1	fc	fc	fc	fc	2	2	4
Sheldon tui chub[b]	1-1	1	u	u	u	u	10	10	20
Catlow Valley tui chub	1-1	1	fc	fc	fc	fc	10	10	20
Northern goshawk	5-10	2	r	x	r	r	8	24	32
Sage grouse	4-2	5	fc	fc	fc	fc	8	31	39
Preble's shrew	9-2	2	u	u	u	x	8	19	27
Pygmy rabbit	4-2	4	fc	fc	fc	u	10	26	36
California bighorn sheep	4-2	2	c	c	c	c	2	28	30
Summer residents									
Ferruginous hawk	5-2	5	u	u	u	-	8	21	29
Black tern	2-1	1	u	r	r	-	8	10	18
Loggerhead shrike	5-8	5	fc	fc	u	-	25	43	68
Transients									
White-faced ibis	0-1	1	fc	u	r	-	0	9	0
Bald eagle	0-7	8	r	-	r	-	0	15	0
Upland sandpiper	0-1	2	x	-	-	-	0	6	0
Yellow-billed cuckoo	0-5	7	x	x	-	-	0	6	0
Flammulated owl	0-2	2	u	x	u	-	0	17	0
Winter residents									
Peregrine falcon	0-3	8	r	-	r	r	0	17	0

[a] For description of classification categories refer to legend for table H-7 in part 4, Appendix H.
[b] Population at Shirk Ranch maintained by periodic flooding of Guano Basin and emigration from source population on Sheldon NWR (Stern et al. 1993).

Part 2. **Regional Endemic Species**

Maintenance of regional biodiversity is related in part to conservation of endemic wildlife, species whose distribution is restricted primarily to a biogeographic region (Knopf 1992). At Hart Mountain NAR, regional endemics are classified as species that occur on the Refuge and have more than 80% of their breeding distribution within the area of the Great Basin delineated by Cronquist et al. (1972:81). Evaluation of distribution of species that breed on the Refuge qualifies 10 species as regional endemics (Table H-9). Taxa represented include (1) 3 fish and 1 amphibian species associated with streams and lakes; 1 mammal species associated with the occurrence of deep soils and sagebrush in uplands and wetlands; and (3) 4 mammal, 1 lizard , and 1 bird species associated mainly with the desert shrub biome of the eastern and western regions of the Refuge.

Analysis of species richness revealed that endemics of the Refuge are associated with upland vegetation types except for fishes and amphibians (refer to table H-5 for data on habitat associations). Within uplands, the number of endemics is greatest where breeding and feeding habitats are provided by a mosaic of vegetation types and succession stages within vegetation types. Sage thrasher, Townsend's ground squirrel, Great Basin pocket mouse, and pygmy rabbit are associated primarily with upland habitats, however, they also use degraded low gradient riparian zones encroached by shrubs, mainly basin big sagebrush (Hanley and Page 1982, Medin and Clary 1989, 1990, Leonard et al. 1992). Protection of these species by maintenance of degraded conditions is indefensible because such a strategy would sacrifice watershed values (Van Havereen and Jackson 1986), compromise wildlife dependent on biologically productive and structurally complex habitats (Dobkin 1993, Jones 1993), and reduce beta diversity, defined as the "change in species [composition] across space [habitats]" (Samson and Knopf 1993). Management practices that maintain and restore wetland vegetation and water supplies would increase habitat quality for endemic trout (Jones 1993), chubs (Williams et al. 1989), and spadefoot toads (Storm 1980).

Table H-3. Classification[a] of endemic species[b] of vertebrate wildlife by status, breeding-feeding assemblage, range, abundance by season, and versatility index, Hart Mountain NAR.

	Assemblages		Abundance by season				Versatility index		
Status and species	Br-Fe	Range	Sp	Su	Fa	Wi	Br	Fe	To
Permanent residents									
Catlow redband trout	1-1	1	fc	fc	fc	fc	2	2	4
Sheldon tui chub[c]	1-1	1	u	u	u	u	10	10	20
Catlow Valley tui chub	1-1	1	fc	fc	fc	fc	10	10	20
Townsend's ground squirrel	9-2	6	c	c	u	h	10	36	46
Antelope ground squirrel	9-2	1	u	u	u	x	4	6	10
Great Basin pocket mouse	9-2	6	c	c	c	u	18	35	53
Pygmy rabbit	4-2	4	fc	fc	fc	u	10	26	36
Great Basin spadefoot toad	1-7	2	c	u	h	h	9	16	25
Sagebrush lizard	4-8	6	fc	c	u	h	7	17	24
Summer residents									
Sage thrasher	4-2	6	c	c	u	-	26	37	63

[a] For description of classification categories refer to legend for table H-7 in part 4, Appendix H.

[b] Species classified as regional endemics (1) breed on the Refuge and (2) have >80% of their breeding distribution within the Great Basin as defined by Cronquist et al. (1972:81).

[c] Population at Shirk Ranch maintained by periodic flooding of Guano Basin and emigration from source population on Sheldon NWR (Stern et al. 1993).

Part 3. **Additional Tables**

Legend for Table H-4.

STATUS

Permanent resident: occurs on year-round basis;
Summer resident: breeds on Refuge; occurs as transient during spring and all;
Transient: does not breed on Refuge; occurs during spring and fall migration;
Winter resident: occurs during winter; may occur as transient in fall and spring.

BREEDING ASSEMBLAGES

(1) Breeds in water;
(2) Breeds on or near ground around water or on emergent vegetation;
(3) Breeds in cliffs, caves, rims, talus or man-made structures;
(4) Breeds on or near ground;
(5) Breeds in shrubs and trees;
(6) Breeds in deciduous shrubs and trees;
(7) Breeds in conifers;
(8) Excavates hole in tree for breeding;
(9) Breeds in an underground burrow;
(10) Breeds in hole made by another species or that has occurred naturally.

FEEDING ASSEMBLAGES

(1) Feeds in water;
(2) Feeds on or near ground;
(3) Feeds in air;
(4) Feeds in shrubs and trees;
(5) Feeds in deciduous shrubs and trees;
(6) Feeds in conifers;
(7) Feeds in water, or on or near ground;
(8) Feeds on or near ground, or in shrubs and trees;
(9) Feeds in shrubs, trees, and air;
(10) Feeds on or near ground, or in shrubs, trees, or air.

RANGE

(1) < 5% of Refuge area used for breeding and feeding;
(2) < 5% of area used for breeding; 5-20% of area used for feeding;
(3) < 5% of area used for breeding; > 20% of area used for feeding;
(4) 5-20% of area used for breeding and feeding;
(5) 5-20% of area used for breeding; > 20% of area used for feeding;
(6) > 20% of area used for breeding and feeding;
(7) < 5% of area used for feeding.
(8) 5-20% of area used for feeding.
(9) > 20% of area used for feeding.

ABUNDANCE BY SEASON

		a few individuals encountered on:	many individuals encountered on:
C	Common or abundant	> 90% of days	> 50% of days
F	Fairly common	50-90% of days	10-50% of days
U	Uncommon	< 10% of days	< 10% of days
R	Rare	< 10% of days	--
X	Extremely rare	10 or fewer records at that season	

Abundance classes developed by DeSante and Pyle (1987) were modified to include representation of all taxonomic groups of wildlife that occur on the Refuge. Therefore, "encounter" refers to the expected rate of observation by an experienced individual of a species in its preferred succession and progression stages of vegetation type(s). Method of "observation" differs among species. It refers to observations made by sight or sound in the case of amphibians, birds, lizards and snakes. In the case of mammals of secretive, nocturnal, and cryptic habit, a species presence and abundance may be detected by tracks, scat, or capture using the appropriate live-trap.

Legend. (Continued)

VERSATILITY INDEX

Br (Breeding versatility index). The sum total number of vegetation types and succession and progression stages of vegetation types preferred for breeding purposes. Includes species classified as permanent residents and summer residents that breed on the Refuge.

Fe (Feeding versatility index). The sum total number of vegetation types and succession and progression stages of vegetation types preferred for feeding purposes. Includes species of all residency categories.

To (Total versatility index). The sum total number of vegetation types and succession and progression stages of vegetation types preferred for breeding and feeding purposes. Includes species classified as permanent and summer residents that breed on the Refuge.

Versatility indices measure "...the sensitivity of each species to habitat change" to foster evaluation of wildlife in natural resource plans developed for the Great Basin of southeastern Oregon (Maser et al. 1984a, 1984b). At Hart Mountain NAR, indices were derived using computation methods of Maser et al. (1984a, 1984b) adapted to the 302 wildlife species and 101 structural stages of 31 vegetation types) found on the Refuge. The versatility index for each species therefore consists of the sum total number of vegetation types and structural stages (i.e., succession stages) preferred for breeding, feeding, or combined use depending on a species' residency mode. In general, the larger the index, the greater the number of habitats used, and the lower the likelihood that alterations in composition of a single preferred habitat would influence the status of the species' population on the Refuge. Note that evaluation of a species' sensitivity to habitat alteration should account not only for size of versatility index but also the amount of area comprised preferred habitat on the Refuge, the status of a species' population on the Refuge, and the status of a species' population and preferred habitat in a biogeographic region.

Table H-4. Classification of vertebrate wildlife species by status, breeding-feeding assemblage, range, abundance by season, and versatility index, Hart Mountain NAR.

	Assemblages		Abundance by season				Versatility index		
Status and species	Br-Fe	Range	Sp	Su	Fa	Wi	Br	Fe	To
Permanent residents									
Cutthroat trout	1-1	1	f	f	f	f	2	9	11
Rainbow trout	1-1	1	c	c	c	c	6	6	8
Catlow redband trout	1-1	1	f	f	f	f	2	2	4
Sheldon tui chub	1-1	1	u	u	u	u	10	10	20
Catlow Valley tui chub	1-1	1	f	f	f	f	10	10	20
Great Basin spadefoot toad	1-7	2	c	u	h	h	9	16	25
Western toad	1-7	2	u	u	r	h	10	25	35
Pacific treefrog	1-7	2	f	c	u	h	10	21	31
Western fence lizard	3-8	2	f	c	u	h	11	15	26
Sagebrush lizard	4-8	6	f	c	u	h	7	17	24
Side-blotched lizard	4-2	6	f	c	u	h	11	22	33
Desert horned lizard	4-2	4	x	r	x	h	8	8	16
Short-horned lizard	4-2	4	f	c	f	h	13	15	28
Western skink	4-2	2	r	u	r	h	12	34	46
Northern alligator lizard	4-8	2	u	f	u	h	8	26	34
Rubber boa	4-2	4	r	u	r	h	18	41	59
Racer	4-8	6	f	c	u	h	16	61	77
Striped whipsnake	4-8	6	r	u	r	h	28	48	76
Gopher snake	4-8	6	f	c	u	h	27	59	86
W. terrestrial garter snake	2-7	2	c	c	f	h	11	24	35
Western rattlesnake	4-2	3	u	f	u	h	18	41	59
Northern harrier	4-2	5	c	c	c	u	13	44	57
Sharp-shinned hawk	5-10	2	f	r	f	r	13	27	40
Cooper's hawk	5-10	2	c	x	f	r	10	26	36
Northern goshawk	5-10	2	r	x	r	r	8	24	32
Red-tailed hawk	5-2	5	c	c	c	r	17	42	59
Golden eagle	3-2	3	c	c	c	f	2	42	44
Prairie falcon	3-2	2	c	c	u	r	2	33	35
Chukar	4-2	4	f	f	f	f	10	20	30
Sage grouse	4-2	5	f	f	f	f	8	31	39
California quail	4-2	2	f	f	f	f	5	29	34
Common snipe	2-1	2	c	c	f	r	7	18	25
Western screech-owl	10-2	2	c	c	c	c	2	15	17
Great horned owl	5-2	2	c	c	c	c	11	29	40
Long-eared owl	5-2	2	f	f	f	f	8	15	23
Downy woodpecker	8-5	1	u	u	u	r	6	9	15
Hairy woodpecker	8-4	1	u	u	u	u	6	18	24
Northern flicker	8-8	4	c	c	c	f	11	36	47
Horned lark	4-2	6	c	c	c	u	26	40	66
Stellar's jay	7-8	1	r	r	r	r	10	13	23
Black-billed magpie	5-2	2	f	f	u	u	22	32	54
Common raven	3-2	3	c	c	c	f	2	55	57
Mountain chickadee	10-4	2	f	f	f	f	8	29	37
Plain titmouse	10-8	2	f	f	f	f	2	9	11
Bushtit	5-4	2	u	u	u	r	14	28	42
Red-breasted nuthatch	10-4	2	c	r	c	u	6	27	33
Pygmy nuthatch	10-6	1	c	c	c	f	4	6	10
Canyon wren	3-2	1	u	u	u	r	2	17	19
Bewick's wren	10-4	2	r	r	r	r	4	12	16
American dipper	2-1	1	u	u	u	r	6	2	8
Ruby-crowned kinglet	7-4	2	c	f	f	r	6	29	35
Mountain bluebird	10-8	2	f	f	u	r	6	26	32
Townsend's solitaire	4-8	2	u	r	f	c	7	31	38
American robin	5-8	2	c	c	f	u	19	45	64
Dark-eyed junco	4-2	4	u	u	f	u	13	31	44

Table H-4. (Continued)

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Cassin's finch	5-8	4	c	c	c	u	18	19	37
Red crossbill	7-6	1	r	r	r	x	6	6	12
Water shrew	9-2	1	u	u	u	x	10	14	24
Vagrant shrew	9-2	2	c	c	c	u	15	33	38
Preble's shrew	9-2	2	u	u	u	x	8	19	27
Raccoon	3-7	1	r	r	r	x	2	12	14
Ermine	9-2	4	f	f	f	u	31	42	73
Long-tailed weasel	9-2	6	c	c	c	u	54	79	133
Badger	9-2	6	c	c	u	r	33	47	80
Striped skunk	9-2	2	r	r	r	x	2	16	18
Coyote	9-2	6	c	c	c	c	25	82	107
Mountain lion	3-2	3	x	x	x	x	2	34	36
Bobcat	3-2	2	f	f	f	f	2	53	55
Yellow-bellied marmot	3-2	1	c	c	u	h	3	17	20
Townsend's ground squirrel	9-2	6	c	c	u	h	10	36	46
Belding's ground squirrel	9-2	6	c	c	u	h	9	19	28
Golden-mantled ground squirrel	9-2	4	f	f	f	x	6	32	38
Antelope ground squirrel	9-2	1	u	u	u	x	4	6	10
Least chipmunk	9-2	6	c	c	c	r	21	48	69
Yellow-pine chipmunk	9-2	2	c	c	f	h	14	28	42
Douglas squirrel	5-8	1	r	r	r	x	8	11	19
Northern pocket gopher	9-2	4	c	c	c	h	26	27	53
Great Basin pocket mouse	9-2	6	c	c	c	u	18	35	53
Ord's kangaroo rat	9-2	6	c	c	c	u	28	30	58
Beaver	2-3	1	f	f	f	r	6	7	13
Deer mouse	9-2	6	c	c	c	u	67	82	149
Desert woodrat	3-2	4	u	u	u	r	2	11	13
Bushy-tailed woodrat	3-2	4	c	c	c	u	12	34	46
Montane vole	9-2	4	c	c	c	u	13	18	31
Long-tailed vole	9-2	4	c	c	c	u	26	32	58
Sagebrush vole	9-2	6	c	c	c	r	16	35	51
Western jumping mouse	4-2	1	f	f	f	x	6	9	15
Porcupine	3-8	3	c	c	c	f	15	47	62
Pika	3-2	1	c	c	c	x	2	7	9
White-tailed jackrabbit	4-2	4	f	f	f	f	14	22	36
Black-tailed jackrabbit	4-2	6	c	c	c	c	20	52	72
Nuttall's cottontail	4-2	6	c	c	c	f	28	42	70
Pygmy rabbit	4-2	4	f	f	f	u	10	26	36
Feral horse	4-2	5	f	f	f	f	11	21	32
Rocky Mountain elk	4-2	2	x	x	x	x	15	45	60
Mule deer	4-2	2	c	c	c	f	25	63	88
Pronghorn	4-2	5	c	c	c	f	6	42	48
California bighorn sheep	4-2	2	c	c	c	c	2	28	30
Summer residents									
Eared grebe	2-1	1	c	f	u	-	8	10	18
Pied-billed grebe	2-1	1	u	r	u	-	8	10	18
American bittern	2-1	1	u	u	r	-	8	11	19
Canada goose	2-7	2	f	f	f	-	6	13	19
Green-winged teal	2-1	2	f	f	f	-	6	10	16
Mallard	2-7	2	c	f	c	-	6	10	16
Northern pintail	2-1	2	c	u	c	-	6	10	16
Blue-winged teal	2-1	2	f	r	u	-	6	10	16
Cinnamon teal	2-1	2	c	c	u	-	6	10	16
Northern shoveler	2-1	2	f	r	u	-	5	10	15
Gadwall	2-1	2	c	f	c	-	6	10	16
American wigeon	2-7	2	f	r	c	-	6	11	17
Canvasback	2-1	1	u	x	u	-	2	10	12
Redhead	2-1	1	u	r	u	-	6	10	16

Table H-4. (Continued)

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Ring-necked duck	2-1	1	u	r	r	-	2	10	12
Ruddy duck	2-1	1	u	x	r	-	5	10	15
Turkey vulture	3-2	3	c	c	f	-	2	59	61
Ferruginous hawk	5-2	5	u	u	u	-	8	21	29
American kestrel	10-2	5	c	c	c	-	9	49	58
Virginia rail	2-1	1	u	u	u	-	2	8	10
Sora	2-1	2	c	f	f	-	6	10	16
American coot	2-1	1	c	c	c	-	6	8	14
Sandhill crane	2-7	2	u	u	u	-	8	13	21
Killdeer	2-7	4	c	c	c	-	10	17	27
Black-necked stilt	2-1	1	u	r	r	-	5	12	17
American avocet	2-1	2	f	f	u	-	3	12	15
Willett	2-1	2	c	c	u	-	9	14	23
Spotted sandpiper	2-1	2	u	u	r	-	5	13	18
Long-billed curlew	2-1	2	u	x	x	-	8	17	25
Wilson's phalarope	2-1	2	c	f	u	-	7	10	17
Black tern	2-1	1	u	r	r	-	8	10	18
Mourning dove	4-2	4	c	f	r	-	21	33	54
Common barn-owl	3-2	2	x	x	x	-	2	18	20
Western burrowing-owl	9-10	4	x	x	r	-	9	17	26
Short-eared owl	4-2	2	f	u	f	-	20	29	49
Common nighthawk	4-3	6	r	c	r	-	23	55	78
Common poorwill	4-3	4	u	c	c	-	14	21	35
Calliope hummingbird	5-8	1	r	r	x	-	8	10	18
Red-naped sapsucker	8-5	1	f	f	u	-	2	6	8
Red-breasted sapsucker	8-5	1	r	r	x	-	2	6	8
Olive-sided flycatcher	7-3	2	u	r	u	-	6	18	24
Western wood peewee	6-3	1	u	f	u	-	2	18	20
Dusky flycatcher	6-3	1	c	c	u	-	5	12	17
Gray flycatcher	5-3	4	c	c	u	-	16	21	37
Say's phoebe	3-3	2	f	f	r	-	2	7	9
Ash-throated flycatcher	10-3	2	u	r	r	-	2	3	5
Western kingbird	5-3	2	u	r	r	-	3	6	9
Tree swallow	10-3	2	f	f	x	-	2	29	31
Violet-green swallow	3-3	4	c	c	x	-	2	50	52
Cliff swallow	3-3	2	c	c	r	-	2	24	26
Barn swallow	3-3	2	f	f	r	-	2	20	22
Scrub jay	5-8	1	f	f	f	-	8	22	30
American crow	5-2	2	r	r	r	-	3	16	19
Rock wren	3-2	6	c	c	f	-	2	36	38
House wren	10-4	2	c	c	u	-	7	26	33
Marsh wren	2-7	1	f	f	f	-	2	4	6
Blue-gray gnatcatcher	5-4	2	f	f	u	-	3	7	10
Swainson's thrush	4-2	1	r	r	x	-	4	6	10
Hermit thrush	4-2	2	u	r	u	-	5	21	26
Sage thrasher	4-2	6	c	c	u	-	26	37	63
Loggerhead shrike	5-8	5	f	f	u	-	25	43	68
European starling	10-2	2	c	c	r	-	5	12	17
Solitary vireo	5-4	2	u	r	u	-	10	27	37
Warbling vireo	6-5	1	c	c	u	-	3	9	12
Orange-crowned warbler	4-4	1	c	f	f	-	6	25	31
Nashville warbler	5-4	2	u	x	r	-	5	27	32
Yellow warbler	6-5	1	c	c	f	-	5	9	14
Yellow-rumped warbler	7-9	2	c	f	c	-	6	27	33
Black-throated gray warbler	5-4	2	c	f	u	-	10	25	35
MacGillivray's warbler	6-5	1	f	c	f	-	6	10	16
Western tanager	7-4	2	c	u	r	-	8	27	35
Black-headed grosbeak	6-5	1	f	u	r	-	6	8	14
Lazuli bunting	6-8	1	f	c	u	-	2	13	15

Table H-4. (Continued)

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Green-tailed towhee	4-2	4	c	c	u	-	19	39	58
Rufous-sided towhee	4-2	2	c	u	c	-	5	30	35
Chipping sparrow	7-2	4	c	f	u	-	13	21	34
Brewer's sparrow	4-8	6	c	c	u	-	27	44	71
Vesper sparrow	4-2	6	c	c	u	-	20	32	52
Lark sparrow	4-2	2	u	r	r	-	17	17	34
Black-throated sparrow	4-2	2	u	f	r	-	9	10	19
Sage sparrow	4-2	6	c	c	u	-	9	24	33
Savannah sparrow	4-2	2	c	c	f	-	14	23	37
Fox sparrow	4-2	2	f	f	u	-	7	17	24
Song sparrow	4-7	1	c	c	f	-	3	11	14
White-crowned sparrow	4-2	5	c	f	c	-	19	50	69
Red-winged blackbird	2-2	2	c	c	u	-	11	17	28
Western meadowlark	4-2	6	c	c	f	-	37	51	88
Yellow-headed blackbird	2-2	1	u	r	r	-	2	8	10
Brewer's blackbird	2-2	2	c	c	u	-	16	27	43
Brown-headed cowbird	5-2	4	f	f	r	-	31	25	56
Northern oriole	6-6	1	f	f	r	-	2	9	11
House finch	5-2	4	u	r	r	-	5	15	20
Pine siskin	7-4	2	u	r	r	-	6	6	12
Transients									
Horned grebe	0-1	7	r	-	x	-	0	8	0
Western grebe	0-1	1	r	r	x	-	0	10	0
Clark's grebe	0-1	1	r	r	x	-	0	10	0
American white pelican	0-1	7	x	x	x	-	0	10	0
Double-crested cormorant	0-1	7	x	x	x	-	0	8	0
Great blue heron	0-1	7	u	x	r	-	0	10	0
Great egret	0-1	7	x	r	x	-	0	10	0
Snowy egret	0-1	7	r	r	x	-	0	10	0
Black-crowned night heron	0-1	1	u	u	u	-	0	10	0
White-faced ibis	0-1	1	f	u	r	-	0	9	0
Tundra swan	0-1	7	c	-	f	-	0	10	0
Greater white-fronted goose	0-7	7	u	-	r	-	0	3	0
Snow goose	0-7	7	r	-	x	-	0	3	0
Ross's goose	0-7	7	x	-	x	-	0	3	0
Wood duck	0-7	7	x	-	x	-	0	10	0
Eurasian wigeon	0-7	7	r	-	r	-	0	10	0
Greater scaup	0-1	7	x	-	r	-	0	10	0
Lesser scaup	0-1	1	u	-	r	-	0	10	0
Common goldeneye	0-1	7	f	-	f	-	0	10	0
Barrow's goldeneye	0-1	7	x	-	x	-	0	10	0
Hooded merganser	0-1	7	u	-	r	-	0	10	0
Bufflehead	0-1	7	f	r	f	-	0	10	0
Common merganser	0-1	7	f	-	r	-	0	10	0
Red-breasted merganser	0-1	7	x	-	x	-	0	10	0
Osprey	0-1	7	r	-	x	-	0	9	0
Bald eagle	0-7	8	r	-	r	-	0	15	0
Swainson's hawk	0-2	3	u	r	u	-	0	27	0
Merlin	0-10	8	r	-	r	-	0	16	0
Black-bellied plover	0-1	7	r	-	r	-	0	11	0
Lesser golden plover	0-1	7	x	-	x	-	0	11	0
Snowy plover	0-1	7	r	-	x	-	0	10	0
Semipalmated plover	0-1	8	u	r	r	-	0	7	0
Greater yellowlegs	0-1	8	f	f	u	-	0	10	0
Lesser yellowlegs	0-1	8	f	f	u	-	0	10	0
Solitary sandpiper	0-1	7	x	-	-	-	0	11	0
Upland sandpiper	0-1	2	x	-	-	-	0	6	0
Marbled godwit	0-1	8	r	u	r	-	0	10	0

Table H-4. (Continued)

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Western sandpiper	0-1	8	f	f	u	-	0	5	0
Least sandpiper	0-1	8	f	f	u	-	0	5	0
Baird's sandpiper	0-1	8	-	r	-	-	0	5	0
Red knot	0-1	7	x	-	-	-	0	5	0
Sanderling	0-1	7	x	x	-	-	0	5	0
Pectoral sandpiper	0-1	7	x	x	u	-	0	10	0
Long-billed dowitcher	0-1	8	f	f	f	-	0	7	0
Short-billed dowitcher	0-1	8	-	x	x	-	0	7	0
Dunlin	0-1	7	r	r	x	-	0	5	0
Northern phalarope	0-1	8	-	r	x	-	0	10	0
Franklin's gull	0-7	7	x	x	-	-	0	10	0
Ring-billed gull	0-7	7	r	r	x	-	0	11	0
California gull	0-7	7	r	r	x	-	0	11	0
Caspian tern	0-1	7	x	x	-	-	0	10	0
Forster's tern	0-1	7	x	x	-	-	0	10	0
Yellow-billed cuckoo	0-5	7	x	x	-	-	0	6	0
Flammulated owl	0-2	2	u	x	u	-	0	17	0
Northern saw-whet owl	0-2	2	r	r	r	-	0	25	0
White-throated swift	0-3	3	r	r	x	-	0	42	0
Vaux's swift	0-3	8	x	-	-	-	0	36	0
Black-chinned hummingbird	0-8	7	r	x	-	-	0	9	0
Broad-tailed hummingbird	0-8	2	u	r	-	-	0	17	0
Rufous hummingbird	0-2	8	-	c	-	-	0	9	0
Belted kingfisher	0-1	7	r	x	x	-	0	6	0
Lewis's woodpecker	0-9	2	r	r	r	-	0	16	0
Williamson's sapsucker	0-6	8	x	-	x	-	0	10	0
Willow flycatcher	0-3	1	u	r	r	-	0	9	0
Least flycatcher	0-3	7	r	r	x	-	0	9	0
Hammond's flycatcher	0-3	8	u	u	r	-	0	18	0
Cordilleran flycatcher	0-3	2	r	u	r	-	0	21	0
Eastern kingbird	0-3	1	x	-	x	-	0	3	0
Rough-winged swallow	0-3	8	u	r	x	-	0	16	0
Bank swallow	0-3	8	r	r	-	-	0	16	0
Clark's nutcracker	0-8	7	x	x	x	-	0	3	0
Winter wren	0-5	1	r	x	u	x	0	7	0
Western bluebird	0-8	2	u	x	u	-	0	16	0
Veery	0-2	7	x	-	x	-	0	6	0
Varied thrush	0-2	7	r	-	u	-	0	15	0
Gray catbird	0-4	7	x	-	-	-	0	4	0
American pipit	0-1	8	u	r	c	-	0	23	0
Red-eyed vireo	0-5	7	x	x	-	-	0	6	0
Townsend's warbler	0-4	8	u	r	r	-	0	24	0
Black-and-white warbler	0-4	7	x	-	-	-	0	21	0
American redstart	0-9	7	r	r	r	-	0	9	0
Ovenbird	0-2	7	x	-	-	-	0	6	0
Northern waterthrush	0-7	7	-	x	x	-	0	4	0
Common yellowthroat	0-7	1	u	r	r	-	0	6	0
Wilson's warbler	0-5	1	f	r	u	-	0	9	0
Yellow-breasted chat	0-5	7	x	x	x	-	0	4	0
Rose-breasted grosbeak	0-5	7	x	x	-	-	0	6	0
Grasshopper sparrow	0-2	2	x	x	-	-	0	19	0
Lincoln's sparrow	0-7	1	r	r	f	-	0	7	0
White-throated sparrow	0-2	8	x	-	r	-	0	41	0
Golden-crowned sparrow	0-2	8	r	-	u	-	0	49	0
Harris's sparrow	0-2	8	-	-	x	-	0	37	0
Bobolink	0-2	2	x	x	-	-	0	12	0
Lesser goldfinch	0-2	7	x	x	-	-	0	2	0
American goldfinch	0-2	7	x	x	x	-	0	9	0
Mink	0-7	7	x	x	x	-	0	14	0

Table H-4. (Continued)

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Winter residents									
Rough-legged hawk	0-2	8	f	-	f	u	0	13	0
Peregrine falcon	0-3	8	r	-	r	r	0	17	0
Golden-crowned kinglet	0-4	8	u	-	f	u	0	29	0
Black-capped chickadee	0-4	7	-	-	-	x	0	8	0
White-breasted nuthatch	0-4	8	-	-	-	r	0	10	0
Brown creeper	0-6	2	r	x	r	r	0	16	0
Bohemian waxwing	0-4	8	-	-	x	x	0	13	0
Cedar waxwing	0-4	8	x	-	x	r	0	9	0
Northern shrike	0-10	8	r	-	u	u	0	25	0
American tree sparrow	0-2	7	-	-	x	r	0	7	0
Lapland longspur	0-2	8	-	-	-	r	0	15	0
Snow bunting	0-2	8	-	-	-	x	0	15	0
Rosy finch	0-2	9	-	-	x	r	0	15	0
Pine grosbeak	0-4	7	-	-	x	r	0	8	0
Common redpoll	0-8	7	-	-	-	x	0	6	0
Evening grosbeak	0-8	8	r	-	r	r	0	17	0

Table H-5. Association of wildlife species[a] with succession and progression stages[b] of upland and wetland vegetation types for breeding and feeding purposes (1=primary use; 0=secondary or non-use), Hart Mountain NAR. Species are listed in phylogenetic order.

	Succession stage							
	Breeding				Feeding			
Vegetation type and wildlife species	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Wyoming big sagebrush								
Sagebrush lizard	0	1	1	1	1	1	1	1
Side-blotched lizard	0	1	1	1	1	1	1	1
Desert horned lizard	1	1	1	0	1	1	1	0
Western skink	0	0	0	0	1	1	1	1
Racer	0	0	0	0	1	1	0	0
Gopher snake	1	1	0	0	1	1	0	0
Western rattlesnake	1	1	0	0	1	1	0	0
Turkey vulture	0	0	0	0	1	1	1	1
Northern harrier	0	0	0	0	1	1	0	0
Swainson's hawk	0	0	0	0	1	1	0	0
Red-tailed hawk	0	0	0	0	1	1	0	0
Ferruginous hawk	0	0	0	1	1	1	0	0
Golden eagle	0	0	0	0	1	1	1	0
American kestrel	0	0	0	0	1	1	0	1
Prairie falcon	0	0	0	0	1	1	0	0
Chukar	0	0	0	0	1	1	0	0
Sage grouse	0	1	1	0	1	1	1	0
California quail	0	0	0	0	1	1	0	0
Mourning dove	0	0	0	1	1	1	0	0
Common barn-owl	0	0	0	0	1	1	0	0
Western screech-owl	0	0	0	0	1	1	0	1
Great horned owl	0	0	0	0	0	0	0	1
Western burrowing-owl	1	1	0	0	1	1	1	0
Short-eared owl	1	1	0	0	1	1	0	0
Common nighthawk	1	1	1	1	1	1	1	1
Gray flycatcher	0	0	0	1	0	0	0	1
Say's phoebe	0	0	0	0	1	1	1	1
Horned lark	1	1	0	0	1	1	0	0
Scrub jay	0	0	0	0	0	0	0	1
Black-billed magpie	0	0	0	1	0	0	0	0
Common raven	0	0	0	0	1	1	1	1
Mountain chickadee	0	0	0	0	0	0	0	1
Plain titmouse	0	0	0	0	0	0	0	1
Bushtit	0	0	0	1	0	0	0	1
Red-breasted nuthatch	0	0	0	0	0	0	0	1
Rock wren	0	0	0	0	1	1	1	1
Canyon wren	0	0	0	0	1	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	0	0	1
Golden-crowned kinglet	0	0	0	0	0	0	0	1
Townsend's solitaire	0	0	0	0	0	0	0	1
American robin	0	0	0	0	0	0	0	1
Sage thrasher	0	1	1	1	1	1	0	0
Bohemian waxwing	0	0	0	0	0	0	0	1
Cedar waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	0	0	1
Loggerhead shrike	0	1	1	1	1	1	1	1
Solitary vireo	0	0	0	0	0	0	0	1
Nashville warbler	0	0	0	0	0	0	0	1
Yellow-rumped warbler	0	0	0	0	0	0	0	1
Black-throated gray warbler	0	0	0	0	0	0	0	1
Townsend's warbler	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	0	0	1
Chipping sparrow	0	0	0	1	0	0	0	1
Brewer's sparrow	1	1	1	0	1	1	1	0
Vesper sparrow	0	0	0	0	1	1	0	0

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Lark sparrow	1	1	1	1	1	1	1	0
Black-throated sparrow	0	1	1	0	1	1	0	0
Sage sparrow	0	1	1	0	1	1	0	0
Grasshopper sparrow	0	0	0	0	1	1	0	0
Western meadowlark	1	1	0	0	1	1	0	0
Brown-headed cowbird	0	0	0	1	0	0	0	0
House finch	0	0	0	1	1	1	0	1
Evening grosbeak	0	0	0	0	0	0	0	1
Long-tailed weasel	1	1	1	0	1	1	1	1
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	1	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	1
Yellow-bellied marmot	0	0	0	0	1	1	0	0
Townsend's ground squirrel	1	1	0	0	1	1	0	0
Antelope ground squirrel	0	0	0	0	1	1	0	0
Least chipmunk	1	1	1	0	1	1	0	0
Great Basin pocket mouse	1	1	0	0	1	1	0	0
Ord's kangaroo rat	1	1	0	0	1	1	0	0
Deer mouse	1	1	0	0	1	1	0	0
Desert woodrat	0	0	0	0	1	1	1	0
Bushy-tailed woodrat	0	0	0	0	1	1	1	0
Sagebrush vole	1	1	1	0	1	1	1	0
Black-tailed jackrabbit	1	1	1	0	1	1	1	0
Pygmy rabbit	1	1	1	0	1	1	1	0
Feral horse	1	1	1	1	1	1	0	0
Pronghorn	1	1	0	0	1	1	0	0
California bighorn sheep	0	0	0	0	1	1	0	0
Total species	23	30	18	15	58	58	24	38
Spiny hopsage								
Sagebrush lizard	0	1	1	-[c]	1	1	1	-
Side-blotched lizard	0	1	1	-	1	1	1	-
Racer	0	0	0	-	1	1	0	-
Gopher snake	1	1	0	-	1	1	0	-
Western rattlesnake	1	1	0	-	1	1	0	-
Mourning dove	0	0	0	-	1	1	0	-
Western burrowing-owl	1	1	0	-	1	1	0	-
Horned lark	1	1	0	-	1	1	0	-
Sage thrasher	0	1	1	-	1	1	0	-
Loggerhead shrike	0	1	1	-	1	1	1	-
Brewer's sparrow	0	1	1	-	1	1	1	-
Black-throated sparrow	0	1	1	-	1	1	0	-
Sage sparrow	0	1	1	-	1	1	0	-
Grasshopper sparrow	0	0	0	-	1	1	0	-
Western meadowlark	1	1	0	-	1	1	0	-
Badger	1	1	0	-	1	1	0	-
Coyote	0	0	0	-	1	1	1	-
Townsend's ground squirrel	0	0	0	-	1	1	0	-
Least chipmunk	1	1	0	-	1	1	0	-
Great Basin pocket mouse	1	1	0	-	1	1	0	-
Ord's kangaroo rat	0	0	0	-	1	1	0	-
Deer mouse	1	1	0	-	1	1	0	-
Sagebrush vole	0	0	0	-	1	1	1	-
Black-tailed jackrabbit	1	1	1	-	1	1	1	-
Pronghorn	0	0	0	-	1	1	0	-
Total species	11	17	8	-	25	25	7	-
Salt desert shrub								
Western fence lizard	0	0	0	-	1	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Side-blotched lizard	0	1	1	-	1	1	1	-
Desert horned lizard	1	1	1	-	1	1	1	-
Short-horned lizard	1	1	1	-	1	1	1	-
Racer	0	0	0	-	1	1	1	-
Gopher snake	1	1	1	-	1	1	1	-
Western rattlesnake	1	1	1	-	1	1	1	-
Turkey vulture	0	0	0	-	1	1	1	-
Golden eagle	0	0	0	-	1	1	1	-
Chukar	0	0	0	-	1	1	0	-
Mourning dove	0	0	0	-	1	1	0	-
Common barn-owl	0	0	0	-	1	1	0	-
Western burrowing-owl	1	1	0	-	1	1	0	-
Common nighthawk	1	1	1	-	0	0	0	-
Horned lark	1	1	0	-	1	1	0	-
Common raven	0	0	0	-	1	1	1	-
Rock wren	0	0	0	-	1	1	1	-
Canyon wren	0	0	0	-	1	1	1	-
Sage thrasher	0	1	1	-	1	1	0	-
Loggerhead shrike	0	1	1	-	1	1	1	-
Brewer's sparrow	0	1	1	-	1	1	1	-
Lark sparrow	1	1	0	-	1	1	0	-
Black-throated sparrow	0	1	1	-	1	1	0	-
Sage sparrow	0	1	1	-	1	1	0	-
Western meadowlark	1	1	0	-	1	1	0	-
Rosy finch	0	0	0	-	1	1	0	-
Long-tailed weasel	1	1	0	-	1	1	1	-
Badger	1	1	0	-	1	1	0	-
Coyote	1	1	1	-	1	1	1	-
Townsend's ground squirrel	0	0	0	-	1	1	0	-
Antelope ground squirrel	1	1	1	-	1	1	0	-
Least chipmunk	1	1	0	-	1	1	0	-
Great Basin pocket mouse	1	1	0	-	1	1	1	-
Ord's kangaroo rat	1	1	1	-	1	1	0	-
Deer mouse	1	1	0	-	1	1	0	-
Desert woodrat	0	0	0	-	1	1	1	-
Black-tailed jackrabbit	1	1	1	-	1	1	1	-
Pronghorn	0	0	0	-	1	1	1	-
Total species	19	24	16	-	37	37	20	-
Winterfat								
Side-blotched lizard	0	0	0	-	1	1	1	-
Racer	0	0	0	-	1	1	1	-
Gopher snake	1	1	1	-	1	1	1	-
Western rattlesnake	1	1	1	-	1	1	1	-
Western burrowing-owl	0	1	1	-	1	1	1	-
Horned lark	1	1	1	-	1	1	1	-
Sage thrasher	0	0	0	-	1	1	1	-
Sage sparrow	0	0	0	-	1	1	1	-
Western meadowlark	0	0	0	-	1	1	0	-
Badger	0	0	0	-	1	1	1	-
Coyote	0	0	0	-	1	1	1	-
Townsend's ground squirrel	0	0	0	-	1	1	1	-
Least chipmunk	0	0	0	-	1	1	1	-
Great Basin pocket mouse	1	1	1	-	1	1	1	-
Ord's kangaroo rat	1	1	1	-	1	1	1	-
Deer mouse	0	0	0	-	1	1	1	-
Black-tailed jackrabbit	0	0	0	-	1	1	1	-
Pronghorn	0	0	0	-	1	1	1	-
Total species	5	6	6	-	18	18	17	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Squirreltail								
Horned lark	0	1	1	-	0	1	1	-
Western meadowlark	0	1	1	-	0	1	1	-
Townsend's ground squirrel	0	0	0	-	0	1	1	-
Great Basin pocket mouse	0	1	1	-	0	1	1	-
Ord's kangaroo rat	0	1	1	-	0	1	1	-
Deer mouse	0	1	1	-	0	1	1	-
Black-tailed jackrabbit	0	0	0	-	0	1	1	-
Pronghorn	0	0	0	-	0	1	1	-
Total species	0	5	5	-	0	8	8	-
Black greasewood								
Great Basin spadefoot toad	1	1	1	-	1	1	1	-
Racer	0	0	0	-	1	1	0	-
Gopher snake	1	1	0	-	1	1	0	-
Western rattlesnake	1	1	0	-	1	1	0	-
Turkey vulture	0	0	0	-	1	1	1	-
Northern harrier	0	0	0	-	1	1	0	-
Golden eagle	0	0	0	-	1	1	1	-
California quail	0	0	0	-	1	1	1	-
Common barn-owl	0	0	0	-	1	1	0	-
Western burrowing-owl	0	0	0	-	1	1	0	-
Short-eared owl	1	1	0	-	1	1	0	-
Common nighthawk	0	0	0	-	1	1	1	-
Common raven	0	0	0	-	1	1	1	-
Sage thrasher	0	1	1	-	1	1	0	-
Northern shrike	0	0	0	-	0	1	1	-
Loggerhead shrike	0	1	1	-	1	1	1	-
Brewer's sparrow	0	0	0	-	1	1	1	-
Lark sparrow	1	1	1	-	1	1	0	-
Black-throated sparrow	0	1	1	-	1	1	0	-
Sage sparrow	0	1	1	-	1	1	0	-
Grasshopper sparrow	0	0	0	-	1	1	0	-
White-throated sparrow	0	0	0	-	1	1	1	-
Golden-crowned sparrow	0	0	0	-	1	1	1	-
White-crowned sparrow	0	0	0	-	1	1	1	-
Harris' sparrow	0	0	0	-	1	1	1	-
Red-winged blackbird	0	0	0	-	1	1	0	-
Western meadowlark	1	1	0	-	1	1	0	-
Brewer's blackbird	0	0	0	-	1	1	0	-
Rosy finch	0	0	0	-	1	1	0	-
Common redpoll	0	0	0	-	1	1	0	-
Long-tailed weasel	1	1	1	-	1	1	1	-
Badger	0	0	0	-	1	1	0	-
Coyote	0	0	0	-	1	1	1	-
Antelope ground squirrel	1	1	0	-	1	1	0	-
Great Basin pocket mouse	1	1	0	-	1	1	0	-
Ord's kangaroo rat	1	1	1	-	1	1	0	-
Deer mouse	1	1	0	-	1	1	0	-
Black-tailed jackrabbit	1	1	1	-	1	1	1	-
Total species	12	16	9	-	37	38	16	-
Black sagebrush								
Sagebrush lizard	0	0	0	-	1	1	1	-
Side-blotched lizard	0	1	1	-	1	1	1	-
Racer	0	0	0	-	1	1	1	-
Gopher snake	0	0	0	-	1	1	1	-
Western rattlesnake	0	0	0	-	1	1	1	-
Sage grouse	0	0	0	-	1	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Common nighthawk	1	1	1	-	0	0	0	-
Horned lark	1	1	1	-	1	1	1	-
Sage thrasher	0	0	0	-	1	1	1	-
Sage sparrow	0	0	0	-	1	1	1	-
Townsend's ground squirrel	0	0	0	-	1	1	1	-
Least chipmunk	0	0	0	-	1	1	1	-
Great Basin pocket mouse	0	0	0	-	1	1	0	-
Ord's kangaroo rat	0	0	0	-	1	1	0	-
Deer mouse	0	0	0	-	1	1	1	-
Sagebrush vole	0	0	0	-	1	1	1	-
Black-tailed jackrabbit	0	0	0	-	1	1	1	-
Feral horse	0	0	0	-	1	1	0	-
Pronghorn	0	0	0	-	1	1	1	-
Total species	2	3	3	-	16	18	15	-
Low sagebrush								
Short-horned lizard	1	1	1	0	1	1	1	0
Rubber boa	0	0	0	0	1	1	1	0
Racer	0	0	0	0	1	1	1	0
Striped whipsnake	0	0	0	0	1	1	1	0
Gopher snake	0	0	0	0	1	1	1	0
Turkey vulture	0	0	0	0	1	1	1	1
Northern harrier	0	0	0	0	1	1	1	0
Sharp-shinned hawk	0	0	0	0	0	0	0	1
Cooper's hawk	0	0	0	0	0	0	0	1
Northern goshawk	0	0	0	0	0	0	0	1
Swainson's hawk	0	0	0	0	1	1	1	1
Red-tailed hawk	0	0	0	1	1	1	1	1
Ferruginous hawk	0	0	0	1	1	1	1	1
Golden eagle	0	0	0	0	1	1	0	0
American kestrel	0	0	0	0	1	1	1	1
Prairie falcon	0	0	0	0	1	1	0	0
Chukar	1	1	1	0	1	1	1	0
Sage grouse	0	1	1	0	1	1	1	0
California quail	0	0	0	0	1	1	1	0
Mourning dove	0	0	0	1	1	1	1	0
Flammulated owl	0	0	0	0	1	1	0	1
Western screech-owl	0	0	0	0	1	1	0	1
Great horned owl	0	0	0	1	1	1	0	1
Long-eared owl	0	0	0	0	1	1	0	1
Short-eared owl	0	0	0	0	1	1	0	0
Common nighthawk	1	1	1	0	1	1	1	1
Common poorwill	1	1	1	0	1	1	1	0
White-throated swift	0	0	0	0	1	1	1	1
Vaux's swift	0	0	0	0	1	1	1	1
Broad-tailed hummingbird	0	0	0	0	1	1	0	0
Gray flycatcher	0	0	0	1	0	0	0	1
Horned lark	1	1	1	0	1	1	1	0
Violet-green swallow	0	0	0	0	1	1	1	1
Scrub jay	0	0	0	0	0	0	0	1
Black-billed magpie	0	0	0	1	0	0	0	0
Common raven	0	0	0	0	1	1	1	1
Mountain chickadee	0	0	0	0	0	0	0	1
Plain titmouse	0	0	0	0	0	0	0	1
Bushtit	0	0	0	0	0	0	0	1
Red-breasted nuthatch	0	0	0	0	0	0	0	1
Rock wren	0	0	0	0	1	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Ruby-crowned kinglet	0	0	0	0	0	0	0	1
Golden-crowned kinglet	0	0	0	0	0	0	0	1
Western bluebird	0	0	0	0	0	0	0	1
Mountain bluebird	0	0	0	0	1	1	1	1
Townsend's solitaire	0	0	0	0	0	0	0	1
American robin	0	0	0	0	0	0	0	1
Bohemian waxwing	0	0	0	0	0	0	0	1
Cedar waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	0	0	1
Loggerhead shrike	0	0	0	1	0	0	0	1
Solitary vireo	0	0	0	0	0	0	0	1
Nashville warbler	0	0	0	0	0	0	0	1
Yellow-rumped warbler	0	0	0	0	0	0	0	1
Black-throated gray warbler	0	0	0	0	0	0	0	1
Townsend's warbler	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	0	0	1
Green-tailed towhee	0	0	0	0	1	1	1	1
Chipping sparrow	0	0	0	1	0	0	0	1
Brewer's sparrow	0	1	1	1	1	1	1	0
Vesper sparrow	1	1	1	0	1	1	1	0
Western meadowlark	1	1	0	1	1	1	1	0
Brown-headed cowbird	0	0	0	1	0	0	0	0
Rosy finch	0	0	0	0	1	1	1	0
House finch	0	0	0	1	0	0	0	1
Evening grosbeak	0	0	0	0	0	0	0	1
Ermine	0	0	0	0	1	1	1	0
Long-tailed weasel	0	0	0	0	1	1	1	0
Badger	1	1	0	0	1	1	0	0
Coyote	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	1
Yellow-bellied marmot	0	0	0	0	1	1	1	0
Townsend's ground squirrel	1	1	1	0	1	1	1	0
Golden-mantled ground squirrel	0	0	0	0	1	1	1	0
Least chipmunk	1	1	1	0	1	1	1	1
Great Basin pocket mouse	1	1	1	0	1	1	0	0
Ord's kangaroo rat	1	1	1	0	1	1	0	0
Deer mouse	1	1	1	0	1	1	1	1
Sagebrush vole	1	1	1	0	1	1	1	0
Porcupine	0	0	0	0	1	1	1	1
Black-tailed jackrabbit	0	0	0	0	1	1	1	1
White-tailed jackrabbit	1	1	0	0	1	1	1	0
Nuttall's cottontail	0	0	0	0	1	1	1	0
Pygmy rabbit	0	0	0	0	1	1	1	0
Feral horse	1	1	1	1	1	1	0	0
Rocky Mountain elk	0	0	0	0	1	1	0	0
Mule deer	0	0	0	0	1	1	1	0
Pronghorn	1	1	1	0	1	1	1	0
California bighorn sheep	0	0	0	0	1	1	0	0
Total species	17	19	17	11	61	61	46	51
Mountain big sagebrush								
Short-horned lizard	1	1	0	0	1	1	0	0
Racer	1	1	0	0	1	1	0	0
Striped whipsnake	1	1	0	0	1	1	0	0
Turkey vulture	0	0	0	0	1	1	0	0
Northern harrier	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	0	0	0	0	0	0	1
Cooper's hawk	0	0	0	0	0	0	0	1
Northern goshawk	0	0	0	0	0	0	0	1

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Swainson's hawk	0	0	0	0	1	1	0	0
Red-tailed hawk	0	0	0	1	1	1	0	0
Golden eagle	0	0	0	0	1	1	0	0
American kestrel	0	0	0	0	1	1	0	1
Prairie falcon	0	0	0	0	1	1	0	0
Chukar	0	0	0	0	1	1	0	0
Sage grouse	0	1	1	0	1	1	0	0
Mourning dove	0	0	0	1	1	1	0	0
Great-horned owl	0	0	0	1	1	1	0	1
Short-eared owl	1	1	0	0	1	1	0	0
Common poorwill	1	1	1	1	1	1	0	0
White-throated swift	0	0	0	0	1	1	1	1
Vaux's swift	0	0	0	0	1	1	1	1
Broad-tailed hummingbird	0	0	0	0	1	1	0	0
Williamson's sapsucker	0	0	0	0	0	0	0	1
Northern flicker	0	0	0	0	1	1	1	1
Gray flycatcher	0	0	0	1	0	0	0	1
Horned lark	1	1	0	0	1	1	0	0
Violet-green swallow	0	0	0	0	1	1	1	1
Scrub jay	0	0	0	0	0	0	0	1
Black-billed magpie	0	0	0	1	0	0	0	0
Common raven	0	0	0	0	1	1	1	1
Mountain chickadee	0	0	0	0	0	0	0	1
Plain titmouse	0	0	0	0	0	0	0	1
Red-breasted nuthatch	0	0	0	0	0	0	0	1
Bushtit	0	0	0	1	0	0	0	1
Rock wren	0	0	0	0	1	1	1	1
House wren	0	0	0	0	1	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	0	0	1
Golden-crowned kinglet	0	0	0	0	0	0	0	1
Townsend's solitaire	0	0	0	0	0	0	0	1
American robin	0	0	0	1	0	0	0	0
Bohemian waxwing	0	0	0	0	1	1	0	1
Sage thrasher	0	1	1	1	1	1	0	0
Cedar waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	0	0	1
Loggerhead shrike	0	0	0	1	0	0	0	1
Solitary vireo	0	0	0	0	0	0	0	1
Nashville warbler	0	0	0	0	0	0	0	1
Yellow-rumped warbler	0	0	0	0	0	0	0	1
Black-throated gray warbler	0	0	0	1	0	0	0	1
Townsend's warbler	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	0	0	1
Green-tailed towhee	0	1	1	1	1	1	1	1
Rufous-sided towhee	0	0	0	0	1	1	0	0
Chipping sparrow	0	0	0	1	1	1	0	1
Brewer's sparrow	1	1	1	0	1	1	1	0
Vesper sparrow	1	1	0	0	1	1	0	0
Fox sparrow	0	0	0	0	1	1	0	0
White-throated sparrow	0	0	0	0	1	1	1	0
Golden-crowned sparrow	0	0	0	0	1	1	1	0
White-crowned sparrow	0	1	1	1	1	1	1	0
Harris' sparrow	0	0	0	0	1	1	1	0
Dark-eyed junco	0	0	0	0	1	1	0	0
Western meadowlark	1	1	0	0	1	1	0	0
Brown-headed cowbird	0	0	0	1	0	0	0	0
Rosy finch	0	0	0	0	1	1	1	0
Cassin's finch	0	1	1	1	1	1	0	0
House finch	0	0	0	0	1	1	0	0

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Evening grosbeak	0	0	0	0	0	0	0	1
Ermine	1	1	1	1	1	1	1	1
Long-tailed weasel	1	1	1	0	1	1	1	1
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	0	0	1	1	1	1
Mountain lion	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	0
Yellow-bellied marmot	0	0	0	0	1	1	0	0
Townsend's ground squirrel	0	0	0	0	1	1	0	0
Belding's ground squirrel	0	0	0	0	1	1	0	0
Golden-mantled ground squirrel	0	0	0	0	1	1	0	0
Least chipmunk	1	1	0	0	1	1	0	0
Yellow-pine chipmunk	0	0	0	0	1	1	0	0
Douglas' squirrel	0	0	0	1	0	0	0	1
Northern pocket gopher	1	1	0	0	1	1	0	0
Deer mouse	1	1	1	1	1	1	1	1
Bushy-tailed woodrat	0	0	0	0	1	1	1	1
Long-tailed vole	1	1	0	0	1	1	0	0
Sagebrush vole	1	1	1	0	1	1	1	0
Porcupine	0	0	0	0	1	1	0	1
Pika	0	0	0	0	1	1	0	0
White-tailed jackrabbit	1	1	0	0	1	1	0	0
Nuttall's cottontail	1	1	1	0	1	1	0	0
Rocky Mountain elk	0	0	0	0	1	1	1	0
Mule deer	0	1	1	1	1	1	1	0
Pronghorn	1	1	0	0	1	1	0	0
California bighorn sheep	0	0	0	0	1	1	0	0
Total species	20	26	13	19	67	67	24	44
Big sagebrush-bitterbrush								
Racer	1	1	0	0	1	1	0	0
Striped whipsnake	1	1	0	0	1	1	0	0
Gopher snake	1	1	0	0	1	1	0	0
Red-tailed hawk	0	0	0	1	1	1	0	0
American kestrel	0	0	0	0	1	1	0	1
Sage grouse	0	1	1	0	1	1	0	0
California quail	0	1	1	0	1	1	0	0
Mourning dove	0	0	0	1	1	1	0	0
Great-horned owl	0	0	0	1	0	0	0	1
Common poorwill	1	1	0	0	1	1	0	0
Gray flycatcher	0	0	0	1	0	0	0	1
Horned lark	1	1	0	0	1	1	0	0
Scrub jay	0	0	0	0	0	1	1	1
Mountain chickadee	0	0	0	0	0	0	0	1
Plain titmouse	0	0	0	0	0	0	0	1
Bushtit	0	0	0	1	0	0	0	1
Red-breasted nuthatch	0	0	0	0	0	0	0	1
Ruby-crowned kinglet	0	0	0	0	0	0	0	1
Golden-crowned kinglet	0	0	0	0	0	0	0	1
Townsend's solitaire	0	0	0	0	0	0	0	1
American robin	0	0	0	1	1	1	0	1
Sage thrasher	0	1	1	1	1	1	0	0
Bohemian waxwing	0	0	0	0	0	0	0	1
Cedar waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	0	0	1
Loggerhead shrike	0	0	0	1	0	0	0	1
Solitary vireo	0	0	0	0	0	0	0	1
Nashville warbler	0	0	0	0	0	0	0	1
Yellow-rumped warbler	0	0	0	0	0	0	0	1

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	E-M-L	L	VL	Feeding E-M	E-M-L	L	VL
Black-throated gray warbler	0	0	0	0	0	0	0	1
Townsend's warbler	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	0	0	1
Green-tailed towhee	0	1	1	1	1	1	1	0
Chipping sparrow	0	0	0	1	1	1	0	1
Brewer's sparrow	1	1	1	0	1	1	1	0
Vesper sparrow	1	1	0	0	1	1	0	0
White-throated sparrow	0	0	0	0	1	1	1	0
Golden-crowned sparrow	0	0	0	0	1	1	1	0
White-crowned sparrow	0	1	1	1	1	1	1	0
Harris' sparrow	0	0	0	0	1	1	1	0
Western meadowlark	1	1	0	0	1	1	0	0
Brown-headed cowbird	0	0	0	1	0	0	0	0
House finch	0	0	0	1	1	1	0	0
Evening grosbeak	0	0	0	0	0	0	0	1
Long-tailed weasel	1	1	1	0	1	1	1	1
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	1	0	1	1	1	1
Mountain lion	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	0
Yellow-bellied marmot	0	0	0	0	1	1	0	0
Belding's ground squirrel	0	0	0	0	1	1	0	0
Least chipmunk	1	1	1	1	1	1	1	1
Yellow-pine chipmunk	0	0	0	0	1	1	0	0
Great Basin pocket mouse	1	1	0	0	1	1	0	0
Ord's kangaroo rat	1	1	0	0	1	1	0	0
Deer mouse	1	1	1	1	1	1	1	1
Long-tailed vole	1	1	0	0	1	1	0	0
Porcupine	0	0	0	0	1	1	0	1
White-tailed jackrabbit	1	1	0	0	1	1	0	0
Nuttall's cottontail	1	1	1	0	1	1	1	0
Rocky Mountain elk	0	0	0	0	1	1	1	0
Mule deer	0	1	1	1	1	1	1	0
Pronghorn	0	0	0	0	1	1	0	0
Total species	18	24	12	15	41	43	17	30
Basin big sagebrush								
Great Basin spadefoot toad	0	0	0	-	1	1	1	-
Western toad	0	0	0	-	1	1	1	-
Western fence lizard	1	1	1	-	1	1	1	-
Sagebrush lizard	0	0	0	-	1	1	1	-
Western skink	0	0	0	-	1	1	1	-
Rubber boa	1	1	0	-	1	1	0	-
Racer	0	0	0	-	1	1	0	-
Striped whipsnake	1	1	0	-	1	1	0	-
Gopher snake	1	1	0	-	1	1	0	-
Western rattlesnake	1	1	0	-	1	1	0	-
Green-winged teal	1	1	0	-	0	0	0	-
Mallard	1	1	0	-	0	0	0	-
Northern pintail	1	1	0	-	0	0	0	-
Blue-winged teal	1	1	0	-	0	0	0	-
Cinnamon teal	1	1	0	-	0	0	0	-
Northern shoveler	1	1	0	-	0	0	0	-
Gadwall	1	1	0	-	0	0	0	-
American wigeon	1	1	0	-	0	0	0	-
Turkey vulture	0	0	0	-	1	1	1	-
Northern harrier	1	1	0	-	1	1	0	-
Swainson's hawk	0	0	0	-	1	1	0	-
Red-tailed hawk	0	0	0	-	1	1	0	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Rough-legged hawk	0	0	0	-	1	1	0	-
Golden eagle	0	0	0	-	1	1	0	-
American kestrel	0	0	0	-	1	1	0	-
Prairie falcon	0	0	0	-	1	1	0	-
Sage grouse	0	0	0	-	1	1	0	-
California quail	1	1	1	-	1	1	0	-
Mourning dove	0	1	1	-	1	1	0	-
Common barn-owl	0	0	0	-	1	1	0	-
Great horned owl	0	0	0	-	1	1	0	-
Western burrowing-owl	1	1	0	-	1	1	0	-
Short-eared owl	1	1	0	-	1	1	0	-
Common nighthawk	0	0	0	-	1	1	1	-
Gray flycatcher	0	1	1	-	0	1	1	-
Black-billed magpie	0	0	0	-	1	1	0	-
Common raven	0	0	0	-	1	1	0	-
Bushtit	0	1	1	-	0	1	1	-
Rock wren	0	0	0	-	1	1	0	-
Canyon wren	0	0	0	-	1	1	0	-
American robin	0	0	0	-	1	1	0	-
Sage thrasher	0	1	1	-	1	1	1	-
Northern shrike	0	0	0	-	1	1	1	-
Loggerhead shrike	0	1	1	-	1	1	1	-
Rufous-sided towhee	0	0	0	-	1	1	1	-
Brewer's sparrow	0	1	1	-	1	1	1	-
Vesper sparrow	0	0	0	-	1	1	0	-
Lark sparrow	1	1	1	-	1	1	0	-
Sage sparrow	0	0	0	-	1	1	1	-
Savannah sparrow	1	1	0	-	1	1	0	-
Grasshopper sparrow	0	0	0	-	1	1	0	-
White-throated sparrow	0	0	0	-	1	1	1	-
Golden-crowned sparrow	0	0	0	-	1	1	1	-
White-crowned sparrow	0	0	0	-	1	1	1	-
Harris' sparrow	0	0	0	-	1	1	1	-
Dark-eyed junco	0	0	0	-	1	1	1	-
Red-winged blackbird	1	1	0	-	0	0	0	-
Western meadowlark	1	1	0	-	1	1	0	-
Brewer's blackbird	1	1	0	-	1	1	0	-
Common redpoll	0	0	0	-	1	1	0	-
Vagrant shrew	0	1	1	-	1	1	1	-
Long-tailed weasel	1	1	1	-	1	1	1	-
Badger	1	1	1	-	1	1	1	-
Coyote	1	1	1	-	1	1	1	-
Mountain lion	0	0	0	-	1	1	1	-
Bobcat	0	0	0	-	1	1	1	-
Townsend's ground squirrel	0	0	0	-	1	1	0	-
Belding's ground squirrel	0	0	0	-	1	1	0	-
Least chipmunk	1	1	0	-	1	1	0	-
Northern pocket gopher	1	1	0	-	1	1	0	-
Great Basin pocket mouse	1	1	0	-	1	1	0	-
Ord's kangaroo rat	0	0	0	-	1	1	0	-
Deer mouse	1	1	1	-	1	1	1	-
Desert woodrat	0	0	0	-	1	1	1	-
Bushy-tailed woodrat	0	0	0	-	1	1	1	-
Sagebrush vole	1	1	1	-	1	1	1	-
Black-tailed jackrabbit	1	1	1	-	1	1	1	-
Nuttall's cottontail	1	1	1	-	1	1	1	-
Pygmy rabbit	1	1	1	-	1	1	1	-
Feral horse	0	0	0	-	1	1	0	-
Mule deer	1	1	1	-	1	1	1	-
Total species	35	43	21	-	70	72	35	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	E-M-L	L	VL	Feeding E-M	E-M-L	L	VL
Wheatgrass								
Rubber boa	0	0	0	0	1	1	1	0
Striped whipsnake	0	0	0	0	1	1	1	0
Northern harrier	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	0	0	0	0	0	0	1
Cooper's hawk	0	0	0	0	0	0	0	1
Northern goshawk	0	0	0	0	0	0	0	1
Red-tailed hawk	0	0	0	1	1	1	0	0
Golden eagle	0	0	0	0	1	1	1	1
American kestrel	0	0	0	0	1	1	1	1
Peregrine falcon	0	0	0	0	1	1	1	0
Prairie falcon	0	0	0	0	1	1	1	0
Chukar	1	1	1	0	1	1	1	0
Common barn-owl	0	0	0	0	1	1	1	0
Western screech-owl	0	0	0	0	1	1	1	1
White-throated swift	0	0	0	0	1	1	1	1
Black-chinned hummingbird	0	0	0	0	1	1	1	0
Lewis' woodpecker	0	0	0	0	0	0	0	1
Violet-green swallow	0	0	0	0	1	1	1	1
Scrub jay	0	0	0	0	0	0	0	1
Black-billed magpie	0	0	0	1	1	1	0	0
Mountain chickadee	0	0	0	0	0	0	0	1
Plain titmouse	0	0	0	0	0	0	0	1
Bushtit	0	0	0	0	0	0	0	1
Red-breasted nuthatch	0	0	0	0	0	0	0	1
Rock wren	0	0	0	0	1	1	1	1
Canyon wren	0	0	0	0	1	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	0	0	1
Golden-crowned kinglet	0	0	0	0	0	0	0	1
Mountain bluebird	0	0	0	0	1	1	1	1
Townsend's solitaire	0	0	0	0	0	0	0	1
American robin	0	0	0	0	0	0	0	1
Bohemian waxwing	0	0	0	0	0	0	0	1
Cedar waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	0	0	1
Loggerhead shrike	0	0	0	1	1	1	1	1
Solitary vireo	0	0	0	0	0	0	0	1
Nashville warbler	0	0	0	0	0	0	0	1
Yellow-rumped warbler	0	0	0	0	0	0	0	1
Black-throated gray warbler	0	0	0	0	0	0	0	1
Townsend's warbler	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	0	0	1
Green-tailed towhee	0	1	1	1	1	1	1	1
Vesper sparrow	1	1	1	0	1	1	1	0
Brown-headed cowbird	0	0	0	1	0	0	0	0
Evening grosbeak	0	0	0	0	0	0	0	1
Long-tailed weasel	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	1
Golden-mantled ground squirrel	0	0	0	0	1	1	1	0
Least chipmunk	0	0	0	0	1	1	1	0
Nuttall's cottontail	0	0	0	0	1	1	1	1
Rocky Mountain elk	0	0	0	0	1	1	0	0
Mule deer	0	0	0	0	1	1	1	1
California bighorn sheep	0	0	0	0	1	1	0	0
Total species	2	3	3	5	29	29	24	37
Fescue								
Short-horned lizard	0	1	1	-	1	1	1	-
Striped whipsnake	0	0	0	-	1	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Northern harrier	0	0	0	-	1	1	1	-
Red-tailed hawk	0	0	0	-	1	1	1	-
Golden eagle	0	0	0	-	1	1	1	-
American kestrel	0	0	0	-	1	1	1	-
Prairie falcon	0	0	0	-	1	1	1	-
Sage grouse	0	0	0	-	1	1	1	-
Horned lark	1	1	1	-	1	1	1	-
Green-tailed towhee	0	1	1	-	1	1	1	-
Vesper sparrow	1	1	1	-	1	1	1	-
Savannah sparrow	1	1	0	-	1	1	0	-
White-crowned sparrow	0	1	1	-	0	1	1	-
Western meadowlark	1	1	1	-	1	1	1	-
Ermine	0	0	0	-	1	1	1	-
Badger	0	0	0	-	1	1	1	-
Coyote	0	0	0	-	1	1	1	-
Townsend's ground squirrel	0	0	0	-	1	1	1	-
Montane vole	1	1	0	-	1	1	0	-
Long-tailed vole	1	1	1	-	1	1	1	-
Sagebrush vole	0	1	1	-	0	1	1	-
White-tailed jackrabbit	1	1	1	-	1	1	1	-
Pronghorn	0	0	0	-	1	1	0	-
California bighorn sheep	0	0	0	-	1	1	0	-
Total species	7	11	9	-	22	24	20	-
Mountain shrub								
Western skink	0	0	0	0	0	1	1	1
Northern alligator lizard	0	0	0	0	1	1	1	0
Rubber boa	0	0	0	0	1	1	0	0
Racer	1	1	0	0	1	1	0	0
Striped whipsnake	1	1	1	1	1	1	0	0
Gopher snake	1	1	0	0	1	1	0	0
Turkey vulture	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	0	0	0	0	0	0	1
Cooper's hawk	0	0	0	0	0	0	0	1
Northern goshawk	0	0	0	0	0	0	0	1
Red-tailed hawk	0	0	0	1	1	1	0	0
Golden eagle	0	0	0	0	1	1	0	0
American kestrel	0	0	0	0	0	0	0	1
Mourning dove	0	0	0	1	1	1	0	0
White-throated swift	0	0	0	0	1	1	1	0
Vaux's swift	0	0	0	0	1	1	1	0
Broad-tailed hummingbird	0	0	0	0	1	1	1	0
Northern flicker	0	0	0	0	1	1	0	0
Dusky flycatcher	0	1	1	0	0	1	1	1
Gray flycatcher	0	0	0	1	0	0	0	1
Tree swallow	0	0	0	0	1	1	1	1
Violet-green swallow	0	0	0	0	1	1	1	1
Scrub jay	0	0	0	0	0	0	0	1
Common raven	0	0	0	0	1	1	0	0
Mountain chickadee	0	0	0	0	0	0	0	1
Plain titmouse	0	0	0	0	0	0	0	1
Bushtit	0	0	0	0	0	0	0	1
Red-breasted nuthatch	0	0	0	0	0	0	0	1
Rock wren	0	0	0	0	1	1	0	0
House wren	0	0	0	0	1	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	0	0	1
Golden-crowned kinglet	0	0	0	0	0	0	0	1
Townsend's solitaire	0	0	0	1	1	1	1	1
Hermit thrush	0	0	0	0	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
American robin	0	0	0	0	1	1	0	1
Bohemian waxwing	0	0	0	0	0	0	0	1
Cedar waxwing	0	0	0	0	0	0	0	1
Solitary vireo	0	0	0	0	0	0	0	1
Orange-crowned warbler	0	1	1	0	0	1	1	1
Nashville warbler	0	0	0	0	0	0	0	1
Yellow-rumped warbler	0	0	0	0	0	0	0	1
Black-throated gray warbler	0	0	0	1	0	0	0	1
MacGillivray's warbler	0	0	0	0	1	1	1	1
Townsend's warbler	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	0	0	1
Lazuli bunting	0	0	0	0	1	1	1	1
Green-tailed towhee	1	1	1	1	1	1	1	0
Rufous-sided towhee	0	0	0	0	1	1	1	0
Vesper sparrow	1	1	0	0	1	1	0	0
Fox sparrow	0	1	1	0	1	1	1	0
White-throated sparrow	0	0	0	0	1	1	1	0
Golden-crowned sparrow	0	0	0	0	1	1	1	0
White-crowned sparrow	1	1	1	0	1	1	1	0
Harris' sparrow	0	0	0	0	1	1	1	0
Dark-eyed junco	0	0	0	1	1	1	0	0
Brown-headed cowbird	0	0	0	1	0	0	0	0
Cassin's finch	0	0	0	1	1	1	0	0
Evening grosbeak	0	0	0	0	0	0	0	1
Ermine	1	1	1	1	1	1	1	1
Long-tailed weasel	1	1	0	0	1	1	0	0
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	1	0	1	1	1	1
Mountain lion	0	0	0	0	1	1	1	0
Bobcat	0	0	0	0	1	1	1	0
Yellow-bellied marmot	0	0	0	0	1	1	0	0
Golden-mantled ground squirrel	0	0	0	0	1	1	0	0
Yellow-pine chipmunk	0	0	0	0	1	1	0	0
Douglas' squirrel	0	0	0	0	0	0	0	1
Northern pocket gopher	1	1	0	0	1	1	0	0
Deer mouse	1	1	0	0	1	1	0	0
Long-tailed vole	1	1	0	0	1	1	0	0
Porcupine	0	0	0	0	1	1	0	1
Pika	0	0	0	0	1	1	0	0
Nuttall's cottontail	1	1	1	0	1	1	0	0
Rocky Mountain elk	0	1	1	1	1	1	1	0
Mule deer	0	1	1	1	1	1	1	0
California bighorn sheep	0	0	0	0	1	1	1	0
Total species	15	19	11	13	51	54	28	38
Mountain mahogany								
Western fence lizard	1	1	1	0	1	1	1	0
Western skink	0	1	1	1	1	1	1	1
Northern alligator lizard	1	1	1	1	1	1	1	0
Rubber boa	0	0	0	0	1	1	0	0
Racer	1	1	1	0	1	1	0	0
Striped whipsnake	1	1	1	1	1	1	0	0
Gopher snake	0	0	0	0	1	1	0	0
Turkey vulture	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	0	0	1	0	1	1	1
Cooper's hawk	0	0	0	0	0	1	1	1
Northern goshawk	0	0	0	0	0	1	1	1
Red-tailed hawk	0	0	0	0	1	1	0	0
Ferruginous hawk	0	1	1	1	1	1	0	0

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Mourning dove	1	1	1	1	1	1	0	0
Long-eared owl	0	1	1	1	1	1	1	0
Common poorwill	1	1	0	0	1	1	0	0
White-throated swift	0	0	0	0	1	1	1	1
Vaux's swift	0	0	0	0	1	1	1	1
Olive-sided flycatcher	0	0	0	0	0	1	1	1
Western wood peewee	0	0	0	0	0	1	1	1
Hammond's flycatcher	0	0	0	0	0	1	1	1
Gray flycatcher	1	1	1	0	1	1	1	1
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Horned lark	1	1	0	0	1	1	0	0
Scrub jay	0	1	1	1	1	1	1	1
Black-billed magpie	0	1	1	1	1	1	0	0
Common raven	0	0	0	0	1	1	0	0
Mountain chickadee	0	0	0	0	0	1	1	1
Bushtit	0	1	1	1	1	1	1	1
Red-breasted nuthatch	0	0	0	0	0	1	1	1
Brown creeper	0	0	0	0	0	1	1	1
Rock wren	0	0	0	0	1	1	0	0
Bewick's wren	0	0	0	0	0	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	1	1	1
Golden-crowned kinglet	0	0	0	0	0	1	1	1
Blue-gray gnatcatcher	0	1	1	1	1	1	1	1
Townsend's solitaire	0	0	0	0	1	1	1	1
Hermit thrush	0	0	0	1	0	1	1	1
American robin	1	1	1	0	1	1	0	0
Sage thrasher	1	1	1	0	1	1	0	0
Northern shrike	0	0	0	0	1	1	1	0
Loggerhead shrike	1	1	1	0	1	1	1	0
Solitary vireo	0	0	0	0	0	1	1	1
Orange-crowned warbler	0	0	0	0	0	1	1	1
Nashville warbler	0	0	0	0	0	1	1	1
Yellow-rumped warbler	0	0	0	0	0	1	1	1
Black-throated gray warbler	0	1	1	1	0	1	1	1
Townsend's warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
Western tanager	0	0	0	0	0	1	1	1
Green-tailed towhee	1	1	1	0	1	1	1	0
Rufous-sided towhee	0	1	1	1	1	1	1	1
Chipping sparrow	0	1	1	1	1	1	1	0
Brewer's sparrow	1	1	0	0	1	1	0	0
Vesper sparrow	1	1	0	0	1	1	0	0
White-throated sparrow	0	0	0	0	1	1	0	0
Golden-crowned sparrow	0	0	0	0	1	1	0	0
White-crowned sparrow	0	0	0	0	1	1	0	0
Harris' sparrow	0	0	0	0	1	1	0	0
Dark-eyed junco	0	1	1	1	1	1	1	0
Western meadowlark	1	1	0	0	1	1	0	0
Brown-headed cowbird	0	1	1	0	1	1	1	0
Cassin's finch	0	1	1	1	1	1	1	0
House finch	0	0	0	0	1	1	1	0
Ermine	1	1	1	1	1	1	1	1
Long-tailed weasel	1	1	1	0	1	1	1	1
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	1	0	1	1	1	0
Mountain lion	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	0
Yellow-bellied marmot	0	0	0	0	1	1	0	0
Golden-mantled ground squirrel	0	0	0	0	1	1	1	0

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Least chipmunk	1	1	0	0	1	1	1	0
Yellow-pine chipmunk	0	0	0	0	1	1	1	0
Douglas' squirrel	0	1	1	1	0	1	1	1
Deer mouse	1	1	0	0	1	1	1	0
Bushy-tailed woodrat	0	0	0	1	1	1	1	1
Long-tailed vole	1	1	0	0	1	1	0	0
Porcupine	1	1	1	1	1	1	1	1
Pika	0	0	0	0	1	1	0	0
Nuttall's cottontail	1	1	0	0	1	1	0	0
Rocky Mountain elk	0	1	1	1	1	1	1	0
Mule deer	1	1	1	0	1	1	1	0
California bighorn sheep	0	0	0	0	1	1	0	0
Total species	25	40	30	22	61	84	56	37
Western juniper								
Western fence lizard	1	1	1	0	1	1	1	0
Sagebrush lizard	1	1	1	0	1	1	0	0
Side-blotched lizard	1	1	1	0	1	1	0	0
Short-horned lizard	1	1	0	0	1	1	0	0
Western skink	1	1	1	1	1	1	1	1
Northern alligator lizard	0	0	0	0	1	1	1	0
Rubber boa	0	0	0	0	1	1	0	0
Racer	1	1	1	0	1	1	0	0
Striped whipsnake	1	1	1	1	1	1	0	0
Gopher snake	1	1	0	0	1	1	0	0
Western rattlesnake	0	0	0	0	1	1	0	0
Turkey vulture	0	0	0	0	1	1	0	0
Northern harrier	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	0	0	0	0	1	1	1
Cooper's hawk	0	0	0	0	0	1	1	1
Northern goshawk	0	0	0	0	0	1	1	1
Swainson's hawk	0	0	0	0	1	1	0	0
Red-tailed hawk	0	1	1	1	1	1	0	0
Ferruginous hawk	0	1	1	1	1	1	0	0
American kestrel	0	0	0	1	1	1	0	0
Merlin	0	0	0	0	0	1	1	1
Chukar	1	1	0	0	1	1	0	0
Sage grouse	0	0	0	0	1	1	0	0
Mourning dove	1	1	1	0	1	1	0	0
Flammulated owl	0	0	0	0	1	1	0	0
Western screech-owl	0	0	0	1	1	1	1	1
Great horned owl	0	0	0	0	1	1	0	0
Long-eared owl	0	1	1	1	1	1	1	1
Northern saw-whet owl	0	0	0	0	1	1	1	1
Common nighthawk	1	1	0	0	1	1	1	1
Common poorwill	1	1	0	0	1	1	0	0
White-throated swift	0	0	0	0	1	1	1	1
Vaux's swift	0	0	0	0	1	1	1	1
Lewis' woodpecker	0	0	0	0	0	1	1	1
Williamson's sapsucker	0	0	0	0	0	1	1	1
Hairy woodpecker	0	0	0	0	0	1	1	1
Northern flicker	0	0	0	1	1	1	0	1
Gray flycatcher	1	1	1	1	1	1	1	1
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Ash-throated flycatcher	0	0	0	1	0	1	1	1
Western kingbird	0	0	0	0	0	1	1	1
Violet-green swallow	0	0	0	0	1	1	1	1
Stellar's jay	0	1	1	1	1	1	1	1
Scrub jay	0	1	1	1	1	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Black-billed magpie	0	1	1	1	1	1	0	0
Mountain chickadee	0	0	0	1	0	1	1	1
Plain titmouse	0	0	0	1	0	1	1	1
Bushtit	1	1	1	1	1	1	1	1
Red-breasted nuthatch	0	0	0	0	0	1	1	1
Brown creeper	0	0	0	0	0	1	1	1
Rock wren	0	0	0	0	1	1	1	1
Bewick's wren	0	0	0	1	0	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	1	1	1
Golden-crowned kinglet	0	0	0	0	0	1	1	1
Blue-gray gnatcatcher	0	0	0	0	0	1	1	1
Western bluebird	0	0	0	0	1	1	0	0
Mountain bluebird	0	0	0	1	1	1	1	1
Townsend's solitaire	0	1	1	1	1	1	1	1
Hermit thrush	0	0	0	0	0	1	1	1
American robin	1	1	1	0	1	1	1	1
Sage thrasher	1	1	0	0	1	1	0	0
Bohemian waxwing	0	0	0	0	0	1	1	1
Cedar waxwing	0	0	0	0	0	1	1	1
Northern shrike	0	0	0	0	0	1	1	1
Loggerhead shrike	1	1	1	1	1	1	1	1
Solitary vireo	0	0	0	0	0	1	1	1
Orange-crowned warbler	0	0	0	0	0	1	1	1
Nashville warbler	0	0	0	0	0	1	1	1
Yellow-rumped warbler	0	0	0	0	0	1	1	1
Black-throated gray warbler	0	1	1	1	0	1	1	1
Townsend's warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
Western tanager	0	0	0	0	0	1	1	1
Green-tailed towhee	1	1	0	0	1	1	0	0
Rufous-sided tohwee	0	0	0	0	1	1	0	0
Chipping sparrow	1	1	1	1	1	1	1	1
Brewer's sparrow	1	1	0	0	1	1	0	0
Vesper sparrow	1	1	0	0	1	1	0	0
Lark sparrow	1	1	1	0	1	1	0	0
Dark-eyed junco	0	1	1	1	0	1	1	1
Western meadowlark	1	1	0	0	1	1	0	0
Brown-headed cowbird	1	1	1	1	1	1	0	0
House finch	0	1	1	0	1	1	0	0
Evening grosbeak	0	0	0	0	0	1	1	1
Long-tailed weasel	1	1	1	0	1	1	1	1
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	0	0	1	1	0	0
Mountain lion	0	0	0	0	1	1	1	1
Yellow-bellied marmot	0	0	0	0	1	1	0	0
Townsend's ground squirrel	1	1	0	0	1	1	0	0
Golden-mantled ground squirrel	0	0	0	0	1	1	0	0
Least chipmunk	1	1	0	0	1	1	0	0
Great Basin pocket mouse	1	1	0	0	1	1	0	0
Deer mouse	1	1	1	1	1	1	1	0
Bushy-tailed woodrat	0	0	0	1	1	1	1	1
Long-tailed vole	1	1	0	0	1	1	0	0
Sagebrush vole	1	1	0	0	1	1	0	0
Porcupine	0	1	1	1	1	1	1	1
White-tailed jackrabbit	1	1	0	0	1	1	0	0
Nuttall's cottontail	1	1	0	0	1	1	0	0
Feral horse	1	1	0	0	1	1	0	0
Rocky Mountain elk	0	0	0	0	1	1	0	0
Mule deer	0	0	0	0	1	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Pronghorn	1	1	0	0	1	1	0	0
California bighorn sheep	0	0	0	0	1	1	0	0
Total species	37	48	27	27	73	105	58	56
Ponderosa pine								
Western skink	0	1	1	1	0	1	1	1
Rubber boa	1	1	1	1	1	1	0	0
Racer	0	0	0	0	1	1	0	0
Striped whipsnake	1	1	1	0	1	1	0	0
Gopher snake	0	0	0	0	1	1	0	0
Turkey vulture	0	0	0	0	1	1	0	0
Northern harrier	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	1	1	1	1	1	1	1
Cooper's hawk	0	1	1	1	0	1	1	1
Northern goshawk	0	1	1	1	0	1	1	1
Red-tailed hawk	0	1	1	1	1	1	0	0
American kestrel	0	0	0	1	1	1	0	0
Mourning dove	1	1	0	0	1	1	0	0
Flammulated owl	0	0	0	0	1	1	1	1
Great horned owl	0	1	1	1	1	1	0	0
Northern saw-whet owl	0	0	0	0	1	1	1	1
Common poorwill	1	1	0	0	1	1	0	0
Calliope hummingbird	0	1	1	1	1	1	0	0
Lewis' woodpecker	0	0	0	1	0	1	1	1
Williamson's sapsucker	0	0	0	0	0	1	1	1
Hairy woodpecker	0	0	0	1	0	1	1	1
Northern flicker	0	0	0	1	1	1	1	1
Olive-sided flycatcher	0	1	1	1	0	1	1	1
Western wood peewee	0	0	0	0	0	1	1	1
Hammond's flycatcher	0	0	0	0	0	1	1	1
Gray flycatcher	1	1	0	0	1	1	0	0
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Stellar's jay	0	1	1	1	1	1	1	1
Clark's nutcracker	0	0	0	0	0	1	1	1
Black-capped chickadee	0	0	0	0	0	1	1	1
Mountain chickadee	0	0	0	1	1	1	1	1
Red-breasted nuthatch	0	0	0	1	0	1	1	1
White-breasted nuthatch	0	0	0	0	0	1	1	1
Pygmy nuthatch	0	0	0	1	0	1	1	1
Brown creeper	0	0	0	0	0	1	1	1
House wren	0	0	0	1	1	1	1	1
Ruby-crowned kinglet	0	1	1	1	1	1	1	1
Golden-crowned kinglet	0	0	0	0	1	1	1	1
Western bluebird	0	0	0	1	1	1	0	0
Mountain bluebird	0	0	0	1	1	1	0	0
Townsend's solitaire	0	0	0	0	1	1	1	1
Hermit thrush	0	0	0	0	0	1	1	1
American robin	1	1	1	0	1	1	0	0
Varied thrush	0	0	0	0	0	1	1	1
European starling	0	0	0	1	1	1	0	0
Solitary vireo	0	1	1	1	0	1	1	1
Orange-crowned warbler	0	0	0	0	0	1	1	1
Nashville warbler	0	0	0	0	0	1	1	1
Yellow-rumped warbler	0	1	1	1	0	1	1	1
Black-throated gray warbler	0	0	0	0	0	1	1	1
Townsend's warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
Western tanager	0	1	1	1	0	1	1	1
Green-tailed towhee	1	1	0	0	1	1	0	0

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Rufous-sided towhee	0	0	0	0	1	1	0	0
Chipping sparrow	1	1	1	0	1	1	1	0
Brewer's sparrow	1	1	0	0	1	1	0	0
Vesper sparrow	1	1	0	0	1	1	0	0
White-throated sparrow	0	0	0	0	1	1	0	0
Golden-crowned sparrow	0	0	0	0	1	1	0	0
White-crowned sparrow	1	1	0	0	1	1	0	0
Dark-eyed junco	1	1	1	0	1	1	0	0
Western meadowlark	0	0	0	0	1	1	0	0
Brown-headed cowbird	1	1	1	1	1	1	0	0
Pine grosbeak	0	0	0	0	0	1	1	1
Cassin's finch	1	1	1	1	1	1	1	1
Red crossbill	0	1	1	1	0	1	1	1
Pine siskin	0	1	1	1	0	1	1	1
Evening grosbeak	0	0	0	0	0	1	1	1
Vagrant shrew	0	1	1	1	1	1	1	1
Long-tailed weasel	1	1	1	1	1	1	1	1
Badger	1	1	0	0	1	1	0	0
Coyote	1	1	0	0	1	1	0	0
Mountain lion	0	0	0	0	1	1	0	0
Golden-mantled ground squirrel	0	0	0	1	1	1	1	1
Yellow-pine chipmunk	1	1	1	1	1	1	1	1
Douglas' squirrel	0	0	0	1	0	1	1	1
Northern pocket gopher	1	1	0	0	1	1	0	0
Deer mouse	1	1	0	0	1	1	1	1
Bushy-tailed woodrat	0	0	0	1	1	1	1	1
Porcupine	0	1	1	1	1	1	1	1
White-tailed jackrabbit	1	1	0	0	1	1	0	0
Nuttall's cottontail	1	1	0	0	1	1	0	0
Rocky Mountain elk	0	1	1	1	1	1	0	0
Mule deer	1	1	0	0	1	1	0	0
Total species	26	41	27	35	54	85	50	49
White fir								
Rubber boa	1	1	1	1	1	1	0	0
Racer	0	0	0	0	1	1	0	0
Striped whipsnake	1	1	1	1	1	1	0	0
Gopher snake	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	1	1	1	1	1	1	1
Cooper's hawk	0	1	1	1	1	1	1	1
Northern goshawk	0	1	1	1	0	1	1	1
Red-tailed hawk	0	1	1	1	1	1	0	0
Merlin	0	0	0	0	1	1	1	1
Northern saw-whet owl	0	0	0	1	1	1	1	1
Vaux's swift	0	0	0	0	1	1	1	1
Lewis' woodpecker	0	0	0	0	0	1	1	1
Williamson's sapsucker	0	0	0	0	0	1	1	1
Hairy woodpecker	0	0	0	1	0	1	1	1
Northern flicker	0	0	0	1	1	1	0	1
Olive-sided flycatcher	0	1	1	1	0	1	1	1
Western wood peewee	0	0	0	0	0	1	1	1
Hammond's flycatcher	0	0	0	0	0	1	1	1
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Stellar's jay	0	1	1	1	0	1	1	1
American crow	0	1	1	1	0	0	0	0
Mountain chickadee	0	0	0	1	1	1	1	1
Red-breasted nuthatch	0	0	0	1	0	1	1	1
White-breasted nuthatch	0	0	0	0	0	1	1	1
Brown creeper	0	0	0	0	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Succession stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
House wren	0	0	0	0	1	1	1	1
Winter wren	0	0	0	1	0	1	1	1
Ruby-crowned kinglet	0	1	1	1	1	1	1	1
Golden-crowned kinglet	0	0	0	0	1	1	1	1
Mountain bluebird	0	0	0	0	1	1	0	0
Townsend's solitaire	0	1	1	1	1	1	1	1
Hermit thrush	0	1	1	1	0	1	1	1
American robin	1	1	0	0	1	1	0	0
Varied thrush	0	0	0	0	0	1	1	1
Solitary vireo	0	1	1	1	0	1	1	1
Orange-crowned warbler	0	0	0	0	0	1	1	1
Nashville warbler	0	1	1	1	0	1	1	1
Yellow-rumped warbler	0	1	1	1	0	1	1	1
Black-throated gray warbler	1	1	0	0	1	1	1	1
Townsend's warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
Western tanager	0	1	1	1	0	1	1	1
Green-tailed towhee	1	1	0	0	1	1	0	0
Rufous-sided towhee	0	0	0	0	1	1	0	0
Chipping sparrow	0	0	0	0	1	1	0	0
Fox sparrow	0	0	0	0	1	1	0	0
White-throated sparrow	0	0	0	0	1	1	0	0
Golden-crowned sparrow	0	0	0	0	1	1	0	0
White-crowned sparrow	1	1	0	0	1	1	0	0
Dark-eyed junco	1	1	1	0	1	1	0	0
Brown-headed cowbird	1	1	1	0	1	1	0	0
Pine grosbeak	0	0	0	0	0	1	1	1
Cassin's finch	1	1	1	1	1	1	1	1
Red crossbill	0	1	1	0	0	1	1	1
Pine siskin	0	1	1	0	0	1	1	1
Evening grosbeak	0	0	0	0	0	1	1	1
Ermine	1	1	1	0	1	1	0	0
Coyote	1	1	0	0	1	1	0	0
Golden-mantled ground squirrel	0	0	0	0	1	1	1	1
Yellow-pine chipmunk	0	1	1	1	1	1	1	1
Douglas' squirrel	0	0	0	1	0	1	1	1
Northern pocket gopher	1	1	0	0	1	1	0	0
Deer mouse	1	1	1	0	1	1	0	0
Bushy-tailed woodrat	0	0	0	1	1	1	1	1
Porcupine	0	1	1	1	1	1	1	1
Nuttall's cottontail	1	1	0	0	1	1	0	0
Rocky Mountain elk	1	1	1	1	1	1	0	0
Mule deer	1	1	0	0	1	1	0	0
Total species	16	33	26	23	40	67	43	44
Terrestrial non-vegetated								
Western fence lizard	1	-	-	-	1	-	-	-
Western skink	1	-	-	-	1	-	-	-
Northern alligator lizard	1	-	-	-	1	-	-	-
Rubber boa	1	-	-	-	1	-	-	-
Racer	1	-	-	-	1	-	-	-
Striped whipsnake	1	-	-	-	1	-	-	-
Gopher snake	1	-	-	-	1	-	-	-
Western rattlesnake	1	-	-	-	1	-	-	-
Turkey vulture	1	-	-	-	0	-	-	-
Golden eagle	1	-	-	-	1	-	-	-
American kestrel	1	-	-	-	1	-	-	-
Peregrine falcon	0	-	-	-	1	-	-	-
Prairie falcon	1	-	-	-	1	-	-	-

Table H-5. (Continued)

Vegetation type and wildlife species	Succession/Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Chukar	1	-	-	-	1	-	-	-
Common barn-owl	1	-	-	-	0	-	-	-
Great horned owl	1	-	-	-	0	-	-	-
White-throated swift	1	-	-	-	1	-	-	-
Vaux's swift	1	-	-	-	1	-	-	-
Say's phoebe	1	-	-	-	1	-	-	-
Violet-green swallow	1	-	-	-	1	-	-	-
Cliff swallow	1	-	-	-	0	-	-	-
Barn swallow	1	-	-	-	0	-	-	-
Common raven	1	-	-	-	1	-	-	-
Rock wren	1	-	-	-	1	-	-	-
Canyon wren	1	-	-	-	1	-	-	-
Raccoon	1	-	-	-	0	-	-	-
Ermine	1	-	-	-	1	-	-	-
Long-tailed weasel	1	-	-	-	1	-	-	-
Striped skunk	1	-	-	-	1	-	-	-
Coyote	1	-	-	-	0	-	-	-
Mountain lion	1	-	-	-	1	-	-	-
Bobcat	1	-	-	-	1	-	-	-
Yellow-bellied marmot	1	-	-	-	1	-	-	-
Golden mantled ground squirrel	1	-	-	-	1	-	-	-
Desert woodrat	1	-	-	-	1	-	-	-
Bushy-tailed woodrat	1	-	-	-	1	-	-	-
Porcupine	1	-	-	-	0	-	-	-
Pika	1	-	-	-	1	-	-	-
Nuttall's cottontail	1	-	-	-	0	-	-	-
California bighorn sheep	1	-	-	-	0	-	-	-
Total species	37	-	-	-	30	-	-	-
Quaking aspen								
Pacific tree frog	0	0	0	0	0	1	1	1
Western skink	0	0	0	0	0	0	0	1
Northern alligator lizard	0	0	0	0	0	1	1	1
Rubber boa	0	1	1	1	1	1	1	1
Racer	0	0	0	0	1	1	1	0
Striped whipsnake	0	0	0	0	1	1	1	1
Gopher snake	0	0	0	0	1	1	1	0
Turkey vulture	0	0	0	0	1	1	1	0
Northern harrier	0	0	0	0	1	1	1	0
Sharp-shinned hawk	0	0	0	0	0	1	1	1
Cooper's hawk	0	0	0	1	0	1	1	1
Northern goshawk	0	0	0	1	0	1	1	1
Swainson's hawk	0	0	0	0	1	1	1	0
Red-tailed hawk	0	1	1	1	1	1	1	0
American kestrel	0	1	1	1	1	1	1	1
Merlin	0	0	0	0	0	1	1	1
Sage grouse	0	0	0	0	1	1	0	0
Mourning dove	0	0	0	1	1	1	1	0
Yellow-billed cuckoo	0	0	0	0	0	0	0	1
Flammulated owl	0	0	0	0	1	1	1	1
Great horned owl	0	1	1	1	1	1	1	0
Long-eared owl	0	0	0	1	1	1	1	1
Northern saw-whet owl	0	0	0	0	1	1	1	1
Common poorwill	0	0	0	0	1	1	1	0
Calliope hummingbird	0	0	0	0	0	1	1	1
Broad-tailed hummingbird	0	0	0	0	0	1	1	1
Rufous hummingbird	0	0	0	0	0	1	1	1
Belted kingfisher	0	0	0	0	0	0	0	1
Lewis' woodpecker	0	0	0	0	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Red-naped sapsucker	0	0	0	1	0	1	1	1
Red-breasted sapsucker	0	0	0	1	0	1	1	1
Downy woodpecker	0	0	0	1	0	1	1	1
Hairy woodpecker	0	0	0	1	0	1	1	1
Northern flicker	0	1	1	1	1	1	1	1
Olive-sided flycatcher	0	0	0	0	0	1	1	1
Western wood peewee	0	0	0	1	0	1	1	1
Willow flycatcher	0	0	0	0	0	1	1	1
Least flycatcher	0	0	0	0	0	1	1	1
Hammond's flycatcher	0	0	0	0	0	1	1	1
Dusky flycatcher	0	1	1	1	0	1	1	1
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Tree swallow	0	0	0	1	1	1	1	1
Violet-green swallow	0	0	0	0	1	1	1	1
Black-billed magpie	0	1	1	0	1	1	1	0
Mountain chickadee	0	0	0	1	0	1	1	1
Bushtit	0	0	0	0	0	1	1	0
Red-breasted nuthatch	0	0	0	1	0	1	1	1
White-breasted nuthatch	0	0	0	0	0	0	0	1
Pygmy nuthatch	0	0	0	1	0	1	1	1
House wren	0	1	1	1	0	1	1	1
Ruby-crowned kinglet	0	0	0	0	0	1	1	1
Golden-crowned kinglet	0	0	0	0	0	1	1	1
Mountain bluebird	0	0	0	1	1	1	1	0
Veery	0	0	0	0	0	0	0	1
Swainson's thrush	0	0	0	1	0	0	0	1
Hermit thrush	0	0	0	0	0	0	0	1
American robin	0	1	1	1	1	1	1	1
Varied thrush	0	0	0	0	0	1	1	1
European starling	0	1	1	1	1	1	1	0
Solitary vireo	0	0	0	1	0	1	1	1
Warbling vireo	0	1	1	1	0	1	1	1
Red-eyed vireo	0	0	0	0	0	0	0	1
Orange-crowned warbler	0	0	0	1	0	1	1	1
Nashville warbler	0	0	0	0	0	1	1	1
Yellow warbler	0	1	1	1	0	1	1	1
Yellow-rumped warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
American redstart	0	0	0	0	0	1	1	1
Ovenbird	0	0	0	0	0	0	0	1
MacGillivray's warbler	0	0	0	1	0	0	0	1
Wilson's warbler	0	0	0	0	0	1	1	1
Western tanager	0	0	0	1	0	1	1	1
Rose-breasted grosbeak	0	0	0	0	0	0	0	1
Black-headed grosbeak	0	0	0	1	0	1	1	1
Lazuli bunting	0	0	0	0	0	1	1	1
Green-tailed towhee	0	0	0	0	0	1	1	0
Rufous-sided towhee	0	0	0	0	0	1	1	1
Fox sparrow	0	0	0	1	0	1	1	1
White-throated sparrow	0	0	0	0	1	1	1	1
Golden-crowned sparrow	0	0	0	0	1	1	1	1
White-crowned sparrow	1	1	1	0	1	1	1	1
Harris' sparrow	0	0	0	0	1	1	1	1
Dark-eyed junco	0	0	0	1	0	1	1	1
Western meadowlark	0	0	0	0	1	1	1	0
Brewer's blackbird	1	1	1	0	1	1	1	0
Brown-headed cowbird	0	1	1	1	1	1	1	0
Northern oriole	0	0	0	1	0	1	1	1
Cassin's finch	0	1	1	1	1	1	1	0

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Water shrew	0	0	0	1	0	1	1	1
Vagrant shrew	0	0	0	1	1	1	1	1
Ermine	0	1	1	1	1	1	1	0
Long-tailed weasel	1	1	1	1	1	1	1	1
Mink	0	0	0	0	0	0	0	1
Badger	1	1	1	0	1	1	1	0
Coyote	0	0	0	0	1	1	1	1
Mountain lion	0	0	0	0	0	1	1	1
Bobcat	0	0	0	0	0	1	1	0
Belding's ground squirrel	1	1	1	0	1	1	1	0
Least chipmunk	1	1	0	0	1	1	0	0
Yellow-pine chipmunk	0	0	0	1	0	1	1	1
Northern pocket gopher	1	1	1	1	1	1	1	1
Beaver	0	0	0	1	0	0	0	1
Deer mouse	1	1	1	1	1	1	1	0
Bushy-tailed woodrat	0	0	0	1	0	1	1	1
Montane vole	1	1	1	0	1	1	1	0
Long-tailed vole	1	1	1	1	1	1	1	1
Sagebrush vole	0	0	0	0	1	1	0	0
Western jumping mouse	0	0	0	1	0	1	1	1
Porcupine	0	0	0	0	1	1	1	0
Nuttall's cottontail	0	1	1	1	1	1	1	0
Rocky Mountain elk	0	0	0	1	0	1	1	1
Mule deer	0	1	1	1	0	1	1	1
Total species	10	27	26	50	45	99	96	83
Mixed deciduous shrub								
Western toad	0	0	0	0	0	1	1	1
Western fence lizard	0	0	0	1	0	1	1	1
Western skink	0	0	0	0	0	1	1	1
Northern alligator lizard	0	0	0	1	0	1	1	1
Rubber boa	0	1	1	1	1	1	1	1
Racer	0	0	0	0	1	1	1	1
Striped whipsnake	0	0	0	0	1	1	1	1
Gopher snake	0	0	0	0	1	1	1	1
Western terrestrial garter snake	1	1	1	1	1	1	1	1
Western rattlesnake	0	0	0	0	1	1	1	1
Turkey vulture	0	0	0	0	1	1	0	0
Sharp-shinned hawk	0	0	0	1	0	1	1	1
Cooper's hawk	0	0	0	1	0	1	1	1
Northern goshawk	0	0	0	0	0	1	1	1
American kestrel	0	0	0	0	1	1	1	0
Merlin	0	0	0	0	0	1	1	1
Prairie falcon	0	0	0	0	1	1	1	0
Chukar	0	0	0	0	1	1	1	1
California quail	0	0	0	0	1	1	1	1
Yellow-billed cuckoo	0	0	0	0	0	0	0	1
Great horned owl	0	0	0	0	1	1	1	0
Northern saw-whet owl	0	0	0	0	0	1	1	1
Common nighthawk	0	0	0	0	1	1	1	1
White-throated swift	0	0	0	0	1	1	1	1
Vaux's swift	0	0	0	0	1	1	1	1
Black-chinned hummingbird	0	0	0	0	0	1	1	1
Calliope hummingbird	0	0	0	1	0	1	1	1
Broad-tailed hummingbird	0	0	0	0	0	1	1	1
Rufous hummingbird	0	0	0	0	0	1	1	1
Lewis' woodpecker	0	0	0	0	0	1	1	1
Downy woodpecker	0	0	0	1	0	1	1	1
Hairy woodpecker	0	0	0	0	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Northern flicker	0	0	0	0	1	1	1	1
Olive-sided flycatcher	0	0	0	0	0	1	1	1
Western wood peewee	0	0	0	0	0	1	1	1
Willow flycatcher	0	0	0	0	0	1	1	1
Least flycatcher	0	0	0	0	0	1	1	1
Hammond's flycatcher	0	0	0	0	0	1	1	1
Dusky flycatcher	0	0	0	0	0	1	1	1
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Tree swallow	0	0	0	0	1	1	1	1
Violet-green swallow	0	0	0	0	1	1	1	1
Cliff swallow	0	0	0	0	1	1	1	1
Stellar's jay	0	0	0	0	0	0	0	1
Scrub jay	0	0	0	1	0	1	1	1
Black-billed magpie	0	1	1	1	1	1	1	0
Black-capped chickadee	0	0	0	0	0	1	1	1
Mountain chickadee	0	0	0	0	0	1	1	1
Bushtit	0	0	0	0	1	1	1	1
Red-breasted nuthatch	0	0	0	0	0	1	1	1
White-breasted nuthatch	0	0	0	0	0	0	0	1
Brown creeper	0	0	0	0	0	0	0	1
Bewick's wren	0	0	0	1	0	1	1	1
House wren	0	0	0	0	0	1	1	1
Winter wren	0	0	0	0	0	0	0	1
American dipper	1	1	1	1	0	0	0	0
Ruby-crowned kinglet	0	0	0	0	0	1	1	1
Golden-crowned kinglet	0	0	0	0	0	1	1	1
Townsend's solitaire	0	0	0	0	0	1	1	1
Veery	0	0	0	0	0	0	0	1
Swainson's thrush	0	0	0	0	0	0	0	1
Hermit thrush	0	0	0	0	0	0	0	1
American robin	0	1	1	1	1	1	1	1
Varied thrush	0	0	0	0	0	1	1	1
Gray catbird	0	0	0	0	0	0	0	1
Sage thrasher	1	1	0	0	0	0	0	0
Bohemian waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	1	1	1
European starling	0	0	0	0	1	1	1	0
Solitary vireo	0	0	0	1	0	1	1	1
Warbling vireo	0	0	0	0	0	1	1	1
Red-eyed vireo	0	0	0	0	0	0	0	1
Orange-crowned warbler	0	0	0	1	0	1	1	1
Nashville warbler	0	0	0	1	0	1	1	1
Yellow-rumped warbler	0	0	0	0	0	1	1	1
Black-throated gray warbler	0	0	0	0	0	1	1	1
Townsend's warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
American redstart	0	0	0	0	0	1	1	1
Ovenbird	0	0	0	0	0	0	0	1
Northern waterthrush	0	0	0	0	0	0	0	1
MacGillivray's warbler	0	0	0	1	0	0	0	1
Common yellowthroat	0	0	0	0	0	0	0	1
Wilson's warbler	0	0	0	0	0	1	1	1
Yellow-breasted chat	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	1	1	1
Rose-breasted grosbeak	0	0	0	0	0	0	0	1
Black-headed grosbeak	0	0	0	1	0	0	0	1
Lazuli bunting	0	0	0	1	0	1	1	1
Green-tailed towhee	0	0	0	0	1	1	1	0
Rufous-sided towhee	0	0	0	1	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Fox sparrow	0	0	0	0	0	1	1	1
Song sparrow	0	0	0	0	0	1	1	1
Lincoln's sparrow	0	0	0	0	0	0	0	1
White-throated sparrow	0	0	0	0	1	1	1	1
Golden-crowned sparrow	0	0	0	0	1	1	1	1
White-crowned sparrow	0	0	0	0	1	1	1	1
Harris' sparrow	0	0	0	0	1	1	1	1
Dark-eyed junco	0	0	0	0	1	1	1	1
Brown-headed cowbird	0	0	0	1	1	1	1	0
Northern oriole	0	0	0	0	0	1	1	1
Common redpoll	0	0	0	0	0	0	0	1
Evening grosbeak	0	0	0	0	0	0	0	1
Water shrew	0	0	0	1	0	1	1	1
Vagrant shrew	0	0	0	1	1	1	1	1
Preble's shrew	0	0	0	1	1	1	1	1
Raccoon	0	0	0	0	0	1	1	1
Ermine	0	1	1	1	1	1	1	1
Long-tailed weasel	1	1	1	1	1	1	1	1
Striped skunk	0	0	0	0	0	1	1	1
Mountain lion	0	0	0	0	0	1	1	1
Bobcat	0	0	0	0	1	1	1	1
Golden-mantled ground squirrel	0	0	0	0	1	1	1	1
Yellow-pine chipmunk	0	0	0	1	0	1	1	1
Northern pocket gopher	1	1	1	1	1	1	1	1
Beaver	0	0	0	1	0	0	1	1
Deer mouse	1	1	1	1	1	1	1	0
Bushy-tailed woodrat	0	0	0	1	0	1	1	1
Long-tailed vole	0	1	1	1	1	1	1	1
Western jumping mouse	0	0	0	1	0	1	1	1
Porcupine	0	0	0	0	1	1	1	1
Nuttall's cottontail	0	1	1	1	1	1	1	0
Rocky Mountain elk	0	0	0	0	0	1	1	1
Mule deer	0	0	0	1	0	1	1	1
California bighorn sheep	0	0	0	0	0	1	1	0
Total species	6	12	11	34	42	102	101	112
Willow								
Western toad	0	0	0	0	0	1	1	1
Pacific tree frog	0	1	1	1	1	1	1	1
Western skink	0	0	0	0	0	1	1	1
Northern alligator lizard	0	0	0	0	0	1	1	1
Rubber boa	0	0	0	0	1	1	1	1
Racer	0	0	0	0	1	1	1	0
Striped whipsnake	0	0	0	0	1	1	1	1
Gopher snake	0	0	0	0	1	1	1	1
Western terrestrial garter snake	0	1	1	1	1	1	1	1
Turkey vulture	0	0	0	0	1	1	1	0
Northern harrier	1	1	1	0	1	1	1	0
Swainson's hawk	0	0	0	0	1	1	1	0
Red-tailed hawk	0	0	0	0	1	1	1	0
Sharp-shinned hawk	0	0	0	1	0	1	1	1
Cooper's hawk	0	0	0	0	0	1	1	1
Northern goshawk	0	0	0	0	0	0	0	1
American kestrel	0	0	0	0	1	1	1	0
Merlin	0	0	0	0	0	1	1	1
Prairie falcon	0	0	0	0	1	1	1	0
Sage grouse	0	0	0	0	1	1	1	0
California quail	0	0	0	0	1	1	1	1
Common snipe	0	1	1	1	1	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Yellow-billed cuckoo	0	0	0	0	0	0	0	1
Mourning dove	0	1	1	1	1	1	1	0
Flammulated owl	0	0	0	0	0	1	1	1
Great horned owl	0	0	0	0	1	1	1	0
Short-eared owl	1	1	0	0	1	1	1	0
Northern saw-whet owl	0	0	0	0	0	1	1	1
Common nighthawk	0	0	0	0	1	1	1	1
Common poorwill	0	0	0	0	1	1	0	0
Black-chinned hummingbird	0	0	0	0	0	1	1	1
Calliope hummingbird	0	0	0	1	0	1	1	1
Broad-tailed hummingbird	0	0	0	1	0	1	1	1
Rufous hummingbird	0	0	0	0	0	1	1	1
Belted kingfisher	0	0	0	0	0	0	0	1
Red-naped sapsucker	0	0	0	0	0	1	1	1
Red-breasted sapsucker	0	0	0	0	0	1	1	1
Downy woodpecker	0	0	0	1	0	1	1	1
Hairy woodpecker	0	0	0	0	0	1	1	1
Northern flicker	0	0	0	1	0	1	1	1
Olive-sided flycatcher	0	0	0	0	0	1	1	1
Western wood peewee	0	0	0	0	0	1	1	1
Willow flycatcher	0	0	0	0	0	1	1	1
Least flycatcher	0	0	0	0	0	1	1	1
Eastern kingbird	0	0	0	0	0	1	1	1
Hammond's flycatcher	0	0	0	0	0	1	1	1
Dusky flycatcher	0	0	0	0	0	1	1	1
Cordilleran flycatcher	0	0	0	0	0	1	1	1
Western kingbird	0	1	1	1	0	1	1	1
Tree swallow	0	0	0	0	1	1	1	1
Violet-green swallow	0	0	0	0	1	1	1	1
Rough-winged swallow	0	0	0	0	1	1	1	1
Bank swallow	0	0	0	0	1	1	1	1
Cliff swallow	0	0	0	0	1	1	1	1
Barn swallow	0	0	0	0	1	1	1	1
Scrub jay	0	0	0	0	0	1	1	1
Black-billed magpie	0	1	1	0	1	1	1	0
American crow	0	0	0	0	1	1	1	0
Common raven	0	0	0	0	1	1	1	0
Black-capped chickadee	0	0	0	0	0	0	0	1
Mountain chickadee	0	0	0	0	0	1	1	1
Bushtit	0	0	0	0	0	1	1	1
Red-breasted nuthatch	0	0	0	0	0	1	1	1
Brown creeper	0	0	0	0	0	0	0	1
Bewick's wren	0	0	0	0	0	1	1	1
House wren	0	0	0	1	0	1	1	1
Winter wren	0	0	0	0	0	0	0	1
Marsh wren	0	0	0	0	0	0	0	1
Ruby-crowned kinglet	0	0	0	0	0	1	1	1
Golden-crowned kinglet	0	0	0	0	0	1	1	1
Western bluebird	0	0	0	0	1	1	1	0
Mountain bluebird	0	0	0	0	1	1	1	0
Veery	0	0	0	0	0	0	0	1
Swainson's thrush	0	0	0	1	0	0	0	1
Hermit thrush	0	0	0	0	0	0	0	1
American robin	0	1	1	1	1	1	1	1
Varied thrush	0	0	0	0	0	1	1	1
Gray catbird	0	0	0	0	0	0	0	1
Sage thrasher	1	1	0	0	1	1	0	0
Bohemian waxwing	0	0	0	0	0	0	0	1
Northern shrike	0	0	0	0	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	E-M-L	L	VL	Feeding E-M	E-M-L	L	VL
European starling	0	0	0	0	1	1	1	0
Solitary vireo	0	0	0	0	0	1	1	1
Warbling vireo	0	0	0	0	0	1	1	1
Red-eyed vireo	0	0	0	0	0	0	0	1
Orange-crowned warbler	0	0	0	0	0	1	1	1
Nashville warbler	0	0	0	0	0	1	1	1
Yellow warbler	0	0	0	1	0	1	1	1
Yellow-rumped warbler	0	0	0	0	0	1	1	1
Black-throated gray warbler	0	0	0	0	0	1	1	1
Townsend's warbler	0	0	0	0	0	1	1	1
Black-and-white warbler	0	0	0	0	0	1	1	1
American redstart	0	0	0	0	0	1	1	1
Ovenbird	0	0	0	0	0	0	0	1
Northern waterthrush	0	0	0	0	0	0	0	1
MacGillivray's warbler	0	0	0	1	0	0	0	1
Common yellowthroat	0	0	0	0	0	0	0	1
Wilson's warbler	0	0	0	0	0	1	1	1
Yellow-breasted chat	0	0	0	0	0	0	0	1
Western tanager	0	0	0	0	0	1	1	1
Rose-breasted grosbeak	0	0	0	0	0	0	0	1
Black-headed grosbeak	0	0	0	1	0	0	0	1
Lazuli bunting	0	0	0	0	0	1	1	1
Green-tailed towhee	1	1	0	0	1	1	1	0
Rufous-sided towhee	0	0	0	0	0	1	1	1
American tree sparrow	0	0	0	0	0	1	1	1
Savannah sparrow	1	1	1	0	1	1	1	0
Fox sparrow	0	0	0	1	0	1	1	1
Song sparrow	0	1	1	1	0	1	1	1
Lincoln's sparrow	0	0	0	1	0	1	1	1
White-throated sparrow	0	0	0	0	1	1	1	1
Golden-crowned sparrow	0	0	0	0	1	1	1	1
White-crowned sparrow	1	1	1	1	1	1	1	1
Harris' sparrow	0	0	0	0	1	1	1	1
Dark-eyed junco	0	0	0	0	1	1	1	1
Bobolink	1	1	1	0	1	1	1	0
Red-winged blackbird	0	1	1	1	1	1	1	1
Western meadowlark	1	1	1	0	1	1	1	0
Brewer's blackbird	1	1	1	0	1	1	1	0
Brown-headed cowbird	0	1	1	1	0	1	1	0
Northern oriole	0	0	0	0	0	1	1	1
Pine grosbeak	0	0	0	0	0	0	0	1
Lesser goldfinch	0	0	0	0	1	1	1	0
American goldfinch	0	0	0	0	1	1	1	0
Water shrew	0	0	0	1	0	1	1	1
Vagrant shrew	0	0	0	1	1	1	1	1
Preble's shrew	0	0	0	1	1	1	1	1
Raccoon	0	0	0	0	0	1	1	1
Ermine	0	1	1	1	1	1	1	1
Long-tailed weasel	1	1	1	1	1	1	1	1
Badger	1	1	1	0	1	1	1	1
Striped skunk	0	0	0	0	0	1	1	1
Coyote	0	0	0	0	1	1	1	1
Mountain lion	0	0	0	0	0	1	1	1
Bobcat	0	0	0	0	0	1	1	1
Belding's ground squirrel	1	1	1	0	1	1	1	0
Least chipmunk	1	1	0	0	1	1	0	0
Yellow-pine chipmunk	0	0	0	1	0	1	1	1
Northern pocket gopher	1	1	1	1	1	1	1	1
Beaver	0	0	0	1	0	0	0	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Deer mouse	1	1	1	1	1	1	1	1
Montane vole	1	1	1	0	1	1	1	0
Long-tailed vole	0	1	1	1	0	1	1	1
Sagebrush vole	0	0	0	0	1	1	0	0
Western jumping mouse	0	0	0	1	0	1	1	1
Porcupine	0	0	0	0	1	1	1	1
Black-tailed jackrabbit	0	0	0	0	1	1	0	0
Nuttall's cottontail	0	1	1	1	1	1	1	1
Rocky Mountain elk	0	0	0	0	0	1	1	1
Mule deer	0	0	0	1	0	1	1	1
Pronghorn	0	0	0	0	1	1	0	0
Total species	15	26	22	33	65	130	124	119
Bluegrass-ryegrass								
Northern alligator lizard	0	0	0	0	0	0	0	1
Rubber boa	0	0	0	0	0	0	0	1
Racer	1	1	1	0	1	1	1	1
Striped whipsnake	0	0	0	0	0	0	0	1
Gopher snake	1	1	1	0	1	1	1	1
Western rattlesnake	0	0	0	0	0	1	1	1
Turkey vulture	0	0	0	0	0	1	1	1
Bald eagle	0	0	0	0	0	1	1	1
Northern harrier	0	0	0	1	0	1	1	1
Swainson's hawk	0	0	0	0	0	1	1	1
Red-tailed hawk	0	0	0	0	0	1	1	1
Ferruginous hawk	0	0	0	0	0	1	1	1
Rough-legged hawk	0	0	0	0	0	1	1	1
Golden eagle	0	0	0	0	0	1	1	1
American kestrel	0	0	0	0	0	1	1	1
Prairie falcon	0	0	0	0	0	1	1	1
Sage grouse	0	0	0	0	0	0	0	1
California quail	0	0	0	0	0	1	1	1
Long-billed curlew	0	0	0	1	0	0	0	1
Mourning dove	1	1	1	0	0	1	1	1
Common barn-owl	0	0	0	0	0	1	1	1
Great horned owl	0	0	0	0	0	1	1	1
Short-eared owl	0	0	0	1	0	1	1	1
Common nighthawk	0	0	0	0	0	1	1	1
Common poorwill	0	0	0	0	1	1	1	0
White-throated swift	0	0	0	0	0	1	1	1
Gray flycatcher	1	1	0	0	1	1	1	0
Horned lark	0	0	0	0	1	1	0	0
Cliff swallow	0	0	0	0	0	0	0	1
Barn swallow	0	0	0	0	0	0	0	1
American crow	0	0	0	0	0	1	1	1
Black-billed magpie	1	1	0	0	0	1	1	1
Common raven	0	0	0	0	0	1	1	1
Bushtit	1	1	0	0	1	1	0	0
Western bluebird	0	0	0	0	0	1	1	1
American robin	0	1	1	0	0	1	1	1
Sage thrasher	1	1	0	0	1	1	1	0
American pipit	0	0	0	0	0	0	0	1
Loggerhead shrike	1	1	0	0	1	1	1	0
European starling	0	0	0	0	0	0	0	1
Brewer's sparrow	1	1	0	0	1	1	1	0
Vesper sparrow	0	0	0	0	0	1	1	1
Lark sparrow	0	1	1	0	1	1	1	0
Sage sparrow	0	0	0	0	1	1	0	0
Savannah sparrow	0	0	0	1	0	1	1	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Grasshopper sparrow	0	0	0	0	0	1	1	1
Golden-crowned sparrow	0	0	0	0	1	1	1	0
White-crowned sparrow	0	0	0	0	1	1	1	0
Lapland longspur	0	0	0	0	0	0	0	1
Snow bunting	0	0	0	0	0	0	0	1
Bobolink	0	0	0	0	0	0	0	1
Western meadowlark	0	1	1	1	0	1	1	1
Brewer's blackbird	0	1	1	1	0	1	1	1
Brown-headed cowbird	0	0	0	0	0	0	0	1
American goldfinch	0	0	0	0	0	1	1	1
Vagrant shrew	0	0	0	0	0	0	0	1
Ermine	0	1	1	1	0	1	1	1
Long-tailed weasel	1	1	1	1	0	1	1	1
Badger	1	1	1	1	0	1	1	1
Coyote	0	0	0	0	0	1	1	1
Bobcat	0	0	0	0	0	1	1	1
Townsend's ground squirrel	1	1	1	0	1	1	1	1
Belding's ground squirrel	0	0	0	1	0	1	1	1
Least chipmunk	1	1	0	0	1	1	1	0
Northern pocket gopher	0	1	1	1	0	1	1	1
Great Basin pocket mouse	1	1	0	0	1	1	1	0
Ord's kangaroo rat	1	1	0	0	1	1	0	0
Deer mouse	1	1	1	1	1	1	1	1
Montane vole	0	0	0	1	0	0	0	1
Long-tailed vole	0	1	1	1	0	1	1	1
Sagebrush vole	1	1	0	0	1	1	1	0
White-tailed jackrabbit	0	1	1	1	0	1	1	1
Black-tailed jackrabbit	1	1	0	0	1	1	1	1
Nuttall's cottontail	0	1	1	0	0	1	1	1
Pygmy rabbit	1	1	1	0	1	1	1	1
Rocky Mountain elk	0	0	0	0	0	0	0	1
Mule deer	0	1	1	0	0	1	1	1
Pronghorn	0	0	0	0	0	0	0	1
California bighorn sheep	0	0	0	0	0	0	0	1
Total species	19	29	18	15	21	61	57	64
Sedge-rush-bluegrass								
Western toad	0	0	0	0	0	0	0	1
Pacific tree frog	0	0	0	0	0	0	0	1
Northern alligator lizard	0	0	0	0	0	1	1	1
Rubber boa	0	0	0	0	0	1	1	1
Racer	1	1	0	0	1	1	1	1
Striped whipsnake	0	0	0	0	0	1	1	1
Gopher snake	1	1	0	0	1	1	1	1
Western terrestrial garter snake	0	0	0	1	0	1	1	1
Western rattlesnake	0	0	0	0	1	1	1	1
American bittern	0	0	0	1	0	0	0	1
Great blue heron	0	0	0	0	0	0	0	1
White-faced ibis	0	0	0	0	0	0	0	1
Greater white-fronted goose	0	0	0	0	0	1	1	1
Snow goose	0	0	0	0	0	1	1	1
Ross' goose	0	0	0	0	0	1	1	1
Canada goose	0	0	0	1	0	1	1	1
Green-winged teal	0	0	0	1	0	0	0	0
Mallard	0	0	0	1	0	0	0	0
Northern pintail	0	0	0	1	0	0	0	0
Blue-winged teal	0	0	0	1	0	0	0	0
Cinnamon teal	0	0	0	1	0	0	0	0
Northern shoveler	0	0	0	1	0	0	0	0

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Gadwall	0	0	0	1	0	0	0	0
Eurasian wigeon	0	0	0	0	0	0	0	1
American wigeon	0	0	0	1	0	0	0	1
Redhead	0	0	0	1	0	0	0	0
Turkey vulture	0	0	0	0	1	1	1	1
Bald eagle	0	0	0	0	0	1	1	1
Northern harrier	0	1	1	1	1	1	1	1
Swainson's hawk	0	0	0	0	1	1	1	1
Red-tailed hawk	0	0	0	0	1	1	1	1
Ferruginous hawk	0	0	0	0	1	1	1	1
Rough-legged hawk	0	0	0	0	1	1	1	1
Golden eagle	0	0	0	0	1	1	1	1
American kestrel	0	0	0	0	1	1	1	1
Peregrine falcon	0	0	0	0	0	0	0	1
Prairie falcon	0	0	0	0	1	1	1	1
Sage grouse	0	0	0	0	0	1	1	1
California quail	0	0	0	0	1	1	1	1
Virginia rail	0	0	0	0	0	0	0	1
Sora	0	0	0	1	0	0	0	1
Sandhill crane	0	0	0	1	0	1	1	1
Black-bellied plover	0	0	0	0	0	1	1	1
Lesser golden plover	0	0	0	0	0	1	1	1
Killdeer	0	0	0	0	0	1	1	1
Black-necked stilt	0	0	0	1	0	0	0	1
Solitary sandpiper	0	0	0	0	0	0	0	1
Willett	0	0	0	1	0	0	0	0
Upland sandpiper	0	0	0	0	0	0	0	1
Long-billed curlew	0	1	1	1	0	1	1	1
Common snipe	0	0	0	1	0	0	0	1
Wilson's phalarope	0	0	0	1	0	0	0	0
Mourning dove	1	1	0	0	1	1	1	0
Common barn-owl	0	0	0	0	1	1	1	1
Great horned owl	0	0	0	0	0	0	0	1
Short-eared owl	0	1	1	1	1	1	1	1
Common nighthawk	0	0	0	0	1	1	1	1
Common poorwill	0	0	0	0	1	1	1	0
White-throated swift	0	0	0	0	1	1	1	1
Northern flicker	0	0	0	0	1	1	1	1
Gray flycatcher	1	1	0	0	1	1	0	0
Tree swallow	0	0	0	0	0	0	0	1
Violet-green swallow	0	0	0	0	0	0	0	1
Rough-winged swallow	0	0	0	0	0	0	0	1
Bank swallow	0	0	0	0	0	0	0	1
Cliff swallow	0	0	0	0	0	0	0	1
Barn swallow	0	0	0	0	0	0	0	1
Black-billed magpie	1	1	0	0	1	1	1	0
American crow	0	0	0	0	1	1	1	1
Common raven	0	0	0	0	1	1	1	0
Bushtit	1	1	0	0	1	1	0	0
Western bluebird	0	0	0	0	1	1	1	1
Mountain bluebird	0	0	0	0	1	1	1	1
American robin	0	0	0	0	0	1	1	1
Sage thrasher	1	1	0	0	1	1	0	0
American pipit	0	0	0	0	0	1	1	1
Northern shrike	0	0	0	0	1	1	0	0
Loggerhead shrike	1	1	0	0	1	1	0	0
European starling	0	0	0	0	0	1	1	1
Rufous-sided towhee	0	0	0	0	1	1	0	0
American tree sparrow	0	0	0	0	0	0	0	1

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Brewer's sparrow	1	1	0	0	1	1	0	0
Vesper sparrow	0	0	0	0	1	1	1	1
Lark sparrow	1	1	0	0	1	1	1	0
Savannah sparrow	0	1	1	1	0	1	1	1
Grasshopper sparrow	0	0	0	0	1	1	1	1
Golden-crowned sparrow	0	0	0	0	1	1	0	0
White-crowned sparrow	0	0	0	0	1	1	0	0
Lapland longspur	0	0	0	0	0	1	1	1
Snow bunting	0	0	0	0	0	1	1	1
Bobolink	0	1	1	1	0	1	1	1
Red-winged blackbird	0	0	0	1	0	0	0	1
Western meadowlark	1	1	1	1	1	1	1	1
Brewer's blackbird	1	1	1	1	1	1	1	1
Brown-headed cowbird	1	1	0	0	1	1	1	1
House finch	1	1	0	0	1	1	0	0
American goldfinch	0	0	0	0	1	1	1	1
Water shrew	0	0	0	1	0	0	0	1
Vagrant shrew	0	0	0	1	0	1	1	1
Preble's shrew	0	0	0	1	0	1	1	1
Raccoon	0	0	0	0	0	1	1	1
Ermine	0	1	1	1	1	1	1	1
Long-tailed weasel	1	1	1	1	1	1	1	1
Mink	0	0	0	0	0	0	0	1
Badger	1	1	1	1	1	1	1	1
Striped skunk	0	0	0	0	1	1	1	1
Coyote	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	1	1	1	1
Townsend's ground squirrel	1	1	0	0	1	1	1	0
Belding's ground squirrel	0	1	1	1	1	1	1	1
Least chipmunk	1	1	0	0	1	1	1	0
Northern pocket gopher	0	1	1	1	1	1	1	1
Great Basin pocket mouse	1	1	0	0	1	1	0	0
Ord's kangaroo rat	1	1	0	0	1	1	0	0
Deer mouse	1	1	1	1	1	1	1	1
Montane vole	0	1	1	1	0	1	1	1
Long-tailed vole	1	1	1	1	1	1	1	1
Sagebrush vole	1	1	0	0	1	1	0	0
Western jumping mouse	0	0	0	1	0	1	1	1
Porcupine	0	0	0	0	0	1	1	1
White-tailed jackrabbit	0	0	0	0	0	1	1	1
Black-tailed jackrabbit	1	1	0	0	1	1	1	1
Nuttall's cottontail	1	1	0	0	1	1	1	1
Pygmy rabbit	1	1	0	0	1	1	1	1
Rocky Mountain elk	0	0	0	0	0	1	1	1
Mule deer	1	1	0	0	0	1	1	1
Pronghorn	0	0	0	0	0	1	1	1
California bighorn sheep	0	0	0	0	0	1	1	1
Total species	27	35	14	37	60	94	81	100
Silver sagebrush								
Western toad	0	0	0	0	0	1	1	1
Pacific tree frog	0	0	0	0	0	0	0	1
Rubber boa	0	0	0	0	0	1	1	1
Racer	0	0	0	0	0	1	1	1
Striped whipsnake	0	0	0	0	0	1	1	1
Gopher snake	0	0	0	0	0	1	1	1
Western terrestrial garter snake	0	0	0	1	0	1	1	1
Western rattlesnake	0	0	0	0	0	1	1	1
Green-winged teal	0	0	0	1	0	0	0	0

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Mallard	0	0	0	1	0	0	0	0
Northern pintail	0	0	0	1	0	0	0	0
Blue-winged teal	0	0	0	1	0	0	0	0
Cinnamon teal	0	0	0	1	0	0	0	0
Gadwall	0	0	0	1	0	0	0	0
American wigeon	0	0	0	1	0	0	0	0
Redhead	0	0	0	1	0	0	0	0
Turkey vulture	0	0	0	0	0	1	1	1
Northern harrier	0	1	1	1	0	1	1	1
Swainson's hawk	0	0	0	0	0	1	1	1
Red-tailed hawk	0	0	0	0	0	1	1	1
Ferruginous hawk	0	0	0	0	0	1	1	1
Rough-legged hawk	0	0	0	0	0	1	1	1
Golden eagle	0	0	0	0	0	1	1	1
American kestrel	0	0	0	0	0	1	1	1
Prairie falcon	0	0	0	0	0	1	1	1
Sage grouse	0	0	0	0	0	1	1	1
Sandhill crane	0	0	0	0	0	0	0	1
Willett	0	0	0	1	0	0	0	1
Upland sandpiper	0	0	0	0	0	0	0	1
Common snipe	0	0	0	1	0	0	0	1
Wilson's phalarope	0	0	0	1	0	0	0	0
Mourning dove	0	0	0	0	0	1	1	0
Great-horned owl	0	0	0	0	0	0	0	1
Short-eared owl	0	1	1	1	0	1	1	1
Common nighthawk	0	0	0	0	0	1	1	1
Common poorwill	0	0	0	0	1	1	1	0
Horned lark	0	0	0	0	1	1	0	0
Cliff swallow	0	0	0	0	0	0	0	1
Barn swallow	0	0	0	0	0	0	0	1
Black-billed magpie	0	0	0	0	0	1	1	1
Common raven	0	0	0	0	0	1	1	1
Western bluebird	0	0	0	0	0	1	1	1
American robin	0	0	0	0	0	1	1	1
Sage thrasher	1	1	0	0	1	1	0	0
American pipit	0	0	0	0	0	0	0	1
Brewer's sparrow	0	0	0	0	1	1	0	0
Vesper sparrow	1	1	0	0	1	1	1	0
Savannah sparrow	0	0	0	1	0	1	1	1
Grasshopper sparrow	0	0	0	0	0	1	1	1
Lincoln's sparrow	0	0	0	0	0	0	0	1
Golden-crowned sparrow	0	0	0	0	1	1	1	0
White-crowned sparrow	0	0	0	0	1	1	1	0
Bobolink	0	0	0	0	0	0	0	1
Red-winged blackbird	0	0	0	1	0	0	0	1
Western meadowlark	1	1	1	0	1	1	1	1
Brewer's blackbird	0	0	0	1	0	1	1	1
Vagrant shrew	0	0	0	0	0	1	1	1
Preble's shrew	0	0	0	0	0	1	1	1
Long-tailed weasel	0	0	0	0	1	1	1	1
Badger	0	0	0	0	1	1	1	1
Coyote	0	0	0	0	1	1	1	1
Bobcat	0	0	0	0	0	1	1	1
Townsend's ground squirrel	0	0	0	0	1	1	1	0
Belding's ground squirrel	0	0	0	0	0	1	1	1
Least chipmunk	0	0	0	0	1	1	1	0
Great Basin pocket mouse	0	0	0	0	1	1	1	0
Ord's kangaroo rat	0	0	0	0	1	1	0	0
Deer mouse	0	0	0	0	1	1	1	0

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Montane vole	0	0	0	0	0	0	0	1
Long-tailed vole	0	0	0	0	0	1	1	1
Sagebrush vole	0	0	0	0	1	1	0	0
White-tailed jackrabbit	0	0	0	0	0	1	1	1
Black-tailed jackrabbit	1	1	0	0	1	1	1	0
Pygmy rabbit	0	0	0	0	1	1	1	1
Feral horse	0	0	0	0	1	1	1	1
Mule deer	0	0	0	0	0	1	1	1
Pronghorn	0	0	0	0	0	0	0	1
Total species	5	8	4	17	20	54	49	53
Poverty-weed primrose								
Great Basin spadefoot toad	0	1	1	-	0	1	1	-
Snowy plover	0	0	0	-	0	1	1	-
Killdeer	0	1	1	-	0	1	1	-
American avocet	0	1	1	-	0	1	1	-
Willett	0	1	1	-	0	1	1	-
Spotted sandpiper	0	1	1	-	0	1	1	-
Common nighthawk	0	0	0	-	0	1	1	-
Horned lark	0	0	0	-	0	1	1	-
Common raven	0	0	0	-	0	1	1	-
American pipit	0	0	0	-	0	1	1	-
Lapland longspur	0	0	0	-	0	1	1	-
Snow bunting	0	0	0	-	0	1	1	-
Feral horse	0	0	0	-	0	1	1	-
Pronghorn	0	0	0	-	0	1	1	-
Total species	0	5	5	-	0	14	14	-
Rush-spikerush-arnica								
Cutthroat trout	0	0	0	-	0	1	1	-
Sheldon tui chub	0	1	1	-	0	1	1	-
Catlow tui chub	0	1	1	-	0	1	1	-
Western toad	0	1	1	-	0	1	1	-
Pacific tree frog	0	1	1	-	0	1	1	-
Western terrestrial garter snake	0	0	0	-	0	1	1	-
Horned grebe	0	0	0	-	0	1	1	-
Eared grebe	0	1	1	-	0	1	1	-
Western grebe	0	1	1	-	0	1	1	-
Clark's grebe	0	1	1	-	0	1	1	-
Pied-billed grebe	0	1	1	-	0	1	1	-
American white pelican	0	0	0	-	0	1	1	-
American bittern	0	1	1	-	0	1	1	-
Great egret	0	0	0	-	0	1	1	-
Snowy egret	0	0	0	-	0	1	1	-
Black-crowned night heron	0	0	0	-	0	1	1	-
White-faced ibis	0	0	0	-	0	1	1	-
Tundra swan	0	0	0	-	0	1	1	-
Canada goose	0	1	1	-	0	1	1	-
Wood duck	0	0	0	-	0	1	1	-
Green-winged teal	0	0	0	-	0	1	1	-
Mallard	0	0	0	-	0	1	1	-
Northern pintail	0	0	0	-	0	1	1	-
Blue-winged teal	0	0	0	-	0	1	1	-
Cinnamon teal	0	0	0	-	0	1	1	-
Northern shoveler	0	0	0	-	0	1	1	-
Gadwall	0	0	0	-	0	1	1	-
Eurasian wigeon	0	0	0	-	0	1	1	-
American wigeon	0	0	0	-	0	1	1	-
Canvasback	0	0	0	-	0	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Redhead	0	0	0	-	0	1	1	-
Ring-necked duck	0	0	0	-	0	1	1	-
Greater scaup	0	0	0	-	0	1	1	-
Lesser scaup	0	0	0	-	0	1	1	-
Common goldeneye	0	0	0	-	0	1	1	-
Barrow's goldeneye	0	0	0	-	0	1	1	-
Hooded merganser	0	0	0	-	0	1	1	-
Bufflehead	0	0	0	-	0	1	1	-
Common merganser	0	0	0	-	0	1	1	-
Red-breasted merganser	0	0	0	-	0	1	1	-
Ruddy duck	0	1	1	-	0	1	1	-
Turkey vulture	0	0	0	-	1	1	1	-
Osprey	0	0	0	-	0	1	1	-
Bald eagle	0	0	0	-	0	1	1	-
Northern harrier	0	0	0	-	0	1	1	-
Peregrine falcon	0	0	0	-	0	1	1	-
Prairie falcon	0	0	0	-	0	1	1	-
Sora	0	1	1	-	0	1	1	-
American coot	0	1	1	-	0	1	1	-
Sandhill crane	0	1	1	-	0	1	1	-
Black-bellied plover	0	0	0	-	1	1	1	-
Lesser golden plover	0	0	0	-	1	1	1	-
Snowy plover	0	0	0	-	1	1	1	-
Killdeer	1	1	1	-	1	1	1	-
Black-necked stilt	0	1	1	-	0	1	1	-
American avocet	1	1	0	-	0	1	1	-
Greater yellowlegs	0	0	0	-	0	1	1	-
Lesser yellowlegs	0	0	0	-	0	1	1	-
Solitary sandpiper	0	0	0	-	0	1	1	-
Willett	0	1	1	-	0	1	1	-
Spotted sandpiper	1	1	0	-	1	1	1	-
Upland sandpiper	0	0	0	-	0	1	1	-
Long-billed curlew	0	0	0	-	0	1	1	-
Marbled godwit	0	0	0	-	0	1	1	-
Pectoral sandpiper	0	0	0	-	0	1	1	-
Long-billed dowitcher	0	0	0	-	0	1	1	-
Short-billed dowitcher	0	0	0	-	0	1	1	-
Common snipe	0	0	0	-	0	1	1	-
Wilson's phalarope	0	1	1	-	0	1	1	-
Northern phalarope	0	0	0	-	0	1	1	-
Franklin's gull	0	0	0	-	0	1	1	-
Ring-billed gull	0	0	0	-	0	1	1	-
California gull	0	0	0	-	0	1	1	-
Caspian tern	0	0	0	-	0	1	1	-
Forster's tern	0	0	0	-	0	1	1	-
Black tern	0	1	1	-	0	1	1	-
Mourning dove	0	0	0	-	0	1	1	-
Common nighthawk	0	0	0	-	1	1	1	-
Horned lark	0	0	0	-	1	1	0	-
Tree swallow	0	0	0	-	0	1	1	-
Violet-green swallow	0	0	0	-	0	1	1	-
Rough-winged swallow	0	0	0	-	0	1	1	-
Bank swallow	0	0	0	-	0	1	1	-
Cliff swallow	0	0	0	-	0	1	1	-
Barn swallow	0	0	0	-	0	1	1	-
Black-billed magpie	0	0	0	-	0	1	1	-
American crow	0	0	0	-	0	1	1	-
Common raven	0	0	0	-	1	1	1	-
American pipit	0	0	0	-	0	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Savannah sparrow	0	0	0	-	1	1	1	-
Lapland longspur	0	0	0	-	1	1	1	-
Snow bunting	0	0	0	-	1	1	1	-
Bobolink	0	0	0	-	0	1	1	-
Red-winged blackbird	0	0	0	-	0	1	1	-
Western meadowlark	0	0	0	-	0	1	1	-
Yellow-headed blackbird	0	0	0	-	0	1	1	-
Brewer's blackbird	0	0	0	-	0	1	1	-
Brown-headed cowbird	0	0	0	-	0	1	1	-
Vagrant shrew	0	0	0	-	0	1	1	-
Preble's shrew	0	0	0	-	0	1	1	-
Mink	0	0	0	-	0	1	1	-
Coyote	0	0	0	-	1	1	1	-
Deer mouse	0	0	0	-	0	1	1	-
Montane vole	0	0	0	-	0	1	1	-
Western jumping mouse	0	0	0	-	0	1	1	-
Porcupine	0	0	0	-	1	1	1	-
Feral horse	0	0	0	-	1	1	1	-
Rocky Mountain elk	0	0	0	-	0	1	1	-
Pronghorn	0	0	0	-	1	1	1	-
California bighorn sheep	0	0	0	-	0	1	1	-
Total species	3	19	17	-	16	110	109	-
Saltgrass								
Great Basin spadefoot toad	1	1	0	-	1	1	1	-
Western rattlesnake	0	0	0	-	1	1	1	-
Northern shoveler	0	1	1	-	0	0	0	-
Turkey vulture	0	0	0	-	1	1	1	-
Northern harrier	0	0	0	-	1	1	1	-
Golden eagle	0	0	0	-	1	1	0	-
Long-billed curlew	0	1	1	-	0	1	1	-
Western burrowing-owl	1	1	0	-	1	1	0	-
Short-eared owl	0	0	0	-	1	1	1	-
Common nighthawk	0	0	0	-	1	1	1	-
Horned lark	0	0	0	-	0	1	1	-
Sage trasher	1	1	0	-	1	1	0	-
American pipit	0	0	0	-	0	1	1	-
Northern shrike	0	0	0	-	1	1	0	-
Loggerhead shrike	1	1	0	-	1	1	0	-
Black-throated sparrow	1	1	0	-	1	1	0	-
Sage sparrow	1	1	0	-	1	1	0	-
Golden-crowned sparrow	0	0	0	-	1	1	0	-
White-crowned sparrow	0	0	0	-	1	1	0	-
Western meadowlark	0	0	0	-	1	1	1	-
Great Basin pocket mouse	0	0	0	-	1	1	1	-
Ord's kangaroo rat	0	0	0	-	1	1	1	-
Black-tailed jackrabbit	0	0	0	-	1	1	1	-
Total species	6	8	2	-	19	22	13	-
Cattail-bulrush								
Cutthroat trout	0	0	0	-	1	1	1	-
Rainbow trout	0	0	0	-	0	1	1	-
Sheldon tui chub	1	1	1	-	1	1	1	-
Catlow tui chub	1	1	1	-	1	1	1	-
Western toad	1	1	1	-	1	1	1	-
Pacific tree frog	1	1	1	-	1	1	1	-
Western terrestrial garter snake	0	0	0	-	1	1	1	-
Horned grebe	0	0	0	-	1	1	1	-
Eared grebe	1	1	1	-	1	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Western grebe	1	1	1	-	1	1	1	-
Clark's grebe	1	1	1	-	1	1	1	-
Pied-billed grebe	1	1	1	-	1	1	1	-
American white pelican	0	0	0	-	1	1	1	-
Double-crested cormorant	0	0	0	-	1	1	1	-
American bittern	1	1	1	-	1	1	1	-
Great blue heron	0	0	0	-	1	1	1	-
Great egret	0	0	0	-	1	1	1	-
Snowy egret	0	0	0	-	1	1	1	-
Black-crowned night heron	0	0	0	-	1	1	1	-
White-faced ibis	0	0	0	-	1	1	1	-
Tundra swan	0	0	0	-	1	1	1	-
Canada goose	0	1	1	-	1	1	1	-
Wood duck	0	0	0	-	1	1	1	-
Mallard	0	1	1	-	1	1	1	-
Green-winged teal	0	0	0	-	1	1	1	-
Mallard	0	0	0	-	1	1	1	-
Northern pintail	0	0	0	-	1	1	1	-
Blue-winged teal	0	0	0	-	1	1	1	-
Cinnamon teal	0	0	0	-	1	1	1	-
Northern shoveler	0	0	0	-	1	1	1	-
Gadwall	0	0	0	-	1	1	1	-
Canvasback	0	1	1	-	1	1	1	-
Redhead	0	1	1	-	1	1	1	-
Ring-necked duck	0	1	1	-	1	1	1	-
Lesser scaup	0	0	0	-	1	1	1	-
Eurasian wigeon	0	0	0	-	1	1	1	-
American wigeon	0	0	0	-	1	1	1	-
Greater scaup	0	0	0	-	1	1	1	-
Common goldeneye	0	0	0	-	1	1	1	-
Barrow's goldeneye	0	0	0	-	1	1	1	-
Hooded merganser	0	0	0	-	1	1	1	-
Bufflehead	0	0	0	-	1	1	1	-
Common merganser	0	0	0	-	1	1	1	-
Red-breasted merganser	0	0	0	-	1	1	1	-
Ruddy duck	0	1	1	-	1	1	1	-
Turkey vulture	0	0	0	-	1	1	1	-
Osprey	0	0	0	-	1	1	1	-
Bald eagle	0	0	0	-	1	1	1	-
Northern harrier	0	1	1	-	1	1	1	-
Peregrine falcon	0	0	0	-	1	1	1	-
Virginia rail	0	1	1	-	1	1	1	-
Sora	1	1	0	-	1	1	1	-
American coot	1	1	1	-	1	1	1	-
Sandhill crane	1	1	1	-	1	1	1	-
Semi-palmated plover	0	0	0	-	0	1	1	-
Killdeer	1	1	0	-	1	1	1	-
Black-necked stilt	0	0	0	-	1	1	1	-
American avocet	0	0	0	-	1	1	1	-
Greater yellowlegs	0	0	0	-	1	1	1	-
Lesser yellowlegs	0	0	0	-	1	1	1	-
Solitary sandpiper	0	0	0	-	1	1	1	-
Willett	0	0	0	-	1	1	1	-
Spotted sandpiper	0	0	0	-	1	1	1	-
Long-billed curlew	1	1	0	-	1	1	1	-
Marbled godwit	0	0	0	-	1	1	1	-
Pectoral sandpiper	0	0	0	-	1	1	1	-
Common snipe	0	0	0	-	1	1	1	-
Wilson's phalarope	0	0	0	-	1	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Northern phalarope	0	0	0	-	1	1	1	-
Franklin's gull	0	0	0	-	1	1	1	-
Ring-billed gull	0	0	0	-	1	1	1	-
California gull	0	0	0	-	1	1	1	-
Caspian tern	0	0	0	-	1	1	1	-
Forster's tern	0	0	0	-	1	1	1	-
Black tern	1	1	1	-	1	1	1	-
Mourning dove	0	0	0	-	1	1	0	-
Short-eared owl	0	1	1	-	1	1	1	-
Common nighthawk	0	0	0	-	1	1	1	-
Horned lark	0	0	0	-	1	1	0	-
Tree swallow	0	0	0	-	1	1	1	-
Violet-green swallow	0	0	0	-	1	1	1	-
Rough-winged swallow	0	0	0	-	1	1	1	-
Bank swallow	0	0	0	-	1	1	1	-
Cliff swallow	0	0	0	-	1	1	1	-
Barn swallow	0	0	0	-	1	1	1	-
Black-billed magpie	0	0	0	-	1	1	1	-
American crow	0	0	0	-	1	1	1	-
Common raven	0	0	0	-	1	1	1	-
Marsh wren	0	1	1	-	0	1	1	-
American pipit	0	0	0	-	1	1	1	-
Common yellowthroat	0	0	0	-	0	1	1	-
Savannah sparrow	0	0	0	-	1	1	1	-
Grasshopper sparrow	0	0	0	-	1	1	0	-
Song sparrow	0	0	0	-	1	1	1	-
Lapland longspur	0	0	0	-	1	1	0	-
Snow bunting	0	0	0	-	1	1	0	-
Bobolink	0	0	0	-	1	1	0	-
Red-winged blackbird	0	1	1	-	1	1	1	-
Western meadowlark	0	0	0	-	1	1	0	-
Yellow-headed blackbird	0	1	1	-	1	1	1	-
Brewer's blackbird	0	0	0	-	1	1	1	-
Brown-headed cowbird	0	0	0	-	1	1	0	-
Rosy finch	0	0	0	-	1	1	0	-
Water shrew	0	1	1	-	1	1	1	-
Vagrant shrew	0	1	1	-	1	1	1	-
Preble's shrew	0	1	1	-	1	1	1	-
Long-tailed weasel	0	1	1	-	0	1	1	-
Mink	0	0	0	-	1	1	1	-
Striped skunk	0	0	0	-	1	1	1	-
Coyote	0	0	0	-	1	1	1	-
Deer mouse	0	0	0	-	1	1	0	-
Montane vole	1	1	0	-	1	1	0	-
Western jumping mouse	0	0	0	-	1	1	1	-
Rocky Mountain elk	0	0	0	-	1	1	0	-
Mule deer	0	0	0	-	1	1	1	-
Pronghorn	0	0	0	-	1	1	0	-
Total species	14	29	25	-	110	114	101	-
Pondweed								
Cutthroat trout	0	0	0	-	0	1	1	-
Rainbow trout	0	0	0	-	0	1	1	-
Sheldon tui chub	1	1	1	-	1	1	1	-
Catlow tui chub	1	1	1	-	1	1	1	-
Western toad	1	1	1	-	1	1	1	-
Pacific tree frog	1	1	1	-	1	1	1	-
Western terrestrial garter snake	0	0	0	-	1	1	1	-
Horned grebe	0	0	0	-	1	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage: Breeding E-M	Breeding E-M-L	Breeding L	Breeding VL	Feeding E-M	Feeding E-M-L	Feeding L	Feeding VL
Eared grebe	1	1	1	-	1	1	1	-
Western grebe	0	0	0	-	1	1	1	-
Clark's grebe	0	0	0	-	1	1	1	-
Pied-billed grebe	1	1	1	-	1	1	1	-
American white pelican	0	0	0	-	1	1	1	-
Double-crested cormorant	0	0	0	-	1	1	1	-
American bittern	1	1	0	-	1	1	1	-
Great blue heron	0	0	0	-	1	1	1	-
Great egret	0	0	0	-	1	1	1	-
Snowy egret	0	0	0	-	1	1	1	-
Black-crowned night heron	0	0	0	-	1	1	1	-
White-faced ibis	0	0	0	-	1	1	1	-
Tundra swan	0	0	0	-	1	1	1	-
Canada goose	0	0	0	-	1	1	1	-
Wood duck	0	0	0	-	1	1	1	-
Green-winged teal	0	0	0	-	1	1	1	-
Mallard	0	0	0	-	1	1	1	-
Northern pintail	0	0	0	-	1	1	1	-
Blue-winged teal	0	0	0	-	1	1	1	-
Cinnamon teal	0	0	0	-	1	1	1	-
Northern shoveler	0	0	0	-	1	1	1	-
Gadwall	0	0	0	-	1	1	1	-
Eurasian wigeon	0	0	0	-	1	1	1	-
American wigeon	0	0	0	-	0	1	1	-
Canvasback	0	0	0	-	1	1	1	-
Redhead	0	0	0	-	1	1	1	-
Ring-necked duck	0	0	0	-	1	1	1	-
Lesser scaup	0	0	0	-	1	1	1	-
Greater scaup	0	0	0	-	1	1	1	-
Common goldeneye	0	0	0	-	1	1	1	-
Barrow's goldeneye	0	0	0	-	1	1	1	-
Hooded merganser	0	0	0	-	1	1	1	-
Bufflehead	0	0	0	-	1	1	1	-
Common merganser	0	0	0	-	1	1	1	-
Red-breasted merganser	0	0	0	-	1	1	1	-
Ruddy duck	1	1	0	-	1	1	1	-
Turkey vulture	0	0	0	-	1	1	0	-
Osprey	0	0	0	-	0	1	1	-
Bald eagle	0	0	0	-	0	1	1	-
Northern harrier	0	0	0	-	1	1	0	-
Rough-legged hawk	0	0	0	-	1	1	0	-
Golden eagle	0	0	0	-	1	1	0	-
American kestrel	0	0	0	-	1	1	0	-
Peregrine falcon	0	0	0	-	1	1	1	-
Prairie falcon	0	0	0	-	1	1	0	-
Virginia rail	0	0	0	-	1	1	1	-
Sora	1	1	0	-	1	1	1	-
American coot	1	1	1	-	1	1	1	-
Sandhill crane	1	1	0	-	1	1	1	-
Black-bellied plover	0	0	0	-	1	1	1	-
Lesser golden plover	0	0	0	-	1	1	1	-
Semipalmated plover	0	0	0	-	1	1	1	-
Snowy plover	0	0	0	-	0	1	1	-
Killdeer	1	1	0	-	1	1	1	-
Black-necked stilt	1	1	0	-	1	1	1	-
American avocet	0	0	0	-	1	1	1	-
Greater yellowlegs	0	0	0	-	1	1	1	-
Lesser yellowlegs	0	0	0	-	1	1	1	-
Solitary sandpiper	0	0	0	-	0	1	1	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Willett	1	1	0	-	1	1	1	-
Spotted sandpiper	0	0	0	-	1	1	1	-
Long-billed curlew	0	0	0	-	1	1	1	-
Marbled godwit	0	0	0	-	1	1	1	-
Western sandpiper	0	0	0	-	1	1	1	-
Least sandpiper	0	0	0	-	1	1	1	-
Baird's sandpiper	0	0	0	-	1	1	1	-
Red knot	0	0	0	-	1	1	1	-
Sanderling	0	0	0	-	1	1	1	-
Pectoral sandpiper	0	0	0	-	1	1	1	-
Long-billed dowitcher	0	0	0	-	0	1	1	-
Short-billed dowitcher	0	0	0	-	0	1	1	-
Dunlin	0	0	0	-	0	1	1	-
Wilson's phalarope	1	1	0	-	1	1	1	-
Common snipe	0	0	0	-	1	1	1	-
Northern phalarope	0	0	0	-	1	1	1	-
Franklin's gull	0	0	0	-	1	1	1	-
Ring-billed bull	0	0	0	-	1	1	1	-
California gull	0	0	0	-	1	1	1	-
Caspian tern	0	0	0	-	1	1	1	-
Forster's tern	0	0	0	-	1	1	1	-
Black tern	1	1	1	-	1	1	1	-
Short-eared owl	1	1	0	-	1	1	0	-
Common nighthawk	0	0	0	-	1	1	1	-
Horned lark	0	0	0	-	1	1	0	
Tree swallow	0	0	0	-	1	1	1	-
Violet-green swallow	0	0	0	-	1	1	1	-
Rough-winged swallow	0	0	0	-	1	1	1	-
Bank swallow	0	0	0	-	1	1	1	-
Cliff swallow	0	0	0	-	1	1	1	-
Barn swallow	0	0	0	-	1	1	1	-
Black-billed magpie	0	0	0	-	1	1	0	-
American crow	0	0	0	-	1	1	0	-
Common raven	0	0	0	-	1	1	0	-
American pipit	0	0	0	-	1	1	1	-
American tree sparrow	0	0	0	-	1	1	0	-
Song sparrow	0	0	0	-	1	1	0	-
Lapland longspur	0	0	0	-	1	1	0	-
Snow bunting	0	0	0	-	1	1	0	-
Red-winged blackbird	0	0	0	-	1	1	0	-
Western meadowlark	0	0	0	-	1	1	0	
Yellow-headed blackbird	0	0	0	-	1	1	0	-
Brewer's blackbird	0	0	0	-	1	1	0	-
Brown-headed cowbird	0	0	0	-	1	1	0	-
Rosy finch	0	0	0	-	1	1	0	-
Vagrant shrew	0	0	0	-	1	1	0	-
Preble's shrew	0	0	0	-	1	1	0	-
Raccoon	0	0	0	-	1	1	0	-
Mink	0	0	0	-	1	1	1	-
Striped skunk	0	0	0	-	1	1	0	-
Coyote	0	0	0	-	1	1	0	-
Deer mouse	1	1	0	-	1	1	0	-
Montane vole	1	1	0	-	1	1	0	-
Western jumping mouse	0	0	0	-	1	1	0	-
Rocky Mountain elk	0	0	0	-	1	1	0	-
Mule deer	0	0	0	-	1	1	0	-
Pronghorn	0	0	0	-	1	1	0	-
Total species	19	19	7	-	117	123	92	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Aquatic non-vegetated								
Cutthroat trout	1	-	-	-	1	-	-	-
Catlow Valley redband trout	1	-	-	-	1	-	-	-
Rainbow trout	1	-	-	-	1	-	-	-
Sheldon tui chub	1	-	-	-	1	-	-	-
Catlow tui chub	1	-	-	-	1	-	-	-
Great Basin spadefoot toad	1	-	-	-	1	-	-	-
Western toad	1	-	-	-	1	-	-	-
Pacific tree frog	1	-	-	-	1	-	-	-
Western terrestrial garter snake	0	-	-	-	1	-	-	-
Eared grebe	0	-	-	-	1	-	-	-
Western grebe	0	-	-	-	1	-	-	-
Clark's grebe	0	-	-	-	1	-	-	-
Pied-billed grebe	0	-	-	-	1	-	-	-
American white pelican	0	-	-	-	1	-	-	-
Double-crested cormorant	0	-	-	-	1	-	-	-
Great blue heron	0	-	-	-	1	-	-	-
Great egret	0	-	-	-	1	-	-	-
Snowy egret	0	-	-	-	1	-	-	-
Black-crowned night heron	0	-	-	-	1	-	-	-
White-faced ibis	0	-	-	-	1	-	-	-
Tundra swan	0	-	-	-	1	-	-	-
Canada goose	0	-	-	-	1	-	-	-
Wood duck	0	-	-	-	1	-	-	-
Green-winged teal	0	-	-	-	1	-	-	-
Mallard	0	-	-	-	1	-	-	-
Northern pintail	0	-	-	-	1	-	-	-
Blue-winged teal	0	-	-	-	1	-	-	-
Cinnamon teal	0	-	-	-	1	-	-	-
Northern shoveler	0	-	-	-	1	-	-	-
Gadwall	0	-	-	-	1	-	-	-
American wigeon	0	-	-	-	1	-	-	-
Canvasback	0	-	-	-	1	-	-	-
Redhead	0	-	-	-	1	-	-	-
Ring-necked duck	0	-	-	-	1	-	-	-
Greater scaup	0	-	-	-	1	-	-	-
Lesser scaup	0	-	-	-	1	-	-	-
Common goldeneye	0	-	-	-	1	-	-	-
Barrow's goldeneye	0	-	-	-	1	-	-	-
Hooded merganser	0	-	-	-	1	-	-	-
Bufflehead	0	-	-	-	1	-	-	-
Common merganser	0	-	-	-	1	-	-	-
Red-breasted merganser	0	-	-	-	1	-	-	-
Ruddy duck	0	-	-	-	1	-	-	-
Osprey	0	-	-	-	1	-	-	-
Bald eagle	0	-	-	-	1	-	-	-
Peregrine falcon	0	-	-	-	1	-	-	-
Black-bellied plover	0	-	-	-	1	-	-	-
Lesser golden plover	0	-	-	-	1	-	-	-
Snowy plover	0	-	-	-	1	-	-	-
Semipalmated plover	0	-	-	-	1	-	-	-
Killdeer	1	-	-	-	1	-	-	-
Black-necked stilt	0	-	-	-	1	-	-	-
American avocet	0	-	-	-	1	-	-	-
Greater yellowlegs	0	-	-	-	1	-	-	-
Lesser yellowlegs	0	-	-	-	1	-	-	-
Solitary sandpiper	0	-	-	-	1	-	-	-
Willett	0	-	-	-	1	-	-	-
Spotted sandpiper	1	-	-	-	1	-	-	-

Table H-5. (Continued)

Vegetation type and wildlife species	Progression stage							
	Breeding				Feeding			
	E-M	E-M-L	L	VL	E-M	E-M-L	L	VL
Long-billed curlew	0	-	-	-	1	-	-	-
Marbled godwit	0	-	-	-	1	-	-	-
Western sandpiper	0	-	-	-	1	-	-	-
Least sandpiper	0	-	-	-	1	-	-	-
Baird's sandpiper	0	-	-	-	1	-	-	-
Red knot	0	-	-	-	1	-	-	-
Sanderling	0	-	-	-	1	-	-	-
Pectoral sandpiper	0	-	-	-	1	-	-	-
Long-billed dowitcher	0	-	-	-	1	-	-	-
Short-billed dowitcher	0	-	-	-	1	-	-	-
Common snipe	0	-	-	-	1	-	-	-
Dunlin	0	-	-	-	1	-	-	-
Wilson's phalarope	0	-	-	-	1	-	-	-
Northern phalarope	0	-	-	-	1	-	-	-
Franklin's gull	0	-	-	-	1	-	-	-
Ring-billed gull	0	-	-	-	1	-	-	-
California gull	0	-	-	-	1	-	-	-
Caspian tern	0	-	-	-	1	-	-	-
Forster's tern	0	-	-	-	1	-	-	-
Black tern	0	-	-	-	1	-	-	-
Belted kingfisher	0	-	-	-	1	-	-	-
Tree swallow	0	-	-	-	1	-	-	-
Violet-green swallow	0	-	-	-	1	-	-	-
Rough-winged swallow	0	-	-	-	1	-	-	-
Bank swallow	0	-	-	-	1	-	-	-
Cliff swallow	0	-	-	-	1	-	-	-
Barn swallow	0	-	-	-	1	-	-	-
American dipper	1	-	-	-	1	-	-	-
American pipit	0	-	-	-	1	-	-	-
Red-winged blackbird	0	-	-	-	1	-	-	-
Yellow-headed blackbird	0	-	-	-	1	-	-	-
Brewer's blackbird	0	-	-	-	1	-	-	-
Raccoon	0	-	-	-	1	-	-	-
Mink	0	-	-	-	1	-	-	-
Total species	11	-	-	-	92	92	-	-

[a] Does not include species of hypothetical permanent resident or summer resident status.
[b] Based on single and multiple succession and progression stages: early-mid (E-M) = combination of those stages; early, mid, late (E-M-L) = mosaic of those stages; late (L) = dominated by late stages; and very late (VL) = dominated by very late stages.
[c] Dash (-) indicates stage was not represented in vegetation type.

Table H-6. Annotated list of vertebrate wildlife species that hypothetically occur or have occurred historically at Hart Mountain NAR.

Species	Comments
Spotted frog	Occurrence indicated by Nussbaum et al. (1983) for Warner Basin and Guano Basin by Stern et al. (1993). Appropriate habitats on Refuge have not been systematically surveyed.
Long-toed salamander	Regional occurrence indicated for semi-arid sagebrush habitats by Storm (1980) and Nussbaum et al. (1983). Appropriate habitats on Refuge have not been systematically surveyed.
Leopard lizard	Observed southeast of Crump Lake in the Warner Valley in 1978 (Gilman et al. 1980). Appropriate habitats on Refuge have not been systematically surveyed.
Common garter snake	Several were collected or observed along the western and northern fringe of Hart Lake in the 1950s (Oregon State University Museum) and in 1978 (Gilman et al. 1980).
Blue grouse	Reported from the canyon of Hart Creek in the 1960s (D. Sipp, pers. commun.). Species was not observed in Hart Creek during wildlife surveys done in the 1980s (Refuge files).
Sharp-tailed grouse	Occurred historically in areas adjacent to Refuge (Kelly 1932, Cushing 1941).
Mountain quail	Occasional individuals heard and seen on the Refuge during the 1950s-1970s (Refuge files). The species has not been observed since the 1970s despite increased frequency of wildlife surveys in the appropriate habitat.
California myotis	Regional occurrence indicated by Verts and Carraway (1984).
Small-footed myotis	Regional occurrence indicated by Verts and Carraway (1984).
Yuma myotis	Regional occurrence indicated by Verts and Carraway (1984).
Little brown myotis	Regional occurrence indicated by Verts and Carraway (1984).
Long-legged myotis	Regional occurrence indicated by Verts and Carraway (1984).
Fringed myotis	Regional occurrence indicated by Verts and Carraway (1984).
Long-eared myotis	Regional occurrence indicated by Verts and Carraway (1984).
Silver-haired bat	Regional occurrence indicated by Verts and Carraway (1984).
Western pipistrel	Regional occurrence indicated by Verts and Carraway (1984).
Big brown bat	Regional occurrence indicated by Verts and Carraway (1984).
Hoary bat	Regional occurrence indicated by Verts and Carraway (1984).
Townsend's big-eared bat	Regional occurrence indicated by Verts and Carraway (1984).
Pallid bat	Regional occurrence indicated by Verts and Carraway (1984).
Western harvest mouse	Observed in the vicinity of northwestern Hart Lake in 1978 (Gilman et al. 1980).
Merriam's shrew	Regional occurrence indicated by Verts and Carraway (1984).
Montane shrew	Regional occurrence indicated by Verts and Carraway (1984).

Table H-6. (Continued)

Species	Comments
Little pocket mouse	Regional occurrence indicated by Verts and Carraway (1984).
Chisel-toothed kangaroo rat	Observed near the narrows between Crump and Hart Lakes in 1978 (Gilman et al. 1980).
Dark kangaroo mouse	Regional occurrence indicated by Verts and Carraway (1984).
Canyon mouse	Regional occurrence indicated by Verts and Carraway (1984).
Pinyon mouse	Regional occurrence indicated by Verts and Carraway (1984). Nearest known site of occurrence to the Refuge is lower Honey Creek, east of Plush (Gilman et al. 1980).
Northern grasshopper mouse	Regional occurrence indicated by Verts and Carraway (1984).
Wolverine	Considered a rare permanent resident of montane habitats in southeastern Oregon (Marshall 1986). One was trapped at Steens Mountain in 1974 (Wilson 1982).
Spotted skunk	Regional occurrence indicated by Verts and Carraway (1984). Reportedly observed in the Warner Valley (R. Paxton, pers. commun.). Appropriate Refuge habitats have not been surveyed systematically.

Table H-7. List of vertebrate wildlife species[a] referred to in EIS.

Lifeform, family, and common name	Scientific name
Amphibians	
Mole salamanders (Ambystomidae)	
Long-toed salamander	*Ambystoma macrodactylum*
Spadefoot toads (Pelobatidae)	
Great Basin spadefoot toad	*Scaphiophus intermontanus*
Treefrogs (Hylidae)	
Pacific tree frog	*Hyla regilla*
True frogs (Ranidae)	
Spotted frog	*Rana pretiosa*
True toads (Bufonidae)	
Western toad	*Bufo boreas*
Birds	
Accipiters and allies (Accipitridae)	
Bald eagle	*Haliaeetus leucocephalus*
Cooper's hawk	*Accipiter cooperii*
Golden eagle	*Aquila chrysaetos*
Ferruginous hawk	*Buteo regalis*
Northern goshawk	*Accipiter gentilis*
Northern harrier	*Circus cyaneus*
Red-tailed hawk	*Buteo jamaicensis*
Rough-legged hawk	*Buteo lagopus*
Sharp-shinned hawk	*Accipiter striatus*
Swainson's hawk	*Buteo swainsoni*
Avocets and stilts (Recurvirostridae)	
American avocet	*Recurvirostra americana*
Black-necked stilt	*Himantopus mexicanus*
Barn-owls (Tytonidae)	
Common barn-owl	*Tyto alba*
Bushtits (Aegithalidae)	
Bushtit	*Psaltriparus minimus*
Cormorants (Phalacrocoracidae)	
Double-crested cormorant	*Phalacrocorax auritus*
Cranes (Gruidae)	
Sandhill crane	*Grus canadensis*
Creepers (Certhiidae)	
Brown creeper	*Certhia familiaris*
Cuckoos (Cuculidae)	
Yellow-bellied cuckoo	*Coccyzus americanus*
Dippers (Cinclidae)	
American dipper	*Cinclus mexicanus*
Doves (Columbidae)	
Mourning dove	*Zenaida macroura*
Falcons (Falconidae)	
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine falcon	*Falco peregrinus*
Prairie falcon	*Falco mexicanus*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Finches and allies (Emberizidae)	
American goldfinch	*Carduelis tristis*
American redstart	*Setophaga ruticilla*
American tree sparrow	*Spizella arborea*
Black-and-white warbler	*Mniotilta varia*
Black-headed grosbeak	*Pheucticus melanocephalus*
Black-throated gray warbler	*Dendroica nigrescens*
Bobolink	*Dolichonyx oryzivorus*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer's sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Cassin's finch	*Carpodacus cassinii*
Chipping sparrow	*Spizella passerina*
Common redpoll	*Carduelis flammea*
Common yellowthroat	*Geothlypis trichas*
Dark-eyed junco	*Junco hyemalis*
Evening grosbeak	*Hesperiphona vespertina*
Fox sparrow	*Passerella iliaca*
Golden-crowned sparrow	*Zonotrichia atricapilla*
Grasshopper sparrow	*Ammodramus savannarum*
Green-tailed towhee	*Pipilo chlorura*
Harris's sparrow	*Zonotrichia querula*
House finch	*Carpodacus mexicanus*
Lapland longspur	*Calcarius lapponicus*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passeria amoena*
Lesser goldfinch	*Carduelis psaltria*
Lincoln's sparrow	*Melospiza lincolnii*
MacGillivray's warbler	*Oporornis tolmiei*
Nashville warbler	*Vermivora ruficapilla*
Northern oriole	*Icterus galbula*
Northern waterthrush	*Seiurus noveboracensis*
Orange-crowned warbler	*Vermivora celata*
Ovenbird	*Seiurus aurocapillus*
Pine siskin	*Carduelis pinus*
Red crossbill	*Loxia curvirostra*
Red-winged blackbird	*Agelaius phoeniceus*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Rufous-sided towhee	*Pipilo erythrophthalmus*
Sage sparrow	*Amphispiza belli*
Savannah sparrow	*Passerculus sandwichensis*
Snow bunting	*Plectrophenax nivalis*
Song sparrow	*Melospiza melodia*
Townsend's warbler	*Dendroica townsendi*
Vesper sparrow	*Pooecetes gramineus*
Western tanager	*Piranga ludoviciana*
Western meadowlark	*Sturnella neglecta*
White-crowned sparrow	*Zonotrichia leucophrys*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
White-throated sparrow	*Zonotrichia albicollis*
Wilson's warbler	*Wilsonia pusilla*
Yellow warbler	*Dendroica petechia*
Yellow-breasted chat	*Icteria virens*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped warbler	*Dendroica coronata*
Flycatchers (Tyrannidae)	
Ash-throated flycatcher	*Myiarchus cinerascens*
Cordilleran flycatcher	*Empidonax occidentalis*
Dusky flycatcher	*Empidonax oberholseri*
Eastern kingbird	*Tyrannus tyrannus*
Gray flycatcher	*Empidonax wrightii*
Hammond's flycatcher	*Empidonax hammondii*
Least flycatcher	*Empidonax mimimus*
Olive-sided flycatcher	*Nuttallornis borealis*
Say's phoebe	*Sayornis saya*
Western kingbird	*Tyrannus verticalis*
Western wood pewee	*Contopus sordidulus*
Willow flycatcher	*Empidonax traillii*
Gnatcatchers and kinglets (Muscicapidae)	
Blue-gray gnatchatcher	*Polioptila caerulea*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Goatsuckers (Caprimulgidae)	
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Grebes (Podicipedidae)	
Eared Grebe	*Podiceps nigricollis*
Horned grebe	*Podiceps auritus*
Pied billed grebe	*Podilymbus podiceps*
Western Grebe	*Aechmophorus occidentalis*
Grouse and allies (Phasianidae)	
Blue grouse	*Dendragapus obscurus*
California quail	*Lophortyx californicus*
Chukar	*Alectoris chukar*
Mountain quail	*Oreotyx pictus*
Sage grouse	*Centrocercus urophasianus*
Gulls and terns (Laridae)	
Black tern	*Chlidonias niger*
California gull	*Larus californicus*
Caspian tern	*Sterna caspia*
Forster's gull	*Sterna forsteri*
Franklin's gull	*Larus pipixcan*
Ring-billed gull	*Larus delawarensis*
Herons and allies (Ardeidae)	
American bittern	*Botaurus lentiginosus*
Black-crowned night heron	*Nycticorax nycticorax*
Great blue heron	*Ardea herodias*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Great egret	*Casmerodius albus*
Snowy egret	*Egretta thula*
Hummingbirds (Trochilidae)	
Black-chinned hummingbird	*Archilochus alexandri*
Broad-tailed hummingbird	*Selasphorus platycercus*
Calliope hummingbird	*Stellula calliope*
Rufous hummingbird	*Selasphorus rufus*
Ibises (Threskiornithidae)	
White-faced ibis	*Plegadis chihi*
Jays and allies (Corvidae)	
American crow	*Corvus brachyrhynchos*
Black-billed magpie	*Pica pica*
Clark's nutcracker	*Nucifraga columbiana*
Common raven	*Corvus corax*
Scrub jay	*Aphelocoma coerulescens*
Stellar's jay	*Cyanocitta stelleri*
Kingfishers (Alcedinidae)	
Belted kingfisher	*Ceryle alcyon*
Larks (Alaudidae)	
Horned lark	*Eremophila alpestris*
Loons (Gaviidae)	
Common loon	*Gavia immer*
Mockingbirds and thrashers (Mimidae)	
Gray catbird	*Dumetella carolinensis*
Sage thrasher	*Oreoscoptes montanus*
Nuthatches (Sittidae)	
Pygmy nuthatch	*Sitta pygmaea*
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Ospreys (Pandionidae)	
Osprey	*Pandion haliaetus*
Owls (Strigidae)	
Flammulated owl	*Otus flammeolus*
Great horned owl	*Bubo virginianus*
Long-eared owl	*Asio otus*
Northern pygmy-owl	*Glaucidium gnoma*
Northern saw-whet owl	*Aegolius acadicus*
Short-eared owl	*Asio flammeus*
Western burrowing-owl	*Athene cunicularia*
Western screech-owl	*Otus kennicottii*
Pelicans (Pelecanidae)	
American white pelican	*Pelecanus erythrorhynchos*
Pipits (Motacillidae)	
American pipit	*Anthus spinoletta*
Plovers (Charadriidae)	
Black-bellied plover	*Charadrius squatarola*
Killdeer	*Charadrius vociferus*
Pacific golden-plover	*Charadrius fulva*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Semipalmated plover	*Charadrius semipalmatus*
Snowy plover	*Charadrius alexandrinus*
Rails (Rallidae)	
American root	*Fulica americana*
Sora	*Porzana carolina*
Virginia rail	*Rallus limicola*
Sandpipers (Scolopacidae)	
Baird's sandpiper	*Caladris bairdii*
Common snipe	*Gallinago gallinago*
Greater yellowlegs	*Tringa melanoleuca*
Least sandpiper	*Caladris minutilla*
Lesser yellowlegs	*Tringa flavipes*
Long-billed curlew	*Numeninus americanus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Marbled godwit	*Limosa fedoa*
Pectoral sandpiper	*Calidris melanotos*
Red knot	*Caladris canutus*
Red-necked phalarope	*Phalaropus lobatus*
Short-billed dowitcher	*Limnodromus griseus*
Solitary sandpiper	*Tringa solitaria*
Spotted sandpiper	*Actitis macularia*
Willet	*Catoptrophorus semipalmatus*
Wilson's phalarope	*Phalaropus tricolor*
Western sandpiper	*Caladris mauri*
Shrikes (Laniidae)	
Loggerhead shrike	*Lanius ludovicianus*
Northern shrike	*Lanius excubitor*
Starlings (Sturnidae)	
European starling	*Sturnus vularis*
Swallows (Hirundinidae)	
Bank swallow	*Riparia riparia*
Barn swallow	*Hirundo rustica*
Cliff swallow	*Petrochelidon pyrrhonota*
Rough-winged swallow	*Stelgidopteryx ruficollis*
Tree swallow	*Iridoprocne bicolor*
Violet-green swallow	*Tachycineta thalassina*
Swifts (Apodidae)	
Vaux's swift	*Chaetura vauxi*
White-throated swift	*Aeronautes saxatalis*
Thrushes (Turdidae)	
American robin	*Turdus migratorius*
Hermit thrush	*Catharus guttatus*
Mountain Bluebird	*Sialia currucoides*
Swainson's thrush	*Catharus ustulatus*
Townsend's solitaire	*Myadestes townsendi*
Varied thrush	*Ixoreus naevius*
Veery	*Catharus fuscescens*
Western Bluebird	*Sialia mexicana*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Titmice (Paridae)	
Black-capped chickadee	*Parus atricapillus*
Mountain chickadee	*Parus gambeli*
Plain titmouse	*Parus inornatus*
Vireos (Vireonidae)	
Red-eyed vireo	*Vireo olivaceus*
Solitary vireo	*Vireo solitarius*
Warbling vireo	*Vireo gilvus*
Vultures (Cathartidae)	
Turkey vulture	*Cathartes aura*
Waterfowl (Anatidae)	
American green-winged teal	*Anas crecca*
American wigeon	*Anas americana*
Barrow's goldeneye	*Bucephala islandica*
Blue-winged teal	*Anas discors*
Bufflehead	*Bucephala albeola*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Cinnamon teal	*Anas cyanoptera*
Common goldeneye	*Bucephala clangula*
Common merganser	*Mergus merganser*
Eurasian wigeon	*Anas penelope*
Gadwall	*Anas strepera*
Greater scaup	*Aythya marila*
Hooded merganser	*Lophodytes cucullatus*
Lesser scaup	*Aythya affinis*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Mallard	*Anas platyrhynchos*
Red-breased merganser	*Mergus serrator*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Ross's goose	*Chen rossii*
Ruddy Duck	*Oxyura jamaicensis*
Snow goose	*Chen caerulescens*
Tundra swan	*Cygnus columbianus*
White-fronted goose	*Anser albiforns*
Wood duck	*Anas sponsa*
Waxwings (Bombycillidae)	
Bohemian waxwing	*Bombycilla garrulus*
Cedar waxwing	*Bombycilla cedrorum*
Woodpeckers (Picidae)	
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Lewis's woodpecker	*Melanerpes lewis*
Northern flicker	*Colaptes auratus*
Red-breasted sapsucker	*Sphyrapicus ruber*
Red-naped sapsucker	*Sphyrapicus nuchalis*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Williamson's sapsucker	*Sphyrapicus thryoideus*
Wrens (Troglodytidae)	
Bewick's wren	*Thyromanes bewickii*
Canyon wren	*Catherpes mexicanus*
House wren	*Troglodytes aedon*
Marsh wren	*Cistothorus palustris*
Rock wren	*Salpinctes obsoletus*
Winter wren	*Troglodytes troglodytes*
Fishes	
Minnows (Cyprinidae)	
Catlow tui chub	*Gila bicolor ssp.*
Sheldon tui chub	*Gila bicolor eurysoma*
Trouts (Salmonidae)	
Catlow Valley redband trout	*Oncorhynchus mykiss ssp.*
Cutthroat trout	*Oncorhynchus clarki*
Rainbow trout	*Oncorhynchus mykiss*
Mammals	
American porcupines (Erethizontidae)	
Porcupine	*Erethizon dorsatum*
Beavers (Castoridae)	
Beaver	*Castor canadensis*
Cats (Felidae)	
Bobcat	*Lynx rufus*
Mountain lion	*Felis concolor*
Deer (Cervidae)	
Mule deer	*Odocoileus hemionus*
Rocky Mountain elk	*Cervus canadensis nelsoni*
Dogs (Canidae)	
Coyote	*Canis latrans*
Evening bats (Vespertilionidae)	
Big brown bat	*Eptesicus fuscus*
California myotis	*Myotis californicus*
Fringed myotis	*Myotis thysanodes*
Hoary bat	*Lasiurus cinereus*
Little brown myotis	*Myotis lucifugus*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Pallid bat	*Antrozous pallidus*
Silver-haired bat	*Lasionycteris noctivagans*
Small-footed myotis	*Myotis leibi*
Townsend's big-eared bat	*Plecotus townsendi*
Western pipistrel	*Pipistrellus hesperus*
Yuma myotis	*Myotis yumanensis*
Hares and rabbits (Leporidae)	
Black-tailed jackrabbit	*Lepus californicus*
Mountain cottontail	*Sylvilagus nuttalli*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Pygmy rabbit	*Sylvilagus idahoensis*
White-tailed jackrabbit	*Lepus townsendi*
Jumping mice (Zapodidae)	
Western jumping mouse	*Zapus princeps*
Pikas (Ochotonidae)	
Pika	*Ochontona princeps*
Pocket gophers (Geomyidae)	
Northern pocket gopher	*Thomomys talpoides*
Pocket mice and allies (Heteromyidae)	
Chisel-toothed kangaroo rat	*Dipodomys microps*
Dark kangaroo mouse	*Microdipodops megacephalus*
Great Basin pocket mouse	*Perognathus parvus*
Little pocket mouse	*Perognathus longimembris*
Ord kangaroo rat	*Dipodomys ordi*
Pronghorns (Antilocapridae)	
Pronghorn	*Antilocapra americana*
Raccoons (Procyonidae)	
Raccoon	*Procyon lotor*
Rats and mice (Cricetidae)	
Bushy-tailed woodrat	*Neotoma cinerea*
Canyon mouse	*Peromyscus crinitus*
Deer mouse	*Peromyscus maniculatus*
Desert woodrat	*Neotoma lepida*
Long-tailed vole	*Microtus longicaudus*
Montane vole	*Microtus montanus*
Northern grasshopper mouse	*Onychomys leucogaster*
Pinyon mouse	*Peromyscus truei*
Sagebrush vole	*Lagurus curtatus*
Western harvest mouse	*Reithrodontomys megalotis*
Sheep and allies (Bovidae)	
California bighorn sheep	*Ovis canadensis califonica*
Shrews (Soricidae)	
Merriam's shrew	*Sorex merriami*
Preble's shrew	*Sorex preblei*
Vagrant shrew	*Sorex vagrans*
Squirrels (Sciuridae)	
Antelope ground squirrel	*Ammospermophilus leucurus*
Belding ground squirrel	*Spermophilus beldingi*
Douglas squirrel	*Tamiasciurus douglasii*
Golden-mantled ground squirrel	*Spermophilus lateralis*
Least chipmunk	*Eutamias minimus*
Townsend's ground squirrel	*Spermophilus townsendi*
Yellow-bellied marmot	*Marmota flaviventris*
Yellow-pine chipmunk	*Eutamias amoenus*
Weasels (Mustelidae)	
Badger	*Taxidea taxus*
Ermine	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*

Table H-7. (Continued)

Lifeform, family, and common name	Scientific name
Mink	*Mustela vison*
Spotted skunk	*Spilogale putorius*
Striped skunk	*Mephitis mephitis*
Wolverine	*Gulo gulo*
Reptiles	
Anguids (Anguidae)	
Northern alligator lizard	*Elgaria coerulea*
Colubrid snakes (Colubridae)	
Common garter snake	*Thamnophis sirtalis*
Gopher snake	*Pituophis melanoleucus*
Racer	*Coluber constrictor*
Striped whipsnake	*Masticophis taeniatus*
Western terrestrial garter snake	*Thamnophis elegans*
Igaunid lizards (Iguanidae)	
Desert horned lizard	*Phrynosoma platyrhinos*
Leopard lizard	*Crotaphytus wislizeni*
Sagebrush lizard	*Sceloporus graciosus*
Short horned lizard	*Phyynosoma douglassi*
Side-blotched lizard	*Uta stansburiana*
Western fence lizard	*Sceloporus occidentalis*
Pit vipers (Viperidae)	
Western rattlesnake	*Crotalus viridis*
Skinks (Scinicidae)	
Western skink	*Eumeces skiltonianus*
Teiids (Teiidae)	
Western whiptail	*Cnemidophorus tigris*
True boas (Boidae)	
Rubber boa	*Charina bottae*

[a] Authorities for scientific and common names included Williams et al. (1989) for fish; Nussbaum et al. (1983) for amphibians and reptiles; AOU (1983, 1985, 1987) for birds; and Verts and Carraway (1984) for mammals.

APPENDIX I
EVALUATION OF CATTLE GRAZING AS A MEANS TO ENHANCE WILDLIFE HABITAT ON HART MOUNTAIN NAR

INTRODUCTION

This appendix provides an evaluation of the use of cattle to enhance wildlife habitat on Hart Mountain NAR. It should not be considered a comprehensive review of relevant literature. We did, however, attempt to provide representative examples of differing philosophies on the subject. Because several comments (Appendix O) were received that expressed concern that we ignored information contained in the Krueger et al. (1991) report and the subsequent correspondence between J. Yoakum (Wildlife Consultant) and Dr. W. Krueger (Department Head of Rangeland Resources, OSU), more of this information was added to this appendix. Additionally, we made certain to include potential applications for using cattle to manage wildlife habitat on Hart Mountain NAR that were identified by Krueger and Buckhouse (1993). For some potential uses, we relied heavily on literature submitted by OSU's Department of Rangeland Resources (Krueger and Buckhouse 1993). Because of the concern that was expressed by public commenters regarding the treatment of livestock grazing in the DEIS, a more thorough evaluation was undertaken in this appendix.

Literature published by E. W. Anderson (Certified Range Consultant) also was submitted by commenters during the public comment period for the DEIS. An affidavit written by D. Bailey (1991; Western Range Service) was submitted to the Service in 1991. It subsequently was reviewed by J. Yoakum, an expert in pronghorn ecology, under contract to the Service (Yoakum 1992c). Several commenters resubmitted the affidavit during the public comment period for the DEIS. An effort was made to incorporate this information to a greater degree in this appendix.

Before beginning, readers should be aware that this appendix only addresses cattle grazing as an active means of accomplishing specific wildlife habitat objectives. This is in contrast to adjusting a cattle grazing program to allow certain habitat conditions to be reached. For example, a riparian area may not be recovering under a season-long grazing program. The program subsequently is changed to a rest-rotation system, and recovery of the area begins to take place. In this example, cattle were not used to initiate the recovery process; the adjustments in season of use merely allowed recovery to begin (i.e., the natural potential of the system to heal itself was given an opportunity to do so). This is an important distinction, and one that is a source of much confusion.

Planning Perspective

Before a management "tool" (e.g., livestock grazing, prescribed burning) can be evaluated as a potential method for managing wildlife habitat in a particular area (e.g., Hart Mountain NAR), goals and objectives must be established (Coughlan and Armour 1992). Please refer to Chapter 1, Section Two for Refuge goals and long-range objectives. Objectives, according to Coughlan and Armour (1992:26), provide the basis for evaluating potential solutions for resolving problems and for evaluating implementation success. Before objectives can be developed for resolving problems, problems must be identified. Please refer to Chapter 1, Section Two for the list of problems to which long-range objectives are directed. The problems listed in Chapter 1 reflect the underlying reasons why Refuge goals currently are not being achieved. Papers presented in the symposium entitled *Can Livestock Be Used as a Tool to Enhance Wildlife Habitat* (Severson 1990b), emphasized the need for establishing specific goals and management plans to achieve those goals (Severson 1990a).

Service policy directs that livestock grazing, as a management practice, may be permitted on a National Wildlife Refuge when it enhances, supports, and contributes to established wildlife management objectives (USFWS 1982:6 RM 9.1). It can also be permitted on a refuge if it is determined to be compatible with the purpose for which the refuge was established; however, livestock grazing in this context does not pertain to this appendix.

Krueger et al. (1991) and Krueger (1992a) recognized the importance of defining desired habitat conditions (e.g., goals and objectives). Krueger et al. (1991) posed the question "When [the Service] accomplish[es their] goal of providing the best habitat for wildlife, what will this unit look like?" They continued by identifying fire, livestock grazing, mechanical devices, and herbicides as being excellent tools when used to direct vegetation change toward defined objectives and within the ecological potential of the area. In other words, the extent to which any of these practices should be used, if they should be used at all, depends on the task at hand (which is defined in the long-range objectives in Chapter 1, Section Two). They also added that tools used to manipulate vegetation should be directed toward influencing natural processes. Krueger (1992a) pointed out that, because the tendency of upland plant communities is to move toward domination by shrubs, maintaining a mixture of succession stages should form the fundamental basis for planning on the Refuge. This in fact does form the basis of the long-range objectives for Refuge uplands, other than woodland and forestland areas (Chapter 1, Section Two).

In his chapter on setting goals, Savory (1988:445-457) emphasized the importance of establishing landscape, quality of life, and production goals before tools (e.g., livestock grazing, fire) are selected for use. For example, he assessed that "if I do not know what I want to make, then what use are a hammer and saw to me?" He identified three common errors in setting goals: "[1.] Setting production goals without reference to either the ecosystem (landscape) or quality of life. [2.] Confusing tools and goals. [and 3.] Making exceedingly narrow goal definitions such as safeguarding or eradicating a particular species, protecting watersheds by mechanical means, stopping desertification by planting trees, and the like." Another hypothetical example, which is relevant to this appendix, that could be added to the third item would be a goal to use livestock to enhance forage quality for wildlife. This type of error is related to the second listed error, and is in error because it, along with the other examples listed under item 3 above, identifies both the goal and a means to accomplish the goal.

Ecological Perspective

The goal of habitat management often relates to design of site disturbance and the control of the performance of plant species after disturbance (Luken 1990:10). Properly designed and executed disturbances can influence plant succession to produce a desired benefit, ranging from increased production of game species to increased watershed health (Maser and Thomas 1983, Sturges 1993). Manipulations applied on an extensive, regular basis can affect regional characteristics of habitats, watersheds, landscapes and, consequently, wildlife populations (Gruell 1986, Armour et al. 1991).

Manipulations of vegetation can be characterized by several factors including type, frequency, and intensity of disturbance. For example, prescribed burning could be considered a low frequency, high-intensity disturbance (Kilgore 1981). On the other hand, some methods of livestock management could be considered a high frequency, low intensity, long-duration disturbance (Holechek et al. 1982). Both types differ in the effects produced; however, objectives for each usually are framed in terms of expectations of probable responses. Ultimately, evaluation of success or failure is related to actions that determine the nature of disturbance, which collectively influence short and long-term response of habitat (Laycock 1983, Bunting et al. 1987).

Krueger et al. (1991) assessed that wildlife are a product of their habitat and, as noted above, advised that tools for manipulating vegetation be directed at natural processes. Because processes shape habitat and habitat management essentially is the management of processes (Luken 1990), the principle that wildlife are a product of their habitat can be expanded to include the assessment that wildlife are a product of processes that shape habitat (including habitat management practices). This principle is important because it dictates or at least influences decisions on the type of vegetation manipulation practices that would be needed to produce the type of habitats that are identified in Refuge goals and objectives. In reading the remainder of this appendix, readers should keep in mind that Refuge goals direct that the Service "manage for healthy and balanced populations of pronghorn and other native wildlife in their natural [to the extent possible] habitat...", and to "[r]estore and maintain, on Refuge lands, the structure, species composition, and processes of native ecological communities and ecosystems of the northern Great Basin region." The resolution of core problems identified in Chapter 1, Section Two will be key in reaching these goals. Long-range objectives provide direction for managers to resolve the core problems. Replicating, to the extent possible, the range of habitat conditions under which native wildlife communities evolved is a central theme of the long-range objectives.

In order to evaluate the usefulness of habitat management methods for accomplishing Refuge goals, needed is an understanding of the processes that created habitat conditions under which native wildlife communities evolved. Krueger et al. (1991) noted the importance of understanding ecological processes in the area being managed. Of primary concern in this FEIS are the processes of succession, soil erosion, soil formation, and disturbances such as fire, herbivory, and mechanical disturbance (including hoof action). Climatic conditions also are important, but are uncontrollable. In particular, fire historically influenced vegetation to a large degree in the northern Great Basin (Kauffman 1990), while grazing by large herbivores played a limited role in influencing habitat conditions prior to the introduction of domestic livestock (based on Mack and Thompson 1982; and Young et al. 1976). These two processes are noteworthy because they are the two primary habitat management practices being evaluated by this FEIS, and because introduction of livestock grazing and suppression of natural fires has had dramatic impacts on vegetation and watershed functioning on lands within Refuge borders.

USE OF CATTLE TO ENHANCE FORAGE

This section provides a review of cattle grazing as a wildlife management practice to improve the quality of food for game animals -- pronghorn, mule deer, and sage grouse in particular. Objectives for improving forage quality by livestock usually are described in terms of increasing nutritional quality of forage, enhancing availability of forage, and to maintain or increase site productivity. Preconditioning fall/winter forage using livestock is addressed first, then prolonging the succulence of forage using livestock is addressed. Following these two discussions, the use of cattle to enhance forage for particular wildlife species (pronghorn, mule deer, sage grouse) is discussed.

The use of cattle to improve the vigor of desirable forage plants and to enhance forage quality formed the basis of the 1970 Resource Management Plan for Hart Mountain NAR (USFWS 1970). A major underlying assumption of the Plan is that "light to moderate grazing by livestock during the growing season will hold back plant development making the forage more nutritious and palatable to wildlife. To do this, each unit would have to be grazed each year. Rotation of deferred grazing systems would accomplish this objective and also provide for improved plant vigor and range conditions."

Preconditioning Autumn/Winter Forage

Since the writing of the 1970 Resource Management Plan (USFWS 1970), the concept of using cattle to enhance forage quality on Hart Mountain NAR has been refined (Anderson et al. 1990a, 1990b). E. W. Anderson used the term "preconditioning" to describe the use of early season livestock grazing to enhance the nutritional quality of autumn/fall forage. He and Scherzinger first described preconditioning in Anderson and Scherzinger (1975), but did not use the term "preconditioning" in their discussion. The goal of preconditioning, as described by Anderson et al. (1990b), is to improve the nutritional quality of autumn/winter forage through the grazing of plants, usually bunchgrasses, during the growing season (see also Anderson and Scherzinger 1975). To improve the quality of autumn/winter forage, according to the concept, livestock must be moved off of treatment areas by mid-growing season to allow regrowth of grazed plants. Sufficient moisture for regrowth after livestock are removed is imperative. Early season grazing causes a delay in phenology of grazed plants. The regrowth, as explained by Anderson et al. (1990b), is cured by heat and lack of moisture when the plants are at maximum forage value. As such, a higher level of nutrients are fixed in the regrowth, resulting in fall/winter forage that has higher nutritional value than otherwise would have been available. This assumes that sufficient moisture is available for regrowth to occur, but not enough for the plants to complete their natural physiological cycle. By terminating physiological processes in regrowing plants (by heat and drought), translocation of nutrients to roots is stopped. Anderson et al. (1990b), therefore, recommends that forage in any particular unit only be preconditioned once out of every two or three years. Krueger (1992b) noted that if a plant completes its annual growth cycle [which requires adequate moisture], it will cure the same nutritionally as if it had not been grazed.

Empirical support for preconditioning was ascertained in part by Pitt (1986) for bluebunch wheatgrass, a native bunchgrass of the intermountain region. He found that growth was delayed in experimentally-raised plants that were subject to moderate defoliation (i.e., plants clipped to 6 inch height) for 2 consecutive years during spring. Following two years of clipping, re-growth (measured on 26 October) had higher protein, digestibility, calcium, and phosphorus contents compared to that of unclipped plants. Clippings that occurred later during critical growth stages (i.e., emergence-seed formation) maintained the highest level of nutrients. Early season clipping in the first year of study did not increase the nutritional quality of regrowth. This suggests that early season defoliation of bluebunch wheatgrass may not consistently enhance nutritional quality of autumn/winter forage or that it may take two consecutive spring grazings to precondition autumn/winter forage. However, as pointed out by Anderson (1991), there was an 89 percent reduction, in Pitt's (1986) study, in flowering stems following 2 years of clipping at boot stage. For plants that were clipped at emergence from boot, there was a 96 percent reduction in flowering stems. Anderson (1991), in her review of the literature on the effects of defoliation on bluebunch wheatgrass, concluded that the "belief that range improvement will occur after one or two years of rest following a single season of more than 'light' use during the growing season is erroneous."

Sheep grazing in coastal clearcuts (Rhodes and Sharrow 1983, 1990) provides additional evidence that livestock can be used to enhance autumn/winter forage for ungulates. In their two year study in a precipitation zone of about 100 inches, Rhodes and Sharrow found that forage (6 plant species primarily used by big game) from areas grazed by sheep in the spring had higher levels of crude protein and dry matter digestibility in October than forage collected from ungrazed areas in October. Anderson and Scherzinger (1975) reported that controlled cattle grazing was the cause of increased elk numbers in a northeastern Oregon winter range (Bridge Creek Wildlife Management Area). In contrast, Skovlin et al. (1983) reported that controlled cattle grazing did not promote increased elk use on a similar range in southeastern Washington (just to the north of Bridge Creek). Cattle grazing in one year of study was associated with reduced elk numbers (Skovlin 1983).

Holechek et al. (1989) surmised that the inconsistency between the two studies "could be explained by factors other than forage quality that may have influenced elk movement into the Bridge Creek Wildlife Management Area" in northeastern Oregon. Krueger (1992b) also assessed that something more than or other than forage quality on the Bridge Creek area may have elicited increased elk numbers. As yet, information has not been published that verifies that the cattle grazing at Bridge Creek Wildlife Management Area has preconditioned autumn/winter forage. Anderson and Scherzinger (1975) pointed out that physiological responses of perennial grasses to cattle grazing on the Bridge Creek area were conjectural. They did not measure nutrient contents of regrowth and ungrazed plants in the autumn or winter. Therefore, use of the Bridge Creek area as an example of where cattle successfully preconditioned forage should be used with caution.

Pitt (1986) pointed out that his results (summarized above) should be extrapolated to other areas with caution primarily because "the extent of regrowth depends upon availability of moisture, with response becoming less pronounced as soil moisture declines." Similarly, Laycock and Price (1970) reported that clipping may not increase total protein content in arid rangelands if soil moisture is low. Holechek et al. (1989:345) surmised that benefits to wildlife from livestock grazing would most likely occur in areas receiving over 20 inches of precipitation, and that benefits from grazing are questionable in the more arid and desert ranges. In Pitt's clipping study, nutritive quality of autumn/winter forage was enhanced by clipping during only one of two years in an area receiving about 40 inches of precipitation per year. In Rhodes and Sharrow (1983, 1990), nutritive quality of forage was enhanced during two years of study in an area receiving nearly 100 inches of precipitation per year on average. Most of Hart Mountain NAR receives less than 12 inches of precipitation per year on average.

In an area about 75 miles northwest of Hart Mountain NAR, Hedrick et al. (1969, as cited by Pitt 1986) found that regrowth of vegetation following cattle grazing only occurred during two of five years. Grazing took place about May 10 - May 31 each year in Fort Rock Valley, Lake County, and average annual precipitation was about 10 inches per year. One possibility why regrowth did not occur in three of five years may be explained by Hedrick et al.'s (1969) assessment that "soil moisture becomes limiting in late spring when dry winds withdraw much of the surface moisture before soil temperatures are high enough to permit rapid plant growth." Apparently, the presence of regrowth after clipping or grazing, does not necessarily indicate that nutritional value in the regrowth (in the fall/winter) is higher than that of unclipped plants (Pitt 1986). Having supervised research on preconditioning, Krueger (1992b) questioned whether spring clipping will yield high quality fall/winter forage compared to unclipped plants. He continued by pointing out that pinpoint accuracy in grazing applications would be required in spring to successfully condition fall/winter forage. As yet, there are no studies that have examined the nutritional value of preconditioned forage compared to ungrazed forage in Great Basin uplands, or that have examined whether herbaceous forage used by pronghorn, mule deer, or sage grouse during the fall, winter, or early spring can successfully or consistently be preconditioned in Great Basin uplands.

Based Pitt (1986), Rhodes and Sharrow (1990), and other research, and the explanation of the concept by Anderson and Scherzinger (1975) preconditioning forage using cattle certainly seems plausible, but the extent to which it can consistently and predictably be accomplished remains uncertain. For managers, potential problems associated with the concept of preconditioning require resolution before field application. In Pitt's (1986) study, increase in nutrient status of wheatgrass was inversely related to plant survival, density of flowering stems, and density of flowers of wheatgrass. Others have noted that bluebunch wheatgrass is highly sensitive to the effects of spring defoliation, despite presence or absence of competition from other species (Blaisdell and Pechanec 1949, Laycock 1967, Mueggler 1975, Rickard et al. 1975, Sauer 1978, Anderson 1991). Although all amounts of defoliation influence subsequent growth of wheatgrass, magnitude of effect apparently is proportional to amount and timing of defoliation (Blaisdell and Pechanec 1949, Mueggler 1975, Pitt 1986). Although response to grazing differs among native bunchgrasses, most species are detrimentally influenced (e.g., reduced vigor and survival) by regular defoliation during the spring growing season (Laycock 1967, Mueggler 1975, Rickard et al. 1975, Perry and Chapman 1976, Eckert and Spencer 1987). Additionally, regrowth may be limited and adverse effects associated with preconditioning may be accentuated during periodic drought. Drought can adversely affect establishment, vigor, and survival of bunchgrasses on ungrazed sites (Pechanec et al. 1937). Drought is a frequent but unpredictable phenomenon at Hart Mountain NAR (Refuge narrative reports).

Prolonging the Duration of Succulent Forage

Similar to the concept of preconditioning is the use of livestock to delay the phenology of forage plants to prolong the succulence of plants in order to sustain forage quality later into the summer (Krueger 1991, 1992a, 1992b; Bailey 1991). It differs from preconditioning because it does not require that a higher than normal amount of nutrients be locked into regrowth while it is in an immature stage. It merely requires that plants regrow after grazing pressure is released and that the regrowing plants take on characteristics of plants at a similar stage of growth, namely a higher nutrient content. Another important aspect of delaying the phenology of forage plants is that, given adequate moisture, it would result in succulent growth remaining available after above-ground portions of ungrazed plants have withered and died (Evans 1986).

As illustrated in Cook et al. (1977, as cited in Krueger 1991), nutrient content of forbs and grasses decline as plants mature. In other words, young plant tissue has a higher nutrient content than more mature tissue (Krueger 1992b). Information provided in Cook and Harris (1968, as cited in Krueger 1991) also documents this phenomenon. The concept of spring grazing to delay the phenology of forage plants is as follows. Herbage removal interrupts plant development and initiates regrowth (or the plants become quiescent; Krueger 1992b). Because development of grazed or clipped plants are set back to an earlier stage, the regrowth takes on similar nutritive values as growth of ungrazed plants at the same stage of development (Krueger 1991). For example, a three-quarter grown plant that is grazed in May will revert back to an earlier stage of development, and resemble the plant as it existed in April (Krueger 1992b). When it regrows and again becomes three-quarter grown (now in June), it will have the same qualities as it did just prior to being grazing in May. Also, when the plant becomes three-quarters grown, other ungrazed plants may already have matured and begun withering.

Laycock and Price (1970) described several studies from 1930 through the 1960's that found percentages of crude protein, phosphorous, carotene, and digestibility to be higher in the regrowth of clipped plants than in unclipped plants (measurements of clipped and unclipped plants presumably were taken on the same day). Several authors found that composition of regrowth of clipped plants were similar in composition to unclipped plants at an earlier growth stage. Apparently, clipping interrupts development of plants, thereby prolonging the amount of time until maturity is reached.

Evans (1986:68), described in more detail in the Sage Grouse section, compared crude protein and crude fiber levels of three forb species collected in July and August from a non-grazed and grazed portion of one meadow on Sheldon NWR. The grazed portion of the meadow had been severely grazed by cattle during the latter half of June. She found that crude protein generally was higher and crude fiber generally was lower in forbs that were collected from the grazed portion in comparison to forbs collected from the ungrazed portion. Collections were made in July and August. Sample size was not large enough to test for statistical significance, but her results were in agreement with information presented in the previous paragraph. Evans (1986) also concluded that "[f]orb regrowth, stimulated by grazing prior to the cessation of plant growth, was available to sage grouse on grazed meadows throughout most of the summer, while forbs on ungrazed meadow became mature and unpalatable by late July." Evans made note that meadows in degraded condition (lowered water table) may not elicit the same response due to reduced moisture available for regrowth.

Krueger (1992b) stated that "[l]ivestock grazing is the only practical tool that can be used to annually manipulate forage quality for planned objectives." If the Service had specific objectives for enhancing late-season forage quality in meadows, the use of cattle to accomplish this objective in meadows with high water tables would be an option. However, Yoakum (1992c) noted that he knows of no studies in which cattle grazing removed lower quality forage and stimulated succulent and high quality regrowth that was used by pronghorn in the Great Basin. Additionally, and more importantly, there are no objectives at this time that call for improved nutritional value of late season forage. There is no reason to believe that the nutritional quality of existing forage plants is deficient during the later months of the summer. Krueger (1992b) apparently recognized this possibility when he stated that "[i]n some cases, improved quality is not needed." He also pointed out that "early defoliation will damage future production" in some cases.

Krueger (1992b) assessed that the elimination of livestock will cause loss of habitat quality on the Refuge because mid to late summer forage quality and palatability will be reduced. This assumes, however, that past (1971-1990) grazing by cattle increased forage quality and palatability of mid to late summer forage above that which would have occurred without cattle grazing. This may only have occurred on limited occasions; only a small portion of the cattle that were grazed on the Refuge during 1971-1990 were grazed early in the growing season and removed while a sufficient amount of the growing season remained for regrowth (Appendix M). Most of the grazing by cattle took place at the latter end of the growing season and into the fall. Grazing rarely was initiated before the last few weeks of the growing season in grazing units consisting primarily of riparian meadow (e.g., Lyons Meadow, North Post, South Post, Goat Creek) and that encompassed comparatively productive uplands and a substantial amount of riparian areas (e.g., Pauite, Deer Creek, Eagle Peak, Willow Creek, North Mountain, South Mountain). The livestock grazing program, in terms of season of use, did not differ substantially before and after 1979 (Appendix M). As described under the pronghorn section below, preconditioning of forage also likely occurred only to a limited extent, if at all during 1971-1990.

While previous cattle grazing management seems to have provided no more than limited opportunity for prolonged succulence of grasses and forbs, it may have provided a more readily accessible source of succulent forage in the spring. Removal of standing dead plant material during the late summer and fall in areas used by cattle would have allowed easier access, by some herbivorous wildlife to newly growing plants in the spring. The extent to which it occurred and benefited wildlife is unknown. Manipulation of vegetation generally benefits some species while adversely affecting others. From this standpoint, we can speculate that elimination of livestock grazing would have negative impacts to those species that benefitted from late summer and fall cattle grazing.

Enhancing Forage for Particular Species

Wildlife species that reportedly benefit from prescribed cattle grazing of grasses, forbs, and shrubs include pronghorn, elk, mule deer, black-tailed deer, and sage grouse (Anderson et al. 1990b). The following discussion examines the potential for using cattle grazing to enhance value of food for pronghorn, mule deer, and sage grouse.

Pronghorn

Anderson et al. (1990a, 1990b) are the only references that have provide an assessment of the use of livestock to enhance forage for pronghorn in the Great Basin. Bailey (1991) asserted that livestock grazing is the most practical and economical means of managing pronghorn and other wildlife on the Refuge. Although he recognized prescribed burning and mechanical treatments as possible methods, he dismissed them because they are uneconomical and often have undesirable impacts. J. Yoakum, an expert in pronghorn ecology, evaluated Bailey's affidavit, and found the contention that cattle grazing is the primary means of maintaining pronghorn habitat on the Refuge to be unsupported by scientific documentation (Yoakum 1992c).

Yoakum (1992c) also found that (1) the affidavit addressed compatible factors associated with livestock grazing, but not noncompatible factors, (2) it predominantly reviewed information that was more than 10 years old, and (3) it did not account for differences in pronghorn ecology among geographic regions (for instance pronghorn did not co-evolve with bison or cattle in the Great Basin) (Yoakum 1992c). Other aspects of Bailey (1991) and Yoakum (1992c) are presented below.

Anderson et al. (1990a, 1990b) assert that the increase in pronghorn populations on the Refuge during the 1980s was a direct consequence of changes made to management of Hart Mountain NAR in 1979 (primarily to the livestock grazing program). The authors suggest that the pronghorn population responded to improved forage quality that resulted from pre-conditioning of herbaceous plants. This claim assumes that (1) cattle grazing increased the nutrient content of forbs and grasses that are important to pronghorn during the fall and winter, (2) forbs and grasses used by pronghorn during the fall and winter were nutritionally inadequate, without preconditioning, and limit the pronghorn population on the Refuge, (3) livestock were managed according to guidelines specified in Anderson et al. (1990b), (4) increased nutritional value of grasses and forbs took place in areas used by pronghorn in the fall and winter, and (5) the rate of increase of the pronghorn population increased after changes were made to the livestock grazing program in 1979. None of these assumptions, however, have been verified. The following discussion examines each of the five assumptions. Because Anderson et al. (1990a) was conducted on Hart Mountain NAR, and because it is the only study that attributes an increase in pronghorn use of an area to preconditioning of forage by cattle (Anderson et al. 1990b), a close examination of the assumptions is warranted.

In regard to the first assumption, nutritional values of grazed and ungrazed plants were not measured, nor is there substantial evidence from similar environments to support the contention that cattle grazing prior to mid-growing season can increase the nutritional value of fall/winter forage in Refuge uplands. Bailey (1991) surmises that cattle grazing removes lower quality forage and stimulates regrowth which is of higher quality, but did not provide any supportive evidence for this. Yoakum (1992c) pointed out that he knows of no studies that substantiate such an assertion for pronghorn in the Great Basin.

More importantly, cattle and pronghorn make use of different plant genera. While cattle make generally feed on grasses (Hanley and Hanley 1982, Stuth 1991), pronghorn generally feed on forbs (O'Gara and Yoakum 1992 for review). Therefore, if cattle successfully preconditioned perennial bunchgrasses, this may have only consequences to pronghorn. However, pronghorn do feed on some grasses. Grasses, primarily Sandberg's bluegrass and cheatgrass, can be an important component of pronghorn diets (Salwasser 1980). Cattle, on the other hand, apparently make limited use of Sandberg's bluegrass where taller species (i.e., bluebunch wheatgrass) are available (Willms et al. 1979). Influence of preconditioning has been reported for coarse-leaved bunchgrasses (Pitt 1986), but not for Sandberg's bluegrass or cheatgrass. The influence of preconditioning on preferred grasses appears limited because of differences in diet composition between livestock and pronghorn, and because of the potential ineffectiveness of pre-conditioning as it applies to Sandberg's bluegrass and cheatgrass, preferred grasses of pronghorn.

Vegetation of the Great Basin did not evolve under heavy grazing pressure by large ungulates as surmised by Bailey (1991). Bailey's supposition that cattle grazing on the Refuge would benefit pronghorn apparently seems to be founded in his belief that pronghorn "have coexisted with large herbivores such as cattle and bison for eons." He postulated that heavy grazing by the large grazers favorably altered vegetation for pronghorn. As pointed out by Yoakum (1992c), neither bison or high numbers of wild herbivores existed in the Great Basin prior to the introduction of domestic livestock. Historical records indicate that large, hoofed grazers such as bison were present in very limited numbers in the intermountain region during the pre-settlement period (Kelly 1932, Butler 1976, Mack and Thompson 1982, Grayson 1988). Climate apparently was one of the primary factors that influenced the pre-historic development of intermountain sagebrush-steppe habitats used by pronghorn (Tisdale 1961, Galbraith and Anderson 1971, Mack and Thompson 1982). Whereas sod-forming grasses were prevalent in the summer-wet prairies of the Great Plains where ungulates abounded, cool-season bunchgrasses were prevalent in the intermountain region (Reynolds et al. 1982, Schwartz and Ellis 1981, Mack and Thompson 1982. Principal bunchgrass taxa that occur in the uplands of the intermountain region and the Refuge are intolerant of intensive grazing during the growing season (Blaisdell et al. 1982).

We do not know of any information to support the second assumption that forbs and grasses used by pronghorn during the fall and winter are nutritionally inadequate, without preconditioning, and that they limit the pronghorn population on the Refuge.

Livestock grazing records indicate that the third assumption, that livestock were managed according to guidelines specified in Anderson et al. (1990b), does not appear to have been met to any large extent. According to Anderson et al. (1990b), livestock must be taken out of units receiving preconditioning treatment about mid-growing season to allow forage to regrow. This apparently is one of the most critical guidelines for preconditioning forage. We found that cattle were removed from units by mid-growing season (allowing for a 2-week leeway) once in each of 3 grazing units, of 6 major units encompassing the primary pronghorn range, during 1979-1987 (8 grazing units existed after 1985) (Appendix M). There are no records to indicate whether regrowth occurred during these 3 instances, and if it had, if it was nutritionally superior to ungrazed plants. If forage was successfully preconditioned, the likelihood is small that it could have significantly increased pronghorn use of the Refuge during 1979-1987 (DeLong and Yoakum 1994 for more detail). During 1971-1990, cattle were removed by about mid-growing season from the following grazing units that encompass the primary pronghorn range (Appendix M).

- Blizzard Ridge (2 times)
- North Poker Jim (1 time)
- Desert Lake (2 times)
- Riffle Canyon (6 times)

Based on Anderson et al. (1990b), therefore, preconditioning could potentially have taken place on 11 occasions out of 179 unit years (number of units multiplied by years that each unit was in existence during 1971-1990) (Appendix M). Most of this occurred in a relatively small grazing unit (Riffle Canyon) that receives comparatively little pronghorn use. Again, these figures do not indicate the number of times that forage was preconditioned because it is not know whether regrowth occurred following cattle grazing or if regrowth contained a higher level of nutrients in the fall/winter. Existing units that encompass the primary distribution of pronghorn are Blizzard Ridge, North Poker Jim, South Poker Jim, Desert Lake, Spanish Lake, Lower Guano Creek, Reservoir Lake, Riffle Canyon (Map 2-1, Volume I). Key areas are within the Blizzard Ridge, Desert Lake, and Spanish Lake units.

In regard to the fourth assumption, there is limited information to determine the amount of overlap between pronghorn fall/winter distribution and spring-time cattle distribution during the years 1979-1987. In the limited number of times and areas that cattle were grazed in the early growing season and removed by about mid-growing season within the range of pronghorn on the Refuge (see above), it is not known how much of the grazing by cattle occurred in areas that were later visited by pronghorn in the fall and winter. Pronghorn primarily use the low sagebrush vegetation type during the fall/winter though some use is made of lakebeds in the fall (Figure 3-10, Volume I). Livestock, on the other hand, made limited use of the low sagebrush vegetation type.

The fifth assumption also was not met. Anderson (1990), in interpreting data presented in Anderson et al. (1990a), asserts that there was an "abrupt, persistent increase in antelope use on the Refuge in 1980--the year grazing systems were adjusted..." DeLong and Yoakum (1994), however, found that pronghorn use of the Refuge from 1970 to 1987 increased at a fairly constant rate, using data presented in Anderson et al. (1990a). The rate of increase during 1980-1987 actually was lower than the rate of increase during 1970-1979, though this was not statistically significant. As such, the 60 percent increase in use of the Refuge by pronghorn between the periods 1970-1979 and 1980-1987, as reported by Anderson et al. (1990a), cannot legitimately be attributed to changes made to the livestock grazing program in 1979. Because there was no apparent change in the rate of increase in pronghorn use of the Refuge before and after 1980, the higher pronghorn use after 1980 cannot be attributed to changes made to the management program in 1979.

Bailey (1991) inferred that, because pronghorn numbers have increased substantially in the presence of livestock, pronghorn have benefitted from cattle grazing on the Refuge. He based this on Anderson's (1990b) comparison of pronghorn numbers during 1970-1978 and 1979-1987. Yoakum (1992c) disagreed, stating that this line of reasoning has no scientific support. He listed conservative harvest, more than 40 years of mild winters, predator control, and water developments as possible contributing factors for the increase in pronghorn numbers. Additionally, pronghorn populations have been on a continued long-term increase for over 70 years throughout most of their habitat in Canada and United States.

An additional consideration in evaluating the potential of using early season cattle grazing to precondition forage for pronghorn is the potential for competition between pronghorn and cattle during pronghorn pregnancy and fawning. Bailey (1991) asserted that minimal dietary overlap occurs between pronghorn and cattle. Yoakum (1992c), however, warned that assessing competition based solely on year-long dietary overlap can be misleading.
Ellis (1970, as cited by Yoakum 1992c) contended that competition for nutritious forage between cattle and pronghorn during late spring and early summer resulted in low fawn survival. As pointed out by Yoakum (1992c), the major reason identified by Ellis for low availability of grasses and forbs during the critical period of pronghorn pregnancy in the Great Basin was heavy utilization of important forage by livestock. McNay (1980, as cited by Yoakum 1992c) found that cattle

displaced pronghorn does on traditional fawning areas on Sheldon NWR, forcing does to have fawns on less favorable areas more subject to predation.

Although competition for forage between cattle and pronghorn likely is not a problem on rangelands in good ecological condition, most of the Refuge is not in good ecological condition (Chapter 3). Sporadic, unpredictable drought would further limit food availability for pronghorn, and reduce the potential for plant regrowth after grazing, and increase the probability of competition between livestock and pronghorn (Ellis 1970, O'Gara and Yoakum 1992).

Mule Deer

A wide range of studies have examined the relationship of cattle grazing to mule deer habitat. The majority, however, address winter use of rangelands by mule deer. Historic increases in western populations of mule deer were attributed mainly to changes in plant succession that resulted from the combined influence of heavy livestock grazing, fire suppression, and regulation of deer harvest (Gruell 1986). Apparently, heavy livestock grazing between 1880-1930 reduced survival of herbaceous plants, reduced spread of fire, advanced vegetative succession, and increased survival and cover of shrubs important to deer, especially on winter ranges (Gruell 1986), including Hart Mountain (Pyle 1991a).

Urness (1990) described the use of livestock to improve mule deer habitat. Principle uses that he described are: (1) increasing the quality of grass growth after grazing of grasses in spring; and (2) increasing the availability, usually production, of bitterbrush after grazing of herbaceous plants and bitterbrush in spring and summer. Leckenby et al. (1982) imply that spring and summer grazing of coarse-leaved bunchgrasses may stimulate increased production, quality, and accessibility of grass growth available to deer on fall and winter ranges. Austin et al. (1983), on the other hand, found that ungrazed crested wheatgrass had more re-growth than spring-grazed areas and deer preferred ungrazed areas for winter foraging.

Primary growth and reproduction of grasses that are important to mule deer on Hart Mountain NAR occurs between February and July; timing depends on species, elevation, aspect, soil moisture, and temperature (Blaisdell 1958, USSCS 1993). Grasses may resume vegetative growth in September and October with the onset of lower temperatures and occurrence of rain in sufficient amounts. Field observations indicate that substantial re-growth of grasses occurs every other year (Refuge narrative reports). There are no evaluations that described whether the cattle grazing systems at Hart Mountain NAR influenced availability of grass growth for deer. Additionally, most cattle grazing took place after the growing season in grazing units that encompass summer mule deer habitat (Anderson and Franzen 1988:Appendix E).

While many reports describe competition for habitat between livestock and mule deer as a real or potential management problem, other reports indicate that careful use of livestock can promote availability of mature bitterbrush for deer (Julander et al. 1961, Julander 1962, Tueller and Monroe 1975, Papez 1976, McConnell and Smith 1977, Austin and Urness 1986, Woodis 1989, Urness 1990). At Hart Mountain NAR and Sheldon NWR, bitterbrush is an important component of deer summer range. For example, deer and cattle diets comprised 47% and 36% of bitterbrush, respectively, during 2 summers on the Sheldon NWR (Woodis 1989). Deer and cattle preferred moderately-heavily hedged growth-forms of bitterbrush (Woodis 1989), which result from intensive browsing by ungulates (McConnell and Smith 1971). Apparently, the cattle grazing program on Sheldon NWR has enhanced bitterbrush browse for mule deer (Anderson et al. 1990b). Intensive grazing of bitterbrush not only modifies growth-form, but apparently increases leader growth and production in mature plants (Tueller and Tower 1979), which apparently is related to increased leaf area and energy balance of browsed growth-forms (McConnell and Smith 1977). However, evidence suggests that most plants in populations of heavily browsed bitterbrush die before reaching age of maximum productivity, usually 60-70 years (McConnell and Smith 1977).

Growth of bitterbrush can be enhanced by intensively grazing herbaceous plants by livestock during spring (Smith and Doell 1968, as cited by Urness 1981; Reiner and Urness 1982). Rest from livestock grazing during the summer (following early season grazing) is important because summer is the critical growing period of shrubs. Reduction of herbaceous plants by heavy livestock use in spring (i.e., >60%) subsequently increases survival and growth of seedling and mature bitterbrush (McConnell and Smith 1970, Neal 1981, Reiner and Urness 1982). Prescription of periodic, heavy grazing of herbaceous plants in spring and early summer is therefore suggested as one of several techniques to improve long-term survival and growth of seedlings and leader production in mature bitterbrush (McConnell and Smith 1977, Neal 1981, Leckenby et al. 1982, Reiner and Urness 1982). Results of research also suggest that a strategy of periodic, intensive cattle browsing in spring and summer is desirable for maintenance of bitterbrush productivity for deer (Tueller and Tower 1979, Woodis 1989).

There are no written accounts that document whether the cattle grazing program on the Refuge enhanced bitterbrush growth, or that the program benefitted mule deer. Mule deer and cattle use of forbs and bitterbrush was not systematically monitored after implementation of the deferred grazing system (Anderson et al. 1990b), so responses postulated for habitat and deer are speculative. Most of the grazing that occurred in units containing a high proportion of bitterbrush took place at the end of the growing season and after the growing season (Appendix M). Based on the Smith and Doell (1968; as cited by Urness 1981), it seems likely that cattle could have made relatively high use of bitterbrush during their critical growing period, assuming that they frequented upland areas. Overuse of riparian areas was prevalent (Refuge files). Marlow and Pogacnik (1981) reported that cattle spent a significant amount of their time in riparian areas during August through September on their study area.

Deferred grazing had several direct and indirect negative effects to mule deer and their habitat. First, Refuge narrative reports record consistent concern about overuse of bitterbrush and competition for bitterbrush between livestock and mule deer in bitterbrush stands. Another problem associated with operation of deferred grazing was its tendency to foster systematic overuse of riparian areas (Refuge files), considered the most important deer habitat in southeastern Oregon (Leckenby et al. 1982). Overuse of riparian areas apparently is not uncharacteristic of deferred grazing systems where upland habitat objectives operate in large, diverse allotments with an uneven distribution of livestock grazing resources (Roath and Krueger 1982a, Platts 1989, Reiswig 1989).

Sage Grouse

Three aspects of enhancing food value by cattle grazing reportedly apply to sage grouse: (1) increase in the availability of forbs by reducing height of surrounding meadow vegetation (Klebenow and Burkhardt 1982, Evans 1986), (2) prolong the succulence and increase the nutritional value of forbs in low gradient, riparian meadows (Evans 1986); and, (3) increase in the diversity and duration of availability of forbs associated with grazing in uplands (Anderson et al. 1990b). Empirical support for increasing forb availability in meadows was provided by Evans (1986), who found that early season grazing by cattle reduced the height of graminoids and delayed forb phenology in meadows. Sage grouse densities were greater in grazed than in ungrazed meadow sites, and differences were attributed to the influence of livestock grazing on forb availability and delayed phenology (Evans 1986:38).

Relatively high utilization levels by livestock (e.g., moderate, heavy, severe) in meadows, assuming a patchy mosaic with lesser used areas, seem to produce the best results for sage grouse (Klebenow and Burkhardt 1982, Evans 1986:99-100). Cattle grazing intensity was only presented for two of the six grazed meadows in Evan's (1986) study; utilization on one of the two meadows was characterized as severe and the other as moderate (Evans 1986:56,69). Klebenow and Burkhardt (1982:20) observed that meadow areas with vegetation height of 2-6 inches seemed to be preferred by sage grouse, and that meadow areas with tall, dense vegetation were avoided. Similar findings were obtained by Oakleaf (1971). Utilization of grazed meadows in Klebenow and Burkhardt's (1982) study ranged from moderate to heavy.

In her study on Sheldon NWR, Evans (1986:98) found that grazing of meadows during the growing season of forbs interrupted the normal processes of maturation and resulted in continued growth of new leaves throughout the summer. Succulent forage for sage grouse, therefore, was available longer into the summer in grazed meadows as compared to forage in ungrazed meadows. Forbs in ungrazed portions of meadows matured and weathered soon after seed set. Lowered water tables in at least one meadow apparently reduced available moisture for regrowth of forbs following grazing by cattle. Evans (1986:68), as summarized at the introduction of the Browse and Forage section above, found that crude protein generally was higher and crude fiber generally was lower in the forbs that were collected from the severely grazed portion of one meadow in comparison to forbs collected from the ungrazed portion of the same meadow.

Other research indicates that timing and intensity of use of riparian meadows by grouse was related to availability of food in uplands, inherent geography (i.e., edge:area ratio) of alluvial valleys, amount of cover reduction associated with livestock grazing, and progression stage of riparian vegetation types (Savage 1969, Oakleaf 1972, Klebenow 1985).

Riparian meadows are considered key habitats for sage grouse in the southeastern Oregon and Hart Mountain NAR (Call and Maser 1985, Refuge files). Sage grouse, however, make limited use of degraded riparian meadows, especially where encroached by sagebrush (Oakleaf 1972, Klebenow 1985), a characteristic of sites in early to mid stages of site progression at Hart Mountain NAR and Sheldon NWR. Problems associated with condition of riparian meadows are aggravated by overuse by cattle, which is consistently described in Refuge narratives, utilization records, and other reports (Reiswig 1989, Pyle and Brown 1991). In moderately-grazed and ungrazed meadows, height of grass cover at sites used selectively by sage grouse averaged one-third to one-half the height of cover at random sites (6 vs. 9 inches) (Klebenow 1985). Reductions in height of grass cover may improve sites for sage grouse, but also may influence status of other riparian-dependent mammals, waterbirds, and fish by reducing cover required for feeding, breeding, or concealment (Kirsch et al. 1978, Platts 1989, Medin and Clary 1990).

Application of livestock grazing to enhance food values for sage grouse on the Refuge may be limited because of the prevalence of deteriorated meadows, and the tendency for overuse of meadows by cattle. A 1992 inventory of resource condition disclosed that most alluvial valleys that could support meadow vegetation were in low-moderate condition, which is attributed to historic overuse by livestock (see Chapter 3).

Anderson et al. (1990b) suggest that cattle grazing on Hart Mountain NAR may have allowed the declining productivity of sage grouse to not decline as sharply on the Refuge as compared to adjacent lands. The basis for this claim involves the assumption that forbs are important to sage grouse, and that livestock grazing during the 1980s increased the diversity of forbs on the Refuge (apparently in reference results presented in Anderson 1990a). Diets of sage grouse in uplands are comprised of a diversity of forb species; however, the bulk of their diet is comprised of relatively few key species (Barnett 1993, Pyle 1993a). Trends in forb species composition described in Anderson et al. (1990a) cannot be substantiated, however, because of insufficient sample sizes, lack of stratification, and because data are only available for two years (Edge 1993, DeLong and Yoakum 1994). Krueger's (1990b) concern that elimination of livestock grazing on the Refuge would cause a reduction in mid to late summer forage quality and palatability appears to be unfounded because most grazing by cattle in units inhabited by sage grouse took place during the latter end of the growing season and well into the fall (please see discussion under the section Prolonging the Duration of Succulent Forage and Appendix M for further detail).

Although the seasonal importance of forbs as key foods of chicks and adults has been described (Barnett 1993, Drut 1993, Pyle 1993a), no studies have described whether native forbs of uplands maintain a longer growth period or higher nutrient content after livestock grazing. Rather, studies that described livestock-habitat relationships indicated that frequent grazing during spring may reduce native forbs palatable to livestock and herbivorous wildlife (Martin et al. 1951, Blaisdell and Pechanec 1949, Laycock 1967, Rickard 1985).

In summary, available evidence suggests that grazing of meadows by cattle in spring can increase use of the meadows by sage grouse (Oakleaf 1972, Klebenow and Burkhardt 1982, Evans 1986). As yet, however, there is no indication that the availability of succulent forbs in late summer is a factor currently limiting sage grouse populations on the Refuge. Also, as pointed out by Evans (1986:104), long-term impacts of grazing to enhance meadow use by sage grouse should be evaluated. One concern is that possible short-term benefits to sage grouse derived from livestock grazing of meadows could impair future sage grouse populations by not allowing riparian meadows to recover. Few data exist to substantiate the contention of Anderson et al. (1990b) that livestock grazing during the 1970s and 1980s influenced the pattern of decline of sage grouse populations on the Refuge (Pyle et al. 1990). Additionally, the relatively high level of grazing necessary to benefit sage grouse (in the short-term) would adversely affect wildlife that require tall, dense meadow vegetation. Long-range objectives (Chapter 1, Section Two) do not call for enhancement of forage quality of late season forage for sage grouse.

USE OF CATTLE TO RESTORE AND MAINTAIN WATERSHED HEALTH IN UPLANDS

The use of livestock has received considerable attention for their possible use in restoring and maintaining healthy vegetation in the upland portions of watersheds. Savory (1988) spends a considerable portion of his book describing the necessity of grazing in semi-arid environments (what he terms "brittle" environments). He contends that if a particular grass plant is not grazed within a two or three year period, the accumulation of old plant material will weaken a grass plant and may actually kill it. Over time, bare ground between plants becomes more expansive as more grass dies under continued rest from grazing, according to Savory. Erosion rates increase and watershed condition deteriorates. As such, Savory asserts that periodic, short-term grazing by large ungulates is absolutely necessary for maintaining watershed health in semi-arid environments.

Anderson (1993) also contends that grazing is needed to maintain the health of fibrous rooted plants. Similar to Savory (1988), Anderson's assessment is that fibrous-rooted plants become decadent or stagnant if left ungrazed over a period of time. Anderson et al. (1990a) explain that "[e]xtensive grazing is required on Hart Mountain because of the expanse and aridity of the area." In their study on Hart Mountain NAR, Anderson et al. (1990a) concluded that the increased number of perennial plant species found on their plots and increased litter cover on one particular plot was due to livestock grazing management. An earlier report (Anderson and Franzen 1988) states that the "general increase in litter on the Refuge [based on 32 plots] is related to the standing residues with safe degree of utilization and the periods of rest and deferred grazing that has been a part of the grazing systems..." These conclusions, however, cannot be substantiated using data presented in Anderson et al. (1990a) or Anderson and Franzen (1988) because utilization of plots by cattle was not confirmed and utilization levels of plots were not monitored. In fact, comparison of plot locations with cattle distribution and utilization during the period 1978-1987 provides substantial evidence that few, if any, of their upland plots were visited by cattle during the period that they monitored vegetation (DeLong and Yoakum 1994). Without confirmation that cattle visited their plots and without knowing the degree of utilization (for those that may have been grazed), relationships between cattle grazing practices and changes in vegetation cannot be made (Range Inventory Standardization Committee 1983).

Stoddart and Smith (1943:132) report in their book, *Range Management*, that a limited amount of grazing may be beneficial to plants. Similarly, Holechek et al. (1989) recognizes a certain amount of grazing can enhance plant productivity under some circumstances; however, they preface this assessment with the understanding that grazing may reduce the ability of plants to compete in plant communities. The discussion on the benefits of grazing in Holechek et al. (1989:129-130) was limited to grazing during the growing season. Several papers were cited by Holechek et al. (1989) in support of the theory that some degree of grazing benefits perennial plants. Before closing their discussion on the benefits of grazing to plants, they pointed out that positive effects of controlled grazing would most likely occur in areas that receive at least 16 inches of precipitation per year on average -- below about 16 inches of annual precipitation, excessive accumulation of dead plant material usually does not occur. Hart Mountain NAR receives, on average, approximately 6-18 inches of precipitation per year (base of mountain and top of the mountain, respectively).

Briske (1991) describes the relationship between grazing and plant development from the standpoint that grazing is a factor that plants have evolved to cope with (through grazing avoidance and grazing tolerance), not to depend on. Holechek et al. (1989:127) also discusses this subject. The idea that herbivory enhances net primary productivity, as a significant ecological process, seems to be losing favor (Heitschmidt 1990, Briske and Heitschmidt 1991, Painter and Belsky 1993). Heitschmidt (1990) suggests that there is not enough evidence to support the hypothesis that most current livestock grazing tactics frequently improve range condition. Although he believes that herbivory can enhance above-ground net primary productivity in more productive areas, Heitschmidt (1990) states that there is little if any support for the theory that livestock can enhance range vegetation in most arid and semi-arid rangelands. Lacey and Van Poollen (1981), in summarizing the results of 12 studies conducted throughout the west, concluded that herbage production was significantly higher on ungrazed ranges as compared to ranges that were moderately grazed by livestock. Krueger (1992b) assessed that one should expect grazing to decrease total growth of plants on an annual basis. In terms of watershed functioning, Satterlund and Adams (1992:351) assessed that many watershed characteristics, such as infiltration rates, recover during periods of non-use by livestock (in contrast to livestock being used to restore these characteristics). Thurow (1991) discussed the effects of livestock grazing on hydrology and soil erosion. He presented the effects of livestock grazing on these processes as impacts to be mitigated, not as benefits to watersheds. He addressed the effects of livestock grazing on water interception, soil structure, water infiltration, vegetation, and water quality.

Belsky (1986) refers to seven review papers that "have together cited more than 40 different studies in support of the hypothesis that consumption or clipping may benefit the affected plant." In Belsky's review of the evidence in favor of the hypothesis (the 40 studies), she found that hard evidence to support the hypothesis that grazing benefits plants is lacking. Painter and Belsky (1993) evaluated Savory (1988), and agreed with several authors that concluded that Savory's claims have not been supported by research, and in some cases have been contradicted. Many of Savory's theories are based on personal observation and have not been substantiated through empirical study.

Although removal of standing dead plant material on a periodic basis is considered beneficial to plant health by some authors (Savory 1988, Anderson 1993), standing dead plant material has been shown to be beneficial to plant health by others (Sauer 1978, Briske 1991). Sneva (1980) provided additional evidence that standing dead plant material may increased production of some bunchgrass species. Sneva (1980), in his study on Whitmar wheatgrass, cited 3 studies that made him question whether increased production would continue if accumulation of dead plant material took place year after year.

Strictly from a watershed health standpoint, available information is highly suggestive that using cattle in attempt to improve watershed health on the Refuge would be ineffective. Additionally, Refuge goals and long-range objectives do not call for the Service to enhance watershed health above what can be considered natural for the area. To attempt such a feat (not necessarily with cattle) would adversely affect some wildlife species and communities that evolved under less "optimum" conditions. Optimum conditions for some wildlife species includes accumulations of standing and fallen dead plant material. Vegetation of the northern Great Basin was not heavily influenced by grazing of large animals (Mack and Thompson 1982). As such, grazing levels above and beyond that which would occur with healthy populations of native herbivores could negatively impact native wildlife species and communities of the area. The latter argument does not, in itself, rule out the possible use of cattle to restore watershed health on the Refuge. If cattle could effectively and economically be used to restore watershed health, temporary use of cattle could be considered. However, as mentioned, the preponderant evidence indicates that herbivory is not needed to restore or maintain healthy watersheds in the Hart Mountain area.

USE OF CATTLE TO MANIPULATE STRUCTURAL DIVERSITY OF VEGETATIVE HABITAT

The potential for using cattle to increase structural diversity of vegetation has been discussed by Holechek et al. (1989:345), Severson (1990), Kie and Loft (1990), and put forth as a recommendation for a way to use cattle on Hart Mountain NAR by Bailey (1991), Krueger and Buckhouse (1993; comment 472, Appendix O), and the Lakeview BLM District (Yoakum 1994a). Holechek et al. (1989) stated that livestock can be selectively grazed to open up dense stands of vegetation. Kie and Loft (1990) cited several studies that indicate that cattle can be used to create tunnels through shrub vegetation (e.g., willow stands). They also cited two studies that put forth evidence that modifying the structure of shrub stands can benefit some species of wildlife. Similarly, the Lakeview BLM District office suggested that one option to consider is to use cattle to break up overgrown, thick, dense vegetation in riparian areas. After discussing this option, it was decided that this would not be applicable to Hart Mountain NAR at this time, given the degraded conditions of riparian areas.

Using the computerized California Wildlife Habitat Relationships (WHR) database, Kie and Loft (1990) predicted the effects of livestock grazing on vertebrate wildlife species in two structural conditions (short-herb and tall-herb) for annual grassland habitat and for wet meadow habitat. They assumed that the arbitrary height category of less than 12 inches (short-herb) to be characteristic of a grazed area and greater than 12 inches (tall-herb) to be characteristic of a non-grazed area for each of the two habitats. The database predicted that reduced herbaceous height to less than 12 inches (from a height of greater than 12 inches) would positively affect 52 species, neutrally affect 171 species, and negatively affect 19 species in California annual grassland communities. In California wet meadow communities, the database predicted that reducing herbaceous height to less than 12 inches would positively affect 59 species, negatively affect 37 species, and have no affect on 169 species.

Kie and Loft (1990) warned that their results should only be used as a first approximation, and that the outputs require close scrutiny for potential errors. The authors pointed where the database listed two small mammals (montane vole and western harvest mouse) as being positively affected by reduced vegetation height, when they actually would be adversely affected by most livestock grazing systems.

Bailey (1991) reported that vegetative height and shape are important factors that influence pronghorn populations, and that livestock could be used to manage these attributes. Yoakum (1992c), however, stated that he knows of no information to support the contention that shape of vegetation affects pronghorn numbers. He continued by explaining that the overabundance of shrubs is the biggest problem on the Refuge, and that he knows of no practical means of using cattle to decrease shrub cover on the Refuge. Krueger (1992a) agreed with this assessment.

Krueger's (1992b) assessment that elimination of livestock grazing will cause loss of forage quality can be extrapolated to include the loss of structural conditions created by late summer and fall grazing in riparian areas. Wildlife species that prefer low statured vegetation in meadows would be adversely impacted by elimination of cattle grazing, as managed during 1971-1990. Based on utilization mapping conducted on the Refuge during 5 years between 1978 and 1989 (Refuge files), height of remaining vegetation in riparian meadows after livestock grazing occurred was not limited to the 12 inches used by Kie and Loft (1990). Species that prefer denser and taller meadow vegetation would be positively impacted.

Use of cattle to create a patchy mosaic of closely clipped vegetation and taller standing vegetation, as it applies to increased use of meadows by sage grouse (Klebenow and Burkhardt 1982, Evans 1986, Anderson et al. 1990b), was discussed previously. Some of the following discussion also pertains to the use of cattle to manipulate the structure of vegetative habitat.

USE OF CATTLE TO ENHANCE WATERFOWL HABITAT

Bailey (1991) surmised that livestock grazing can be used as tool to improve and maintain waterfowl habitat on the Refuge, based on Kantrud (1990) and Sedivec (1990). Sedivec (1990) reported that waterfowl nesting success was higher in grazed areas as compared to non-grazed areas in North Dakota prairie potholes. Bailey reported that Kantrud (1990) "found that light to moderate livestock grazing generally improves waterfowl habitat." This statement is in error because Kantrud (1990) did not make any assessments to this effect. He described a range of effects of livestock grazing on waterfowl.

Kantrud (1990), in his review of the literature, described the benefits of creating openings in tall, dense emergent vegetation in marshes of the prairie pothole region by using prescribed burning and/or livestock grazing. Kantrud's (1990) paper focused on the problem of excessively dense and tall emergent wetland vegetation. Overly dense and tall emergent wetland vegetation is not a current problem on Hart Mountain NAR. Benefits primarily pertain to use of marsh habitat by breeding pairs and their broods during breeding season -- discussion relative to nesting habitat was limited. Although Kantrud cited a number of sources that provide evidence that moderate livestock grazing (enough to create openings in marsh vegetation) can benefit some species of waterfowl, he cited several others that reported on the adverse impacts of heavy to severe grazing of marsh vegetation and vegetation along shoreline areas.

Peek (1986:198) stated that the influence of livestock grazing activities on waterfowl range from positive, to neutral, to detrimental. The only benefit of livestock production that Peek pointed out is the development of stock-watering impoundments in arid regions of the West. This benefit, however, does not pertain to livestock grazing as a process.

Severson (1990), in summarizing the symposium in which Kantrud (1990)(see above paragraph) presented his paper, qualified Kantrud's discussion on livestock grazing as a method for managing waterfowl habitat (it could also apply to Sedivec et al. 1990). Severson stated that "...it is easier to visualize how livestock could be used to manage vegetation in the Northern Great Plains [in contrast to the American Southwest]. The primary reason is that the vegetation of the Plains evolved under significant grazing pressure by large ungulates; whereas that in the Southwest did not. The logic employed by Kantrud (these proceedings) in his assessment of using prescribed cattle grazing and prescribed fire as replacements for bison and wildfire, to manage waterfowl habitat in the Prairie Pothole region of the Great Plains, is correct for that region. However, the same logic should be cautiously applied to other regions, such as the mountain wetland "cienagas" of the Southwest." Similar to the Southwest, vegetation of the Great Basin did not evolve under a substantial amount of grazing pressure by large ungulates (Mack and Thompson 1982, Young et al. 1976).

Holechek et al. (1982, as cited by Strassmann 1987) report that limited burning or grazing every 1-3 years increases blue-winged teal production in Iowa and South Dakota. A study cited by Kirsch (1969) reported higher nesting success of blue-winged teal in moderately grazed areas compared to ungrazed areas. However, Kirsch points out that most of the ungrazed areas that contained nests consisted of narrow strips or clumps of idle land, that were later shown to be more vulnerable to predation.

The Blitzen Valley Management Plan for Malheur NWR (USFWS 1990:143-144), reports that impacts of livestock grazing to breeding waterfowl on the Refuge are indirect because cattle are grazed primarily in the fall or winter. Grazing cattle during the fall or winter alleviates direct conflicts between cattle and ducks during the waterfowl breeding season. Possible benefits of cattle grazing of meadows include: (1) habitat diversity and patchiness, (2) increased chances of successful germination of seeds, (3) cattle dung can host invertebrate wildlife which can be used by other wildlife, (4) it can stimulate growth of new vegetation. Only the first benefit was accompanied by a literature citation. Preliminary findings of a study conducted on Malheur NWR (USFWS 1990:144) suggest that meadow areas that were rake-bunch grazed had higher numbers of ducks and geese present on them during April-May as compared to meadow areas that were left idle.

In their management recommendations, Gilbert et al. (unpublished manuscript) reported that removal of residual vegetation may be required to rejuvenate duck nesting cover at frequencies of about every 6 or 7 years. This treatment would only apply to an area if residual vegetation is "so dense as to insulate the soil and block light penetration, thereby reducing new growth." Removal of residual cover, if needed, could be accomplished using livestock, haying, or prescribed burning. Except for limited exceptions, Gilbert et al. concluded that if objectives of Monte Vista NWR (Colorado) include maximizing duck production, activities such as grazing, haying, and burning should be curtailed in waterfowl nesting habitat (a 3-year rest rotation grazing system typified cattle grazing during the last 10 years of the study).

Kirsch (1969), after reviewing waterfowl literature, suggested that "cover removal such as regular grazing and mowing should be discontinued on areas managed primarily for waterfowl production and that management practices that create dense rank cover be substituted." He recommended that periodic burning or soil disturbance be tested as a means to create dense, rank cover. In reviewing the literature, Kirsch was unable to find a single example of where livestock grazing increased waterfowl production. Strassmann (1987), in reviewing livestock grazing and haying programs of 123 NWRs, concluded that "there is solid evidence that cattle grazing is harmful to all species of ducks that managers believed to benefit from grazing." Braun et al. (1978, as cited by USFWS 1990) reported that at least 55 studies on waterfowl have demonstrated that livestock grazing can be detrimental to waterfowl production and that they knew of only one study that reported higher nest success in areas moderately grazed by livestock compared to idle lands. Holechek et al. (1989:353) noted that grazing by livestock, at even light intensities, appears to be harmful to nesting waterfowl, with some exceptions.

Kirby et al. (1992) reviewed the literature on the effects of livestock on breeding waterfowl. They found no evidence from appropriately designed studies to indicate that livestock grazing benefits upland nesting ducks. Some circumstantial results from poorly designed experiments suggest the opposite. However, they went on to say that livestock grazing should remain in the manager's tool kit, but that the status of wildlife habitat and refuge objectives must define the need for a particular grazing regime. They also made the assessment that if immediate restoration of riparian habitat is the goal, "no measure would will be as successful as completely excluding livestock."

Cattle grazing can increase the abundance of edible green shoots in goose feeding areas (Greenwood 1978, as cited by Strassman 1987). USFWS (1992d) cited another example in which moderate livestock grazing was used to create feeding habitat for wintering waterfowl. Use of cattle to enhance winter forage for waterfowl is not applicable to Hart Mountain NAR.

Available information indicates that cattle could possibly be used to rejuvenate waterfowl nesting habitat in the Hart Mountain area if not conducted more than once every 6-7 years. Livestock grazing, prescribed burning, or haying would only be necessary if accumulation of fallen vegetation is adversely impacting new growth of vegetation and reducing the quality of duck nesting habitat. At present, there is no reason to believe that dead plant material would accumulate to the point where it would reduce the quality of duck nesting habitat on Hart Mountain NAR. Whether or not herbaceous vegetation should be reduced in a particular area would depend on objectives of the area. Available information indicates that frequent grazing by livestock (every 1-3 years regardless of season of use) would adversely impact duck nesting habitat. The use of cattle to create openings in tall, dense emergent vegetation in marshes is not applicable to Hart Mountain NAR at present.

USE OF CATTLE TO CONTROL CHEATGRASS AND INCREASE COVER OF NATIVE PERENNIAL GRASSES AND FORBS

Livestock grazing has been examined as a means to control cheatgrass at least as far back as the 1940's (Vallentine and Stevens 1992). Livestock grazing also is generally considered a factor in promoting the establishment and prominence of cheatgrass (Vallentine and Stevens 1992). Krueger and Buckhouse (1993; comment 482, Appendix O) explained the concept of using cattle to control cheatgrass and enhance native perennial grasses as follows. Cattle grazing conducted early in the spring, when cheatgrass is rapidly growing and native bunchgrasses have not yet begun to grow would adversely impact cheatgrass while having minimal impacts on native bunchgrasses. If cattle are removed while adequate soil moisture remains, bunchgrasses would complete their development. Under this treatment, cheatgrass would decline in abundance and native perennial bunchgrasses would increase in cover. This conceptual framework is consistent with that provided by Vallentine and Stevens (1992). They cite several studies that demonstrate that clipping and grazing by livestock can hinder the growth of, or kill, cheatgrass.

There does not appear to be any studies, however, that demonstrate that cheatgrass growth can be hindered without impacting native perennial bunchgrasses. Vallentine and Stevens (1992) reason that sufficient information probably does not exist to carry out the precise control over cattle grazing that would be required to effectively control cheatgrass within a narrow window of opportunity that <u>may</u> exist. J. Young (Agriculture Research Service, personal communication) explained that when one goes out on the ground, one will find many times that native bunchgrasses are emerging prior to emergence of cheatgrass. Tisdale and Hironaka (1981) found that native perennial grasses were more adversely impacted than cheatgrass following simultaneous clipping.

Valentine and Stevens (1992) concluded that livestock grazing is not an effective method of controlling cheatgrass. Sanders (1992), in assessing its practicality, found that the preponderant evidence indicates little chance of conversion from annual to perennial grassland communities through grazing management in areas receiving less than 12 inches of precipitation per year. Potential problem areas for cheatgrass invasion on the Refuge receive 6-12 inches per year on average. J. Young (personal communication, as above) also feels that cattle grazing would be ineffective for controlling cheatgrass.

USE OF CATTLE TO CONTROL BROAD-LEAVED WEEDS

Non-native, broad-leaved forbs (broad-leaved weeds), along with cheatgrass, continues to be a threat to some Refuge habitats. As such, measures must be taken to eliminate (where possible) or control broad-leaved weeds. Use of livestock to control broad-leaved weeds has been shown to be effective under a variety of circumstances, and not-so-effective under other circumstances (Parman 1986, Lacey 1987, Brock 1988). Upon inquiry, the center for the Appropriate Technology Transfer for Rural Areas (ATTRA 1992a, 1992b) sent the information they had available regarding the use of livestock for controlling weeds. Information addressed the use of goats, cattle, and hogs to control weeds. In general, sheep seem to hold the most promise for controlling broad-leaved weeds (Lacey 1987, Brock 1988) and cattle apparently hold the least promise (Brock 1988).

Most references to control of weeds by livestock refer to the use of goats and sheep (Lacey 1987, Brock 1988, USBLM 1991:3-13). Lacey (1987) explained that, to be effective, the grazing animal must be adapted to using weedy plants (in our case, broad-leaved weeds). Evolutionary adaptations of different classes of livestock (e.g., cattle, sheep, goats) predisposition them to feed on particular food groups (e.g., grasses, forbs, browse)(Hanley 1982; Provenza and Balph 1987 as cited by Stuth 1991). Sheep primarily feed on forbs, and browse and grass to a lesser extent; goats primarily feed on browse, but they use all classes of forage; and cattle primarily feed on grass (Brock 1988). Cattle generally prefer eating grass in contrast to forbs (Hanley and Hanley 1982, Brock 1988, Stuth 1991). The small mouth of sheep, along with their small body size and relatively large rumen allow them to be selective feeders (Hanley 1982 for review). The rumen of cattle is large, allowing them to subsist on high cellulose forage (e.g., grass). Therefore, studies and observations of sheep and goats would provide only limited information on possible applications for using cattle in controlling broad-leaved weeds. The Service is not considering the use of sheep or goats at this time, and as such, the remainder of this discussion is limited to studies and observations that address cattle.

Dalrymple (1991) points out economic benefits of using livestock to control weeds compared to mechanical and herbicide treatments. Economic savings, however, assume that livestock are readily available and grazing systems can merely be adjusted to control weeds in particular areas.

Brock (1988) provides two examples where cattle successfully had been used to control particular plant species: (1) cattle effectively controlled aspen suckering, and (2) cattle controlled leafy spurge through repeated trampling. The second example was based on an observation (not a study) made by Gene Foss, a rancher, as reported by Parman (1986), which Lacey (1987) pointed out has not been quantified by research. Lacey went on to discuss at length a study that documents the avoidance of leafy spurge by cattle. As for the first example, it is not likely that the Refuge will be in need of aspen control any time in the near future.

Lacey (1987) provides 6 examples where cattle were used to control weeds: (1) the Parman (1986) example was discussed previously, (2) as was the study that contradicted his observation; (3) cattle effectively controlled aspen suckering (same reference used in Brock 1988); (4) cattle were not effective at decreasing the cover of clubmoss (Selaginella densa); (5) cattle have been reported to used prickly pear (Opuntia polycantha) after spines have been burned off (however, no mention was made in regard to control of prickly pear); (6) cattle were not effective in attempts to control spotted knapweed (Centaurea maculosa).

Advantages in using livestock for controlling noxious weeds, according to USBLM (1991:1-22), are: "(1) they use weeds as a food source, (2) following a brief adjustment period, they sometimes consume as much as 50 percent of their daily diet of this species, (3) average daily gains of offspring grazing certain weed-infested pastures can sometimes be significantly higher than average daily gains of offspring grazing grass pastures, and (4) sheep or goats can be used in combination with herbicides." As pointed out in USBLM (1991), these advantages mainly apply to sheep and goats. Disadvantages of using domestic animals (e.g., cattle, sheep, goats) are: "(1) they also use nontarget plants as food sources, (2) the use of domestic animals, like sheep or goats, require a herder or temporary fencing, (3) the animals may be killed by predators such as coyotes, (4) heavy grazing of some weed species, such as leafy spurge, tends to loosen the stool of the grazing animals, and (5) most weed species are less palatable than desirable vegetation and would cause overgrazing" (USBLM 1991). The dangers of the spread of weeds by livestock were discussed at length by Lacey (1987). He recommended that livestock that previously had grazed in areas infested by weeds be confined for 9-10 days before being introduced into weed-free areas. According to Lacey, cattle are major dispersers of weed seeds in some areas.

Based on the information presented above, cattle would likely have limited value for controlling broad-leaved weeds on the Refuge. Lacey (1987) pointed out that the effects of grazing on weed populations has not been satisfactorily evaluated in research trials, and that extensive trial and error is needed to implement a selective grazing program. He also pointed out that "the feasibility of controlling range weeds with the application of extensive livestock management practices is limited," although further research is warranted.

USE OF CATTLE TO RE-ESTABLISH NATIVE GRASSES AND FORBS

The possible use of cattle in re-establishing native vegetation on Hart Mountain NAR was suggested by Krueger and Buckhouse (comment 497, Appendix O). Lakeview BLM District suggested that cattle could be used to disturb the soil and aid in implanting seeds (Yoakum 1994a). The latter possibility was discussed in light of Gus Hormay's rest rotation grazing system and Savory's (1988) holistic grazing system.

Reseeding of native grasses and forbs likely will be required in the Wyoming big sagebrush vegetation type in the northern and eastern portions of the Refuge (Semi-desert Terrace, Loamy Terrace, and Droughty Bottomland Fan range sites) following shrub-reduction treatments. Without reseeding, the objective of restoring a healthy balance of shrubs, grasses, and forbs likely would be unobtainable in the near future. Terrain in the Wyoming big sagebrush vegetation type in the northern and eastern portions of the Refuge generally is nearly level to gently sloping and surface soils generally are not rocky (Anderson 1978).

Research on the use of cattle to disseminate seeds in rangeland habitats is still in its infancy. In describing the Vegetation Diversity Project of BLM, Pyke and Borman (1993) identified a potential research topic as being the effectiveness of animals as dispersal agents. They pointed out that an initial phase of studies should evaluate the viability of seeds of native desirable and undesirable species after passing through the digestive tract of certain animals. The second phase of research should then examine germination and survival of seeds in feces. Studies on the viability of seeds following passage through digestive tracts of cows (Barrow 1988, Ocumpaugh et al. 1991, Barrow and Havstad 1992, Gardener et al. 1993) indicate that this method might be possible on a management level. Research by BLM should shed light on the extent to which (1) seeds of plants occurring in Wyoming big sagebrush communities would remain viable after passing through the digestive system of a cow, and (2) seeds of these species would germinate and grow in cow feces in an arid environment. Ocumpaugh et al. (1991) presented preliminary findings on the field establishment of seeds that were placed in "artificial cow pats" and placed in a field after it had been sprayed with Glysophate to kill competing plants. Establishment success was higher for rose clover and switchgrass seeds that were incorporated into the artificial cow pats compared with seeds that were broadcast without cow pats. No difference in success were detected for Illinois bundleflower.

Barrow (1988) and Barrow and Havstad (1992) report that seeds of five plant species of New Mexico can remain viable after passing through the digestive tract of cattle. Ocumpaugh et al. (1991) found that a high proportion of seeds from legumes that have small, hard seeds remained viable after passing through the digestive tract of a cow. Good survival also was obtained for 3 grass species; however, there was essentially no survival with 3 other grass species. Ocumpaugh et al. (1991) estimated that it would take about 500 viable Alamo switchgrass seeds per cow pat to get a 70 percent chance of producing 1 plant per cow pat. It takes nearly 2,000 viable seeds before feeding to produce 500 seeds that remain viable after passing through a cows digestive tract. They estimated that it would take approximately 3,000 viable seeds to successfully produce 1 plant using this method, assuming that the high rate (70%) of seedling survival per cow pat can be achieved under an actual management scenario. Gardener et al. (1993) concluded that only pasture legumes producing hard seed have much potential for successful dissemination by cattle. None of the bunchgrass species that they tested showed much potential for being successfully disseminated by cattle. They tested 10 species of legumes and 8 species of grasses.

J. Young (Research Leader, Agricultural Research Service, Reno, Nevada, personal communication) said that there are few species in Wyoming big sagebrush that have hard-coated seeds. He went on to say that indian ricegrass will pass through the digestive system of a cow, but he has never observed one to germinate in a cow patty. He did not see any advantages to using cattle to disseminate seeds; he saw more disadvantages. Young and Young (1986:192) point out that "...the collection of seeds by rodents, who remove the lemma and palea, may be the major natural stand-renewal process. Seed dispersal in dung, as pointed out by Barrow and Havstad (1992), does not provide seed-soil contact that is characteristic of seed burial techniques. Seed burial may be important for species that naturally are dispersed by seed-caching rodents, and may explain why Young (personal communication) has not observed germination of indian ricegrass in cow patties. Barrow and Havstad (1992) suggested that other technologies could be developed (other than dispersal by livestock) which could be used in wildlife management. For example, seed could be provided to wildlife in feeding devices placed adjacent to water sources. Young et al. (1981) did not address the potential use of livestock for disseminating seeds. They recommend direct seeding using a drill in wildland situations.

Lacey (1987) cited several studies that reported on the passage of viable seeds of noxious weeds through the digestive tract of cows, horses, and sheep. Livestock are major dispersers of weed seeds (Lacey 1987, Vallentine and Stevens 1992). Lacey cited one study that found seeds can be retained in the digestive tract of cattle for 7 to 10 days.

There are at least 9 limitations for initiating a program on Hart Mountain NAR for disseminating seeds using cattle (in addition to adverse environmental impacts): (1) herbaceous vegetation is scarce in areas where seed sources are scant (i.e., forage for cattle is scarce); (2) water distribution is low in areas where seeds need to be distributed in the Wyoming big sagebrush vegetation type; (3) viability of grass seeds, after passing through the digestive tract of cattle, is low for most species tested; (4) viability of seeds after passage is highly variable from species to species and no work has been conducted on species native to Wyoming big sagebrush areas; (5) a tremendous amount of seed would be required to produce a small number of plants; (6) coordination of such a program would be resource intensive; (7) application of native seeds by other means would be more economical and efficient; (8) cattle could potentially disseminate noxious weed seeds (which are highly adapted to such a dispersal mechanism) along with desirable seeds; and (9) cattle grazing could adversely impact already degraded habitats.

USE OF CATTLE TO CREATE FIRELINES

Although not much has been written on the subject, the use of cattle to create fire lines for prescribed burning has been proposed in a variety of sources including Savory (1988:174), Krueger (1991), Lakeview BLM District (Yoakum 1994a), and comments 485 and 486 of Appendix O. Savory (1988) suggests that diluted molasses or salt solution lightly sprayed over "almost any kind of country" will excite a herd of cattle to make a firebreak. He asserts that this can be done at minimal cost and without exposing soil or increasing erosion. Krueger (1991) recommended using cattle to remove fine fuels to create firelines in highly combustible situations. Lakeview BLM District suggested using cattle to reduce plant fuel in firebreaks, primarily in situations where cheatgrass is abundant.

Based on the objective to create a mosaic of burned and unburned patches, the use of natural breaks in fuels (e.g., low sagebrush when burning mountain big sagebrush, ridgelines, lakebeds), and other natural features such as snowpockets (when burning in the spring) would be more effective as fire breaks than cattle. Use of cooler and more moist burning conditions rather than extensive firelines would promote desired burn patches. Additionally, needed firelines can be burned during less severe conditions than the actual prescribed burn.

Although using cattle to create or improve prescribed fire breaks has been used on private lands (D. Hatfield, Brothers, Oregon, personal communication), this potential use would have limited value on the Refuge for several reasons, including the high density and cover of sagebrush and low amount of fine fuels where firelines would be most needed (areas where natural breaks in fuel are uncommon), and a clearly defined fireline would not be desirable.

If livestock are grazed for other purposes on the Refuge, adjustments could conceivably be made in the cattle grazing program to treat a particular area.

However, if cattle are not present on the Refuge when conditions are suitable for creating a fireline or are not being used for another purpose on the Refuge, bringing cattle onto the Refuge solely to create firelines for a particular prescribed burn could be logistically and economically unreasonable.

USE OF CATTLE TO RESTORE RIPARIAN AREAS

The possible use of cattle to foster willow growth, foster riparian recovery, and to increase shading of stream channels on Hart Mountain NAR was suggested by Krueger and Buckhouse of OSU's Department of Rangeland Resources (comments 489 and 490, Appendix O). These possible uses are described below.

The concept of using cattle to enhance willow growth was explained by Krueger and Buckhouse in their comments. According to Krueger and Buckhouse, livestock will preferentially choose grass when green grass and green willows are present early in the growing season. Willows, according to the concept, would be given competitive advantage over grass when grass is grazed during the early growing season. However, if livestock are removed prior to the depletion of soil moisture later in the season, grass will regrow and complete its reproductive cycle, and essentially complete the season with about the same status as if it had not been grazed at all. We are unaware of any studies or other reports that document instances where cattle grazing has enhanced willow growth. Svejcar et al. (1992) and another study cited in Svejcar et al. (1992) found that maximum photosynthetic rates in willow occurred in July and August. However, the growing season of herbaceous vegetation in most areas inhabited by willow on the Refuge is April 15 - July 15 (Anderson 1978). B. Kovalchik (Riparian Ecologist, U.S. Forest Service, personal communication) was unaware of how cattle could be used to foster willow growth. He did, however, agree that early season grazing by cattle would minimize adverse impacts.

Krueger and Buckhouse (comment 489, Appendix O) stated that "managed grazing, particularly early season grazing... promotes riparian recovery at rates similar to exclusion". Because we were unclear as to the intended meaning of the term "promote", we asked for a clarification of the term as used in this sentence. In their response, they stated that "research, demonstration, and experience of fisheries scientists like Chaney, Elmore and Platts, and range managers has amply demonstrated that given proper, intensive management of livestock, riparian recovery from historic abuse can occur at rates similar to, and in certain instances, more rapidly, than ungrazed watersheds" (Krueger and Buckhouse 1993). This seems to imply that livestock can be used to restore riparian areas.

E. Chaney (Northwest Resource Information Center, Idaho), W. Platts (Don Chapman Consultants, Idaho), and W. Elmore (BLM riparian specialist) were contacted by telephone regarding the statement. Chaney and Platts disagreed with it, reasoning that a riparian area grazed by cattle would not recover at the same rate as a riparian area excluded of cattle. Platts added that nothing can beat complete rest, and Chaney added that proper management would be practically impossible to get under normal circumstances. They agreed with the Service, however, that recovery can proceed in a grazed riparian area if cattle are adequately managed. Although Elmore felt that similar rates of recovery can occur, he went on to stated that the only true and tried system that works in all situations is rest from livestock. None of the persons contacted knew of any instances where cattle grazing has accelerated riparian recovery (refer to DeLong 1994 for more details of the conversations).

Krueger and Buckhouse (comment 491, Appendix O) also stated that livestock can "foster shade for cover or thermal protection of waterways..." We requested documentation from OSU's Department of Rangeland Resources to support this supposition, but have not received any information as of yet.

Given available information (refer to Appendix J for additional discussion), we agree with Kindschy's (1987, as cited in USBLM 1991b) assessment that, "in essence, livestock are NOT 'a tool' to improve riparian ecosystems. Rather, they are a cost that may often be accommodated and still enable successional advancement of riparian vegetation and attendant functional values." It is well established that recovery of many riparian areas can proceed under a carefully managed livestock grazing program (Kaufmann and Krueger 1984, Platts 1990, Kovalchik and Elmore 1992, Buckhouse and Elmore 1993, Chaney et al. 1993).

USE OF CATTLE TO REDUCE SHRUB COVER IN UPLANDS

There seems to be little disagreement as to the ineffectiveness of using cattle to reduce sagebrush cover. Yoakum (1992b) and Krueger (1992a, 1992b) concurred that use of cattle to reduce shrub cover would not be practical on Hart Mountain NAR. Krueger (1992a) continued by stating that "[f]ire would likely be the choice on the refuge and with careful design and precautions by professionals should be effective." Krueger (1991, 1992a) agreed with Yoakum (1991) that the overabundance of shrubs is a major limitation to improving wildlife diversity on the Refuge.

Krueger and Buckhouse (1993) submitted 3 papers that evaluated the use of livestock for controlling shrubs. Wood (1987) studied the effectiveness of using cattle, sheep, and goats to control shrubs in abandoned farmland in Vermont. Although goats were by far the best animal for the task, cattle eventually lowered shrub cover, but they also increased Canada thistle and bull thistle. Brock (1988), in his review of research on the use of livestock to control weeds and brush, did not find any examples of cattle being used to control shrubs. Although Lacey (1987) presented several examples of sheep and goats being used to control a number of shrub species, he did not present any examples of cattle being used to control shrubs. He did, however, present an example in which cattle were used to control aspen suckering. Krueger (1991) cited a study in which sheep were run through an area in Utah during a bitter cold winter; apparently, they got some control by mechanical damage by the sheep. In other discussions on controlling shrubs (Hall 1985, Holechek et al. 1989, USBLM 1991), cattle were not evaluated as a potential means of reducing shrub cover.

Although the impracticality of using cattle to reduce shrub cover may appear academic, it is an important point because the overabundance of shrub cover is a major underlying reason why Refuge goals are not currently being achieved (Chapter 1, Section Two). Management of upland habitats for native wildlife communities must address this problem first and foremost. Excessive shrub cover is the primary factor in uplands that limits wildlife diversity. According to Winward (1991), Wyoming big sagebrush cover that exceeds 15 percent and mountain big sagebrush that exceeds 20 percent restricts amount of grasses and forbs. Current cover of shrubs in upland areas on the Refuge are nearly twice these levels (Chapter 3). As such, shrub cover on the Refuge limits the amount of forbs, which are important for pronghorn, mule deer, and sage grouse, and it limits grass cover that is important for sage grouse nesting. Reduced herbaceous cover also translates to reduced litter cover, lowered water infiltration, increased overland flow, less stable soil, excessive soil erosion, increased sediment loads in stream water, higher amounts of water during flooding events, reduced ground-water storage, and reduced perennial flow of streams.

USE OF CATTLE TO ACHIEVE DEFINED LONG-RANGE OBJECTIVES

Krueger et al. (1991) observed that "livestock grazing is probably the primary economically feasible tool"..."if you intend to manage the vegetation of the Hart Mountain Refuge so that you can influence palatability of forages for wildlife, control prescribed burns, direct changes in vegetation composition, and provide sustainable and changing habitats." However, they also noted that livestock grazing is an excellent tool when it is used to accomplish specific objectives that have been defined. Long-range objectives are defined in Chapter 1, Section Two of the FEIS. Similarly, Kirby et al. (1992), in their paper on whether the needs of livestock grazing outweigh the problems on National Wildlife Refuges, stated that habitat management goals define whether manipulation by livestock grazing is needed. Service policy directs that livestock grazing, as a management practice, can be permitted on a refuge if, in part, it contributes to established objectives.

Long-range objectives for vegetation types in the desert shrub and shrub-grassland biomes (90 percent of the Refuge) focus on the periodic reduction of shrub cover to increase the prevalence of early and mid stages of succession and to lower the level of shrub cover in late successional stands. In other words, the primary object throughout most Refuge uplands is to "direct changes in vegetation composition" toward a reduced amount of shrub cover (within and among plant communities). Cattle grazing apparently would not be practical for this purpose (see above section). Additionally, to "provide sustainable and changing habitats" in these vegetation types, periodic reduction of shrub cover would be required according to defined objectives. Again, cattle would not be practical for this purpose.

Using cattle to control cheatgrass and increase cover of native perennial grasses and forbs, re-establish native grasses and forbs, and to create firelines could contribute to reaching long-range objectives for upland vegetation types if they could effectively and reliably be used to accomplish these tasks. As described previous sections, however, there is no indication that cattle could effectively and reliably be used for these purposes. The use of cattle grazing to accomplish long-range objectives defined for the remaining upland vegetation types (in the montane shrub, conifer woodland, and conifer forest) does not appear to be practical.

Long-range objectives for vegetation types in riparian vegetation types focus on the re-establishment of riparian vegetation on streambanks, stabilization of streambanks, raising of water tables, and increasing the distribution, abundance, and structural diversity of riparian vegetation throughout valley bottoms. In other words, the primary object throughout most Refuge riparian areas is to "direct changes in vegetation composition" toward an increased amount of riparian vegetation that more closely resembles native riparian plant communities (along streambanks and throughout valley bottoms). Based on available information, cattle grazing would not be practical for this purpose (please refer to the section on the use of cattle to restore riparian areas). Additionally, to "provide sustainable and changing habitats" in these vegetation types, the primary objective (stated above) would have to be met. Long-range objectives for other wetland vegetation types are similar.

Influencing the palatability and nutritional quality of individual plants was not defined as an objective. Based on available information, cattle grazing does not appear to be the most practical and economically feasible tool to accomplish the defined objectives of the Refuge (Chapter 1, Section Two of the FEIS).

APPENDIX J
IMPACTS OF MANAGEMENT ACTIONS

INTRODUCTION

This appendix provides a review and assessment of potential impacts of major management actions being considered in this FEIS (Volume I). It provides the basis of assessments made in Chapter 4. Extent of impacts would vary depending on the degree to which the management actions would be carried out under each alternative. This appendix provides one of the primary basis for assessments made in Chapter 4 of the FEIS.

For information obtained from the Final EIS for Vegetation Treatment on BLM Lands in Thirteen Western States (USBLM 1991), only the BLM document is cited, unless specific references cited in the document were reviewed by Refuge staff. Hart Mountain NAR falls within the borders of the analysis area, and upland habitat is similar to that of BLM lands surrounding the Refuge.

PART ONE - EFFECTS ON UPLAND HABITATS

A. SOILS

1. Direct Effects of Vegetation Treatment

Direct effects of vegetation treatments on soil are varied. Prescribed burning may directly affect soil by altering chemical properties, nutrient availability, postfire soil temperature, microorganism populations, physical properties, and erosion. Prescribed burning affects soil physical characteristics properties and processes (Blaisdell 1953, Wright and Heinselman 1973, Nimer and Payne 1978, DeBano 1990, Acker 1992). Nature and extent of fire effects on soil are specific to vegetation type, succession state, and fire regime (Kilgore 1981, Parsons and DeBenedetti 1979, Bunting et al. 1987, DeBano 1990). Vegetation type and succession state determine the amount and distribution of nutrient pools in live and dead organic matter and to a significant extent, fire regime (Parsons and DeBenedetti 1979, Wright and Heinselman 1973, Kilgore 1981, Bunting et al. 1987).

Combustion of organic matter causes immediate, on-site reduction in total nitrogen and carbon through volitization, but increases short-term availability of nutrients to nitrifying bacteria and plants through deposition of nitrogen and phosphorus in ash and consequent leaching into upper profiles of the soil (Wright and Heinselman 1973, Nimer and Payne 1978, DeBano 1990, Acker 1992). Soil surfaces blackened by fire and charred organic matter increase soil surface temperature and therefore stimulate earlier plant growth over the short-term (Nimer and Payne 1978). Within vegetation type, the greater the severity of a fire, the greater the reduction of carbon and primary plant nutrients through volitization (DeBano 1990, Kilgore 1981). Short-term decline in infiltration after fire is followed by long-term increase associated with change in vegetation structure and ground cover

(Tiedemann et al. 1990, Sturges 1993). Similarly, short-term increase in wind and water erosion potential after fire is followed by long-term decline where vegetation vigor is enhanced and ground cover is increased (Blaisdell 1953, Tiedemann et al. 1990, Sturges 1993).

Direct adverse effects of prescribed burning on soils would be minimized by prescribing appropriate (1) ignition techniques, (2) fuel, organic layer and soil moisture at the time of burning, (3) thickness and packing of litter layers, (4) depth and duration of heat penetration into organic and soil layers, (5) soil type, and (6) soil texture (Bunting et al. 1987; USBLM 1991:3-37). Fire prescriptions would account for desirable and undesirable variation in fire effects associated with different prescription objectives established for vegetation types and ecological sites that vary in ecological condition (Bunting et al. 1987, USSCS 1993).

Mechanical treatments can affect soil directly by disturbing surface structure, and indirectly by influencing vegetation and litter. Disturbance to soil can increase water infiltration (Sturges 1983, Sturges 1986). However, without successfully increasing herbaceous cover, increased infiltration would only be temporary (Sturges 1983; Sturges 1986; USBLM 1991:3-31).

Disturbing soils can increase the likelihood of cheatgrass invasion in Wyoming big sagebrush sites depleted of perennial bunchgrasses (Hedrick et al. 1966, Young and Evans 1974, Evans and Young 1978). Reseeding disturbed sites to native or alien (e.g., crested wheatgrass) bunchgrass can reduce the chance of cheatgrass dominance (Koehler 1975, Young et al. 1976, Evans and Young 1978, Young and Evans 1978, Schmisseur and Miller 1980).

The extent of disturbance to the soil surface depends on the technique used (USBLM 1991:3-42). Mowing and chopping methods for reducing sagebrush cover minimally disturb the soil. Disturbance by chaining and railing is greater. Disking and plowing would disturb soil to the largest degree.

Herbicides apparently affect soils less extensively than fire. In sites subjected to herbicides, initial amount and distribution of organic matter is minimally influenced compared to changes associated with burning (Mueggler and Blaisdell 1958, Sturges 1983, Wambolt and Payne 1986, Tiedemann et al. 1990). However, control of shrub cover can affect long-term soil properties and subsequent resources available for establishment and growth of herbaceous plants (Rittenhouse and Sneva 1976, Schmisseur and Miller 1980, Winward 1991). Extent of increase in water infiltration in sites sprayed with 2,4-D is related to grass and shrub cover before spraying, amount of sagebrush killed by spraying, and increase and persistence of ground cover and grass-dominated states of succession after spraying (Hedrick et al. 1966, Eckert et al. 1972, Sturges 1983, 1986, 1993).

Active ingredients of tebuthiuron and 2,4-D bind to soil particles and are broken down in the soil by soil microorganisms (DowElanco 1994, USEPA 1988, USBLM 1991). Impacts of herbicides to microorganisms can be beneficial or harmful depending on application rates of herbicides and the soil environment. Herbicides' persistence is measured in terms of "half-life", or the length of time needed for one-half of the herbicide applied to break down to substances that are no longer of toxicological concern. Plumb et al. (1977) monitored soil residues in California for more than 1 year and observed that 2,4-D half life was approximately 19 days. 2,4-D residues, however, may decline slower in cold, dry soils compared to moist, wet soils (Norris 1981, Newton et al. 1990). Wauchope et al. (1991, as cited by USBLM 1991:3-45) reported that the most representative half-life were 10 days (2-41 days) for 2,4-D and 360 days (13-450 days) for tebuthiuron. Tebuthiuron is relatively persistent in the soil and may be available for root uptake approximately 10 years following application. At five locations, maximum depth of tebuthiuron leaching in soil was 0-6 inches at 1 site, 12-18 inches at 3 sites, and 18-24 inches at 1 site (DowElanco 1994). However, the maximum depth sampled for the latter site was 24 inches; therefore, the true maximum depth was undetermined. Newton et al. (1990) found no evidence that large amounts of 2,4-D moved to soil depth of 24 inches.

Effects of vegetational changes are described under the Vegetation section.

2. <u>Indirect Effects of Vegetation Treatment</u>

In areas where excessive shrub cover dominates, substantial reduction of soil erosion will not occur until cover of litter and herbaceous plants is significantly increased. Herbaceous plant and litter cover will not increase until shrub cover is substantially reduced (Winward 1991, Laycock 1991). Impacts to soils resulting from reduction of shrub and juniper cover vary according to extent of treatment and changes in plant community, soil type, slope, and vegetation type. Therefore, treatment effects on soils within vegetation type are assessed by alternative for each vegetation type (Chapter 4, Section Two).

Direct effects of livestock use on soil depend on the habitat being grazed. In general, impacts to upland habitats would be limited, except on sites where concentrated use occurred. An exception would be concentration areas usually near water sources. Disturbance of the soil surface in some vegetation types, especially where mycrophytic crusts occur, can lead to increased soil erosion potential (St. Clair and Johansen 1993, St. Clair et al. 1993). Indirect effects stem primarily from the influence of livestock grazing on ground cover and vegetation composition.

Rest from livestock grazing and non-use of fire, herbicides, or other shrub control measures would not result in substantial change in composition of plant communities or soil characteristics where shrub cover is excessive (Winward 1991, Laycock 1991). Soil erosion is greater and infiltration of water is lower on sites with excessive shrub cover compared to sites with less shrub cover and more ground cover (Blaisdell et al. 1982; USSCS 1993).

3. Effects of Roads and Campgrounds

Excessive soil erosion can occur and gullies can form after development and use of poorly designed roads. Probability of soil erosion is influenced by many factors including soil type, pitch of hill-slope, gradient of road, road design and drainage, and intensity of vehicle use (Dunne and Leopold 1978:510, USSCS 1993). For example, roads that frequently cause damage on the Refuge result from faulty site selection and development.

Possible strategies to correct problem areas of roads could include: closing the road; closing the road and relocating the route; and redesigning the existing road (eg., develop roadbed, install culverts). In some cases where gullies occur, structures such as rock rip-rap may need to be installed to retard erosion.

Like roads, improperly designed, heavily used campgrounds can adversely impact vegetation, soils, and site quality. Once a site is selected, effects associated with development (eg., compaction, clearing vegetation) can be mitigated by controlling location and intensity of visitor use.

B. WATER QUALITY

1. Direct Effects of Vegetation Treatment

Direct effects of prescribed burning and mechanical treatments on water quality would be minor. Runoff on recently burned sites can increase sedimentation in streams (USBLM 1991:3-43).

Herbicides may reach waterbodies during vegetation treatment through accidental application or drift of herbicide, or post-treatment through surface or subsurface runoff (USBLM 1991). Heavy rainfall and overland runoff following herbicide application could result in transportation of herbicides to non-targeted waterbodies and result in reduced water quality. The concentration of herbicides in runoff water is dependent on numerous environmental and site dependent variables.

Leaching of herbicides into the groundwater also could potentially occur. USBLM (1991:3-45) ranked 17 herbicides considered for use on rangelands for the likelihood of movement through the soil profile with infiltrating water based on the chemical properties of each herbicide. Of these 17 herbicides, tebuthiuron was the fourth herbicide with the greatest potential to contaminate groundwater and 2,4-D was the second herbicide with the least potential to contaminate groundwater. However, the potential of herbicides to contaminate the groundwater also depends on the method and application rate of herbicides as well as soil characteristics and other environmental and climatic factors (USBLM 1991).

The Department of Environmental Quality (DEQ) identified 2,4-D as a pesticide of concern in Oregon because its chemical and physical characteristics were likely to pollute ground and surface water. However, statewide assessment resulted in no evidence of 2,4-D contamination in Oregon groundwater (Pettit et al. 1987).

Environmental Protection Agency (USEPA 1988) stated that, although laboratory experiments show that 2,4-D can move in the soil, its potential to do so under practical conditions in the field is limited. DowElanco (1994) reported that "the physical/chemical properties of tebuthiuron suggest that it has a theoretical, but limited, potential to leach into groundwater." At this time, the DEQ has not identified tebuthiuron as a pesticide of concern in Oregon.

Mitigation measures to minimize potential impacts of herbicides on water quality and nontarget plants and animals would include:

1. Minimizing chemical applications prior to anticipated heavy rainfall period;
2. Timing pesticide applications so that they have more time to be taken up by growing sagebrush;
3. No application of herbicides during late fall or winter months.
4. Ground application of herbicides via hand-held or vehicle dispensers.
5. No application of herbicides within a 100 foot buffer zone of riparian areas and other wetlands.

2. Indirect Effects of Vegetation Treatment

Treatments can influence water quality indirectly by changing site characteristics such as ground cover and litter cover. Temporary reduction of vegetation may increase overland flow of water and soil erosion during thunderstorms, thereby elevating stream volume and sedimentation (Beschta 1990, Tiedemann et al. 1990). Probability of runoff is influenced by soil type, vegetation cover, pitch of hill-slope and the type, intensity, and duration of precipitation (USBLM 1991:3-41). Severe erosion may occur after reduction in litter, ground cover, and soil organic material followed by heavy rainfall (Beschta 1990). Increased sedimentation may consequently occur in streams (Beschta 1990, Tiedemann et al. 1990).

Indirect consequences of vegetation treatments on water quality result from changes in soil structure, vegetation and litter. Mechanical treatments that disturb the soil would not increase sediment load in most cases because this type of treatment would be limited to level to nearly level ground (for example, much of the Wyoming big sagebrush habitat). In some cases, soil disturbance may increase infiltration which would reduce runoff and sedimentation, at least temporarily (USBLM 1991:3-41). As vegetation cover increases, especially grasses and forbs, the probability of erosion and associated watershed-level impacts would diminish (Beschta 1990). Additional information is provided in the Soils and Vegetation sections.

Livestock use in uplands can affect water quality directly by increasing sediment loading and coliform bacteria counts in overland runoff, and indirectly through the impacts they have on vegetation (Blaisdell et al. 1982, Minshall et al. 1989).

Sediment loading can increase through increased soil disturbance and disruption of mycrophytic crusts (St. Clair et al. 1993).

Long-term reductions in cover of sagebrush seldom occurs in late-successional stands in the absence of deliberate thinning measures or stand-replacement disturbance such as fire (Sneva et al. 1984, Laycock 1991). Maintenance of excessive sagebrush cover can maintain greater rates of soil erosion in uplands and sedimentation in streams compared to sites with less sagebrush and more ground cover of herbaceous plants (Blaisdell et al. 1982, Sturges 1993).

3. Effects of Roads and Campgrounds

The effects that roads would have on water quality would be proportional to the effects they have on soils (refer to Soils sections). Increased sedimentation is the main water quality problem associated with roads (Satterlund and Adams 1992). Because road surfaces are bare of vegetation, compacted, and resist infiltration, virtually all precipitation becomes runoff. Runoff is quickly concentrated into drainages that may reach nearby streams. Satterlund and Adams (1992) also noted that concentrated runoff always increases the likelihood of erosion. They went on to state that, because roads in wildland areas can exert a primary negative impact on water quality, they must be located, designed, and constructed with environmental integrity in mind. Campgrounds and camping sites in upland habitats would have similar consequences as roads if they are not properly designed.

C. VEGETATION

Fire historically was a primary process that influenced habitat conditions in landscapes of eastern Oregon (Dealy et al. 1978, Shinn 1980, Gruell 1985a, 1985b, Kauffman 1990). Prescribed burning can simulate the effects that natural fire has on habitat condition and landscapes (Wright et al. 1979, Kauffman 1990, Young 1990). Prescribed burning and other methods of habitat manipulation are used primarily to retard succession from a shrub-dominated to a grass-dominated state (Koehler 1975, Wright et al. 1979, Blaisdell et al. 1982, Kauffman 1990). On the other hand, livestock grazing can advance the rate of succession from a grass-dominated to a shrub-dominated state where perennial grasses and forbs are grazed frequently and intensively during the growing season (Ellison 1960, Tisdale and Hironaka 1981, Blaisdell et al. 1982, Monsen and McArthur 1985, Winward 1985). Cover of herbaceous plants is inversely related to cover of sagebrush beyond a threshold level (e.g., >15% cover of Wyoming big sagebrush) that differs with site potential (Sneva et al. 1984, Winward 1991, Laycock 1991). Consequently, rest from livestock grazing and other disturbances would not substantially increase cover of herbaceous plants on sites where shrub cover is excessive, a core habitat problem identified in the EIS.

Effects of prescribed burning on nutrient cycling are not replicated by mechanical methods or herbicides (Blaisdell et al. 1982, DeBano 1990). Existing condition of habitats, costs of treatment, and socio-economic factors influence evaluations of different treatments with respect to determining which best achieves habitat management objectives (Koehler 1975, Blaisdell et al. 1982, Morton 1993).

1. Direct Effects of Vegetation Treatment

Vegetation treatment methods can have substantial effects on structure, composition, and vigor of vegetation types (Wright et al. 1979, Blaisdell et al. 1982, Blaisdell and Holmgren 1984). With respect to shrub and tree reduction, the initial impact of prescribed burning, mechanical, and herbicide treatments is reduction of height, cover, and mass of above-ground vegetation. Extent of height, cover, and mass reduction is influenced by the type of method used and prescription followed. Fires usually kill low sagebrush and big sagebrush (Refuge files, Wright et al. 1979, Bunting et al. 1987). Most other shrub species re-sprout from rootstocks after burning (Wright et al. 1979, Bunting et al. 1987). Re-sprouting response differs among shrub species (Wright et al. 1979, Young 1983, Winward 1985). For example, mature bitterbrush exhibits a low to moderate rate of resprouting (Britton and Clark 1985, Driver 1990). However, mature snowbrush ceanothus, green rabbitbrush, mountain snowberry, gray horsebrush, serviceberry, and chokecherry exhibit high rates of re-sprouting (Wright et al. 1979, Young 1983). Fire may be necessary for long-term maintenance of bitterbrush stands; seedling establishment is enhanced and mortality of mature bitterbrush is reduced on sites with moist soils subject to low and moderate intensity fire (Britton and Clark 1985, Bunting et al. 1985, Driver 1990).

Among perennial grasses, 2 types of responses to fire occur. First, mortality of all species increases with increased severity of fire (Wright et al. 1979). Secondly, coarse-leaved species, such as bluebunch wheatgrass, are more tolerant of burning compared to fine-leaved species, such as Idaho fescue (Wright et al. 1979, Blaisdell et al. 1982). Thus, grass response to fire is influenced by the composition and abundance of grasses on a site before burning, the season and severity of burn, and management practices after burning (Bunting et al. 1987).

Fire effects differ among forb species based on differences in composition and abundance of forbs before burning, season and severity of burning, and management practices after burning (Wright et al. 1979, Blaisdell et al. 1982, Pyle 1993a). Collectively, annual forbs usually increase and maintain cover above pre-burn levels for 1-2 years after burning in mountain big sagebrush and Wyoming big sagebrush (Refuge files, Wright et al. 1979). Perennial forbs usually increase and maintain cover above pre-burn levels for 5-15 years after burning in mountain big sagebrush (Blaisdell 1953, Harniss and Murray 1973, Wright et al. 1979, Pyle 1993a). Perennial forbs are not a major component of vegetational cover before or after burning in Wyoming big sagebrush sites (Bunting et al. 1987, USSCS 1993).

Effects of herbicides on big sagebrush and low sagebrush stands differ by type of herbicide. Application of 2,4-D selectively kills, within one growing season, forb and shrub species that are undergoing major growth at the time of application (Ware 1983). Application of tebuthiuron kills sagebrush gradually over 3 year period (DowElanco 1994). Amount of reduction of sagebrush density differs among rates of tebuthiuron application (DowElanco 1994). In Wyoming, Johnson et al. (1993) reported that big sagebrush decreased and grasses generally increased with progressively heavier tebuthiuron application rates.

2. Indirect Effects of Vegetation Treatment

Prescribed burning can significantly impact productivity and composition of upland plant species (Harniss and Murray 1973, Wright et al. 1979, Blaisdell et al. 1982, Kauffman 1990, Pyle 1993a). Herbaceous vegetation usually would dominate cover for 5-20 years after burning (Harniss and Murray 1973, Koniak 1985). Actual duration of dominance by herbaceous plants is influenced by life history attributes of species that occupy a site before and after burning, the ecological status of a site before burning, the size and intensity of burn, and the frequency and intensity of management practices applied after burning (Blaisdell et al. 1982, Humphrey 1984, Koniak 1985, Bunting et al. 1987).

Cutting or breaking sagebrush with mechanical treatments also increases herbaceous species, however, duration of response tends to be less persistent than burning (Mueggler and Blaisdell 1958, Blaisdell et al. 1982, Wambolt and Payne 1986). Unlike prescribed burning, above-ground plant parts are damaged but not killed (Blaisdell et al. 1982). Railing and roto-beating cause little damage to grasses and forbs (Tausch and Tueller 1977, Mueggler and Blaisdell 1958, Blaisdell et al. 1982). However, reduction of Wyoming big sagebrush cover may increase cover of cheatgrass if density of surviving perennial bunchgrasses is insufficient (Evans and Young 1978). Seeding native perennial bunchgrasses may be necessary in some areas (Koehler 1975, Evans and Young 1978).

Schneegas and Zufelt (1965) treated mixed sagebrush/bitterbrush rangelands, and were successful in applying herbicides to decrease sagebrush while maintaining bitterbrush. Difference in survival rate was attributed to difference in timing of application with respect to stage of plant growth of sagebrush and bitterbrush.

The herbicide 2,4-D is used to kill sagebrush, however the chemical also can result in death of forb species and reduction of forb cover in the short-term (Blaisdell and Mueggler 1956, Blaisdell et al. 1982). However, few studies have examined long-term response of forbs to 2,4-D application. One that did found that forbs recovered and increased above pre-treatment levels (Wambolt and Payne 1986). Perennial grasses usually exhibit a short and long-term increase in cover after herbicide application (Blaisdell et al. 1982, Wambolt and Payne 1986, Sturges 1993). Short-term impacts of 2,4-D use can occur in proportion to forb cover prior to treatment and the forbs killed by the treatment (Blaisdell et al. 1982). Consequently, 2,4-D application usually is not recommended where increasing forb cover is an objective (Blaisdell et al. 1982).

When fires, mechanical treatment, or herbicide treatment is prescribed for shrub dominant stands, it is important to determine whether or not the area has sufficient cover of forbs and grasses to recover (Bunting et al. 1987). If grass and forb cover is sufficient to provide recovery, then a natural increase in herbaceous cover can occur. However, if there is insufficient cover, natural reproduction of herbaceous vegetation may be limited. When this happens, the area may become invaded by undesirable species such as cheatgrass, and the area may eventually return to a heavier stand of shrubs (Pechanec et al. 1960). To rectify this, areas can be seeded using techniques identified by Plummer et al. (1968) and Yoakum et al. (1980). Both of these reports identify using a large variety of plant species, preferably native, applied with natural simulation practices. Ten basic principles of successful plantings (Plummer et al. 1968) have been tested on thousands of semi-arid western rangeland acres in the Great Basin. Improved habitat quality for deer, pronghorn, and bighorn sheep is well documented (Tueller and Monroe 1975, Graf 1980, Yoakum 1980).

Livestock grazing has had a major effect on condition of upland habitats of the Refuge. Based on the magnitude of effect, detailed discussion of the underlying factors is warranted. Ecological communities in the northern Great Basin were affected by herbivorous hoofed mammals to a limited degree prior to introduction of domestic livestock (Young et al. 1976, Mack and Thompson 1982). In the Great Basin, various species of perennial bunchgrasses comprise the bulk of grass cover in upland vegetation types. Collectively, bunchgrasses are less resistant to frequent grazing, especially during growing season, compared to sod-forming grasses characteristic of the Great Plains (Blaisdell et al. 1982, Mack and Thompson 1982).

Control of location, timing, and intensity of livestock use determines which foods are selectively used by livestock and whether livestock use significantly influences plant succession (Ellison 1960, Blaisdell et al. 1982, Blaisdell and Holmgren 1984, Platts and Nelson 1985). In the intermountain west, increase in cover of sagebrush and other shrubs is associated primarily with frequent, intensive use of herbaceous plants during the growing season coupled with fire exclusion (Ellison 1960, Laycock 1967, Blaisdell et al. 1982, Heady 1983, Kauffman 1990). Appendix I provides further discussion.

Existing habitat conditions on the Refuge are influenced primarily by excessive shrub cover (page 124 in Chapter 3 of the EIS). Excessive shrub cover is attributed to livestock management that occurred before Refuge establishment and management of fire and livestock grazing after Refuge establishment (Rouse 1958, Deming 1961b, Pyle 1991a, 1993b). Shrub cover does not appear to have changed substantially since 1968 (page 124 in Chapter 3) despite increasingly conservative practices of livestock management. This is consistent with findings and observations of Sneva et al. (1984), Winward (1991), and Laycock (1991), who reported that sagebrush cover typically will maintain dominance over perennial herbaceous species in the absence of stand-replacement disturbances.

PART TWO - WETLAND VEGETATION TYPES

A. SOIL

1. Direct Effects of Vegetation Treatment

Direct impacts of livestock grazing on soils can include trampling of streambanks and reduction of infiltration rates from soil composition. Damage to streambanks is reported where banks have been de-stabilized by excessive livestock use (Clary and Webster 1989, Armour et al. 1991). Probability of damage to streambanks from livestock use is related to several factors including: (1) characteristics of streambanks and adjacent stream channels; (2) type and condition of streambank vegetation; and (3) success of control over the timing, intensity, and duration of livestock use (Clary and Webster 1989, Platts 1989; Myers and Swanson 1991). Streambanks with coarse-textured soils are less prone to damage from livestock use than streambanks with fine-textured soils (Myers and Swanson 1991). Reduction of infiltration rate has occurred in some alluvial floodplains of the Refuge based on a comparison of infiltration on sites with different histories of livestock use (Refuge files, Pyle and Brown 1991).

2. Indirect Effects of Vegetation Treatments

Prescribed burning, livestock grazing, and haying indirectly influence soils by changing vegetation vigor and composition. Reduction in above-ground vegetation and temporary exposure of soil are immediate consequences of prescribed burning in riparian areas (DeBenedetti and Parsons 1984, Tiedemann et al. 1990). The more severe the burn, the more vegetation is reduced, organic matter is removed, and mineral soil is exposed (DeBenedetti and Parsons 1984, Beschta 1990). Collectively, cover of herbaceous plants usually is restored to pre-burn levels by the second year and increases above pre-burn levels thereafter until the onset of late succession (Britton et al. 1980, DeBenedetti and Parsons 1984, Young 1986).

Amount of unstable streambank is related to composition of streambank soils, composition of streambank vegetation, and intensity of livestock use (Clary and Webster 1989, Platts 1989). Intensive use of sites by livestock can increase probability of streambank damage by reducing composition of deep-rooted sedges and willows and increasing composition of shallow-rooted grasses (Kovalchik 1987, Kovalchik and Elmore 1992). Increased infiltration rates and decreased soil compaction were associated with non-use by cattle and a rest-rotation cattle grazing system (Bohn and Buckhouse 1985). Recovery of infiltration and soil compaction appeared to be hindered by season-long and deferred rotation cattle grazing. After one year of research, Hayes (1978) reported that rest-rotation cattle grazing in central Idaho did not significantly accelerate channel movement by bank degradation.

Non-structural and structural management practices are used to restore streambanks and channels. Non-structural methods include rest from livestock grazing (Clary and Webster 1989) and increased control over livestock use (Platts

1989). Structural techniques include planting willow (McCluskey et al. 1983), installation of juniper revetment (Sheeter and Clair 1981), and construction of check-dams (Heede 1966).

3. Effects of Roads and Campgrounds

Roads traveling through wetland habitats compact soils and accelerate soil erosion (Thomas et al. 1979b). Roads that travel along and through streams increase sedimentation (Dunne and Leopold 1978:714). In campgrounds, soils of wetland plant communities are subject to compaction by vehicles and intensive use by people (Refuge files). Reduction in infiltration from compaction reduces water retention and water release capacities of emergent wetlands of floodplains (Dunne and Leopold 1978:167, Gebhardt et al. 1989).

B. WATER QUALITY

1. Direct Effects of Vegetation Treatments

Direct effects of prescribed burning on water quality would be minor because most burns would be of low intensity and severity (Refuge files). Severe, high intensity fires can increase nutrient content in streams, however, effects usually are short-lived (Tiedemann et al. 1990, USBLM 1991:3-43). Livestock can reduce water quality by trampling banks and defecating in streams (Dunne and Leopold 1978:740, Platts and Nelson 1985).

Overland runoff could potentially carry herbicides into riparian systems. EPA reported the acceptable level of tebuthiuron in drinking water as 2.0 ppm and 70 ppb for 2,4-D. The greatest concentration of tebuthiuron in water documented by DowElanco (1994) was 0.18 ppm. 2,4-D is labeled for use in water. Solomon et al. (1988) reported that rates of dissipation of 2,4-D were similar for concentrations of 1.0 and 2.5 kg/ha, and within 15 days < 5% of herbicide amount remained in the water. In their discussion, they stated that "[f]rom the point of view of environmental impact, the relatively short persistence of these chemicals [2,4-D included] suggests that their effects in the aquatic ecosystem, if any, are likely to be short-term and acute in nature."

2. Indirect Effects of Vegetation Treatments

Indirect effects of prescribed burning, haying and livestock grazing on water quality relate to the extent to which they influence vegetation attributes. Changes in vegetation leading to increased sedimentation can decrease water quality of streams (Platts and Nelson 1985, Clary and Webster 1989, Minshall et al. 1989).

3. <u>Effects of Other Habitat Management Practices</u>

Check dams, if constructed properly, can enhance water quality by removing sediments from the water column (Heede 1966, Manci 1989). If poorly constructed, erosion of stream channels increases, sedimentation increases, and water quality diminishes (Beschta and Platts 1989, Elmore and Beschta 1987).

4. <u>Effects of Roads and Campgrounds</u>

Soil erosion associated with open roads through wetland habitats is of a concern. In campgrounds, excessive soil compaction increases the probability of soil erosion and sedimentation in streams (Thomas et al. 1979c). Mitigation measures include control of location, timing, and intensity of use of visitors (Thomas et al. 1979c).

C. <u>VEGETATION</u>

1. <u>Direct Effects of Vegetation Treatments</u>

Fire is extremely important in aspen ecology (Bartos 1978, Jones and DeByle 1985, Mueggler 1988). Killing mature aspen trees is essential for regeneration and maintenance of aspen in some sites (Jones and DeByle 1985). Restoration of aspen stands that have been invaded by sagebrush or juniper occurs most rapidly if these stands are burned (Brown 1985, Brown and Simmerman 1986). In degraded stands, periodic burning can restore aspen dominance and habitat diversity (Bartos 1978, DeByle 1985a,b).

2. <u>Indirect Effects of Vegetation Treatments</u>

Prescribed burning and livestock grazing can have positive and negative effects on vegetation. Prescribed burning can simulate natural fire, which periodically reduced cover and density of herbaceous and woody plants before Euro-American settlement (Jones and DeByle 1985, Young 1986). Periodic burning mineralizes plant nutrients, which can stimulate microbial activity and plant growth (DeBano 1990). Some nutrients are directly lost through volatilization (Faulker and de la Cruz 1982, DeBano 1990). Nutrient losses during fire can be minimized by control of prescription conditions (Bunting et al. 1987, Peterson 1990).

Prescribed burning temporarily reduces vegetation structure. Plant vigor can increase and exceed pre-burn levels 2-5 years after treatment in emergent wetlands (Britton et al. 1980, DeBenedetti and Parsons 1984, Young 1986), and in aspen woodlands (DeByle et al. 1989, Bartos et al. 1991). Reduced plant vigor in emergent wetlands can result from excessive livestock use (Taylor 1986, Clary and Webster 1989, Platts 1989). Reduced vigor of particular species can result in changes in composition of wetland plant communities (Hargis and McCarthy 1986, Young 1986, Kovalchik 1987, Kovalchik and Elmore 1992).

When plant vigor is consistently reduced, streambank erosion can increase because of decreased root-mass and binding ability of streambank plants in alluvial valleys

(Clary and Webster 1989, Gebhardt et al. 1989). Consequently, streambanks become less resistant to high water flows, banks erode, channel form changes, and water tables drop in alluvial valleys (Van Havereen and Jackson 1986, Gebhardt et al. 1989, Leonard et al. 1992). Lowered water tables reduce cover of wetland plants and increase cover of upland plants (e.g., big sagebrush) tolerant of dry soils (Elmore and Beschta 1987). Under these conditions, stream channels continue to erode until a new floodplain becomes established at a lower base level (Van Havereen and Jackson 1986, Gebhardt et al. 1989).

3. Effects of Roads and Campgrounds

Riparian vegetation can substantially be reduced where roads travel through narrow riparian corridors (Thomas et al. 1979b). The relatively large area comprised of roads, parking areas, and camp sites in Hot Springs Campground reduces the amount of area available for vegetation growth. Visitors using the site occasionally damage aspen and willow by trampling, cutting, and burning. Trampling of streambanks seemingly reduces vegetation vigor and growth in Hot Springs campground.

PART THREE - AIR QUALITY

The Environmental Protection Agency requested a seven point analysis be completed regarding protecting air quality standards when prescribed burning is addressed in an Environmental Impact Statement (please refer to comment 383, Appendix O). Those points include; listing alternative methods and reasons why they are not appropriate, Quantifications of the amounts and types of material to be burned, description of the burn type proposed, measures to reduce emissions, quantification of emissions of regulated pollutants, applicable regulatory requirements, description of air quality impacts, and smoke vector modelling, if available. The following analysis addresses these points:

Alternatives to prescribed burning include biological, mechanical and chemical applications to shrub management. Biological techniques include the use of animals that use shrubs for forage but in all probability is not compatible with the intent of the Refuge. Mechanical methods include disking and chaining. Large scale surface disturbances, reduced effectiveness because of slope, rocky and timbered areas, and long term impacts to vista quality make large scale mechanical treatments unsuitable. Chemical methods include ground or aerial applications of herbicides such as 2,4-D and Tebuthiuron. Use of herbicides will not only control shrubs, the target species, but may also have undesirable effects on forbs and grasses as well. In addition, the public has expressed growing dissatisfaction with the widespread use of herbicides on public lands. Large scale use of these alternatives is impractical for the above reasons, however, small scale site specific areas may be found suitable for these treatments.

An average of about 160, 500, 900, and 2,000 acres per year would be targeted for prescribed burning on Hart Mountain NAR under Alternatives A, B, C, and D, respectively. Refer to Hart Mountain NAR Table 2-2 of Chapter 2, Volume I of the FEIS for target species.

Broadcast burning natural fuel beds from multiple ignitions is the most effective method used to create patchy, mosaic burn patterns. Most acreage on a given burn day will be treated with quickly moving head fires, allowing for the most efficient combustion which produces the least particulates.

The most commonly experienced weather patterns in Southeastern Oregon are stable continental air masses and frontal weather conditions. Transport wind (free air) direction during stable continental air mass conditions is southwesterly. Transport wind (free air) direction during frontal passage is generally northwesterly. These two climactic conditions comprise the greatest percentage of upper air movement days. However, changes are abrupt and transitioning conditions can be from any direction. Special attention and assistance from the National Weather Service is required to obtain the most current condition and forecast information to ensure that down wind smoke plume vectors do not cause smoke intrusions into sensitive areas. Firing technique and timing also work to mitigate smoke impacts. The predominate use of head fires will produce the most efficient method of combustion. Burning late in the day during the period of greatest atmospheric instability will loft smoke into layers of air turbulence and transport winds. This works to dilute smoke and move it down wind. In addition, burning during low fuel moisture conditions will reduce the amount of smoke produced from combustion of wildland fuels.

The amount of material to be burned averages 3.5 tons per acre and emits roughly 87 lbs. of particulates per acre. On an average burn day, 500 acres will burned, emitting 297 lbs. of particulate matter per hour, for roughly five hours. In addition to particulates, wildland fuels emit a variety of compounds as gases during combustion. While the research does not quantify amounts, it is known that carbon monoxide, oxides of nitrogen and sulfur, and other gases are present in smoke. It should be noted that water vapor comprises the greatest percentage of wildland fuels smoke.

Smoke management plans currently in place in the State of Oregon do not apply to burning of non-forested areas. Two PM-10 non-attainment areas exist east of the Cascade Mountains, Klamath Falls and LaGrande. The remoteness and absence of sensitive downwind smoke targets in southeastern Oregon have contributed to the liberal requirements of local smoke management. Any prescribed fire action involving the pine stand at Blue Sky will follow state smoke management procedures.

The following Class I airsheds exist within 200 kilometers of Hart Mountain NWR; the Gearhart Wilderness Area, 50 miles due west, and Lava Beds National Monument, 90 miles due west-southwest. Other Class II sensitive smoke targets include the settlement of Plush, OR, seven miles west, Lakeview, OR, 30 miles west-southwest, State Highway 395, 25 miles west, and Burns, OR, 60 miles north. The use of southerly and northerly transport winds would mitigate smoke impacts to these areas. Transport winds from these directions would avoid smoke intrusions in Plush, Lakeview, Highway 395 and Class I airsheds. The smoke impact to Burns would be minimal because of the distance, dilution of smoke, short duration smoke production and efficient combustion.

As public lands, Hart Mountain NWR experiences frequent public recreational use. A backcountry byway links paved road near Lakeview with Frenchglen. Campgrounds, trails and roads are all subject to smoke intrusion. Signs along travel corridors are posted during burning operations to advise individuals of burning operations.

Drift smoke from Hart Mountain NWR is not anticipated to create significant impacts when combining with drift smoke from forestry practices burning in other parts of the state. Average burn acres per day will be 500 acres or less for 15 days per year. When compared to other areas using prescribed burning, this represents an insignificant addition to the smoke load of class II airsheds. In addition, distance, smoke dilution and short duration will minimize cumulative effects of smoke for Hart Mountain NWR.

PART FOUR - WILDLIFE

Wildlife can be affected by a number of management activities and regulations on the Refuge including vegetation treatment, other habitat manipulations, hunting and fishing, transplanting, predator control, recreation management, and road management.

A. SHRUB/JUNIPER COVER REDUCTION

Most of the impacts that vegetation treatments have on wildlife result from changes in vegetation structure, plant species composition, habitat diversity, forage quality, and forage quantity. Use and non-use of prescribed burning, mechanical treatments, and herbicides are the primary methods being considered in this FEIS to manage shrub cover. Non-use of these management practices is included because it also influences succession, progression, and condition of all major wildlife habitats of the Refuge. The following discussion addresses the influence of management practices on wildlife.

a) Ecological Perspective

Fire historically played a significant role in shaping habitats of eastern Oregon (Dealy et al. 1978, Gruell 1985a, 1985b, Shinn 1980, Kauffman 1990). With respect to uplands, fire was once a primary process that influenced succession in vegetation types and therefore, the quality of habitat available to wildlife (Wagner 1983, Gruell 1986, Kauffman 1990). Since Euro-American settlement, plant succession and habitat conditions in upland ranges were influenced increasingly by the interaction of fire, livestock grazing, and introduction of alien grasses and forbs (Wagner 1978, Autenrieth et al. 1982, Heady 1983, Kauffman 1990). Reports indicate that these same factors substantially influenced past and current habitat conditions available to wildlife in upland habitats of the Refuge (Deming 1961b, USFWS 1970, Pyle 1991a, 1993b).

b) **Direct Effects of Treatments**

Treatments seldom result in direct mortality of wildlife. Direct killing of vertebrate wildlife as a consequence of prescribed burning is rare (USBLM 1991:3-51). Direct effects of mechanical treatments on wildlife, consisting of disturbance during the treatment process, would be of short duration and localized. Appendix E of the FEIS for Vegetation Treatment on BLM Lands in Thirteen Western States (USBLM 1991) provides results of an in-depth risk analysis for terrestrial and aquatic wildlife exposure to herbicides. Sections 6 to 8 are specific to wildlife. Based on evaluation of this approved NEPA document, we concluded that the risks to wildlife from herbicides would be low when application rates and other use and prescription standards were strictly followed.

USBLM (1991) reported that 2,4-D, in relatively high concentrations, is moderately toxic to vertebrate species and moderately to highly toxic to aquatic species. Lethal doses (50% mortality, LD) of 2,4-D for rainbow trout (48 hour), mallards (oral) and rats (oral) was 1.1 mg/l, >2,000mg/kg and 300-1,000 mg/kg, respectively. 2,4-D amine is practically nontoxic to amphibians (Johnson 1976 as cited in USBLM 1991). The lethal effects of 2,4-D on grazing wildlife have not been reported although LD_{50} for cattle was 100 mg/kg (USDA 1984 as cited in USBLM 1991). USBLM (1991) summarized that insects appear to be relatively tolerant to high levels of 2,4-D based on studies with honey bees. Bioaccumulation is low for tested animals exposed to 2,4-D and accumulated residues are rapidly excreted once exposure ceases (Norris 1981 and USDA 1984 as cited in USBLM 1991).

USBLM (1991) reported that tebuthiuron is moderately to slightly toxic to mammals and birds and slightly to nontoxic to most fish and invertebrates. LD_{50} ratings of tebuthiuron for rainbow trout (eggs and larvae), rats (oral) and mallards (oral) were 26 ppm, 640 mg/kg, and >2,000 mg/kg, respectively. Honey bees sprayed with 30,000 ppm tebuthiuron, which is equivalent to 5.56 kg/ha (5 lb/acre), did not differ in survival from bees sprayed with water. Bees sprayed with 120,000 ppm, equivalent to 22.4 kg/ha (20 lb/acre), had significantly higher mortality than controls (USDA 1986 as cited in USBLM 1991). Tebuthiuron was readily metabolized and eliminated in the urine of tested animals (USDA 1986 as cited in USBLM 1991).

c) **Habitat Diversity (Landscape Level)**

The primary benefit of reducing shrub cover in upland habitats is to increase the amount of early and mid succession stages. This increases habitat diversity and it increases the amount of habitat available to wildlife species dependent on grassland habitats (Refuge files, see Chapter 3 and Appendix B for discussion).

Immediate impacts of various treatments can be severe, though localized, depending on the method. Reduction of ground cover can adversely impact some species of small mammals during any time of year, and ground-nesting birds during the nesting season (Kirsch et al. 1978, Starkey 1985, Bock et al. 1993). Impacts to nesting birds would be mitigated by burning prior to or following the nesting season (USFWS 1990, Morton 1993).

Although shrub removal treatments may kill individual animals during the treatment operation, long-term effects on wildlife populations would be beneficial. Impacts of vegetation treatments on Refuge wildlife would vary tremendously depending on the type of land and amount of land treated, treatment pattern, and treatment effects on vegetation composition (Bunting et al. 1987, Morton 1993).

Expectations of wildlife response to shrub and juniper control differ among wildlife species. Possible population responses include: (1) increase in treated area; (2) decline in treated area; (3) colonization and increase in treated area; and (4) decrease and abandonment of treated area. Management practices that increase interspersion of succession stages can increase habitat diversity and species diversity provided that amounts of each succession stage exceed minimum areas requirements of different wildlife species (Thomas et al. 1979a, 1979b). Increased amount of habitat in early-mid succession would benefit species seasonally associated with grassland-like habitats. For example, increasing the amount of land in early and mid succession in Wyoming big sagebrush stands could increase distribution, productivity, and population size of pronghorn of the Refuge (J. Yoakum, personal communication). Shrub cover and height are the primary factors that presently limit use of Wyoming big sagebrush in late succession (Herrig 1974, Yoakum 1980).

d) **Vegetation Composition**

Vegetation treatments designed to reduce shrub cover can cause considerable change in vegetation diversity (Blaisdell et al. 1982, Sapsis 1990, Pyle 1993a). General change in structure (e.g., change from dominance of shrubs to dominance of grasses and forbs) was addressed in the previous section. Changes in composition of herbaceous plants also occurs. For discussion of the influence of composition of habitats on featured species see Appendix F of the FEIS.

Use of herbicides to control sagebrush cover can reduce forb cover in the short-term (USBLM 1991:3-98). Consequently, wildlife species that feed on forbs, such as pronghorn and sage grouse, could be impacted on treated sites because of reduced forb availability (Yoakum 1978, Autenrieth et al. 1982, Pyle 1993a). However, forb increases over the long-term could benefit pronghorn and sage grouse (Wambolt and Payne 1986, Pyle 1993a).

Maintenance of excessive sagebrush cover can result from non-use of management practices that regulate cover of sagebrush (Laycock 1991, Winward 1991, Pyle 1993a). Sites that presently have excessive sagebrush cover and sparse cover of perennial herb species would comprise greater cover of perennial herb species after reduction in sagebrush cover (Blaisdell et al. 1982, Bunting et al. 1987, Winward 1991, Pyle 1993b).

Long-term changes in sage grouse populations may be determined by the extent to which habitat management influences grass, forb, and shrub cover in uplands (Crawford et al. 1992, Gregg et al. 1994). Although eliminating shrub cover results in short-term reduction of nesting habitat, quality of nesting habitat could increase as a balance of forb, grass, and shrub cover occurred during late succession (J.A. Crawford, personal communication). At present, shrub cover is excessively high on the Refuge (Pyle 1991a, DeLong 1993b). Winward (1991) and Laycock (1991) reported that, given conditions similar to the Refuge, reduced shrub cover and increased grass and forb cover is not expected without active shrub control measures.

B. PRESCRIBED BURNING IN RIPARIAN HABITATS

Fire can play a critical role in the long-term maintenance of riparian habitat used by wildlife (Britton et al. 1980, Jones and DeByle 1985, Starkey 1985, Young 1986, USFWS 1990). Periodic fire is considered essential for long-term maintenance of the distribution and abundance of aspen in the intermountain west (DeByle 1985a, Kauffman 1990). Burning can result in differential short and long-term effects on species composition of wildlife communities. For example, birds such as vireos and sapsuckers depend mainly on tree trunks and canopies for feeding and breeding purposes (Maser et al. 1984a). These taxa are reduced in the short-term where decadent aspen is burned, trees are wind-thrown, and canopy area of aspen is reduced (Maser et al. 1984b). Although the value of a burned site is temporarily diminished for vireos and sapsuckers, the value of the site is increased for species like mule deer that bed and browse in young aspen (Leckenby et al. 1982), which increases after fire (Bartos et al. 1991). In the long-term however, habitat structure used by vireos and sapsuckers would increase and populations of vireos and sapsuckers could increase because fire stimulated development of a new aspen stand that had a greater number of trees, canopy area, and distributional extent compared with pre-treatment conditions (DeByle 1985a, DeByle 1985b).

In dry meadows, forb availability can be enhanced, in the short-term with periodic burning (DeBenedetti and Parsons 1984, Hargis and McCarthy 1986). Periodic burning of dry meadows may benefit pronghorn and sage grouse indirectly if availability of forbs is increased (Savage 1969, Yoakum 1982, Pyle et al. 1990). However, use of meadows by these species also is influenced by other factors including site geography, water availability, and hiding cover (Oakleaf 1971, Herrig 1974, Klebenow 1985). For example, sage grouse tend to use narrow meadows more than wide meadows because of increased area of meadow feeding habitat proximate to cover in adjacent uplands (Oakleaf 1971, Evans 1986).

Removal of above-ground vegetation in emergent wetlands causes a short-term reduction in herbaceous cover available to wildlife (Cornely et al. 1983, Kantrud 1990). Probability of impact would be reduced by burning at a time when plants are dormant and wildlife use is minimal, usually late winter (Young 1986, USFWS 1990, Morton 1993). Immediate impacts of burning meadows is unavoidable in the case of sites occupied by some species of sedentary small mammals (Cornely et al. 1983). This study also indicated that adverse effects on sedentary species can be minimized by maintenance of unburned patches, and that population size recovered and increased on burned sites the year after treatment.

C. LIVESTOCK GRAZING

a) **Ecological Perspective**

Hoofed grazing mammals historically had a limited role in shaping ecological communities in the northern Great Basin (Young et al. 1976, Mack and Thompson 1982, Heady 1983, Wagner 1983, Yoakum 1992c). After Euro-American settlement, livestock increasingly influenced habitat conditions on the landscape in terms of direct removal of plant cover, and in terms of indirect and cumulative effects on succession in uplands and progression in wetlands (Byran 1928, Wagner 1978, Wagner 1983, Heady 1983, Kauffman 1990). Appendix I provides further discussion.

In uplands, increase in the amount of shrub-dominated stages of late succession is associated with increase in use by species that depend on the occurrence and amount of shrub-dominated habitat (Maser et al. 1984a, Gruell 1986, also refer to Chapter 3 of the EIS). Conversely, increase in the amount of herb-dominated stages of early succession is associated with increase in use by species that depend on the occurrence and amount of herb-dominated habitat (Wagner 1983, Maser et al. 1984a, Chapter 3 of the EIS). In wetlands, decrease in the productivity and structure characteristic of late and very late progression stages is associated with a decrease in use by species dependent on these stages (Winegar 1977, Thomas et al. 1979c, Oakleaf et al. 1983, Minshall et al. 1989, Chapter 3 of the EIS).

Livestock use also can influence the quality of food and cover available to wildlife within succession and progression stages and, consequently, increase habitat available to some wildlife species, but decrease habitat available to other species (see Appendix F for discussion). Importance of livestock grazing and its relationship to wildlife habitat quality is determined by knowledge of ecological processes (Hall 1985), wildlife-habitat relationships (Thomas et al. 1979), and cultural values (Wagner 1983).

b) **Direct Impacts of Cattle**

The presence of cattle may affect Refuge wildlife. Grazing livestock usually would not displace pronghorn, except on fawning grounds in spring and in sites where food is limited (Buechner 1950, McNay and O'Gara 1982). Livestock displacement of bighorn and mule deer has been reported in habitats such as riparian areas seasonally important to all 3 species (Rule 1989, Kie et al. 1991, Payer 1992).

Patterson (1952) reported destruction of sage grouse nests by trailing herds of sheep.

c) **Changes in Vegetation Composition and Quality**

Upland Habitats. Cattle grazing can be used to manipulate vegetation composition. It has been shown to increase habitat available to some wildlife species (Hanley and Page 1981, Urness 1979, Holechek et al. 1982, Woodis 1989). In general, any changes in habitat usually benefit some species while having negative impacts on others (Hall 1984).

The presumption that forb production can be enhanced for wildlife through livestock grazing practices has limited application in upland habitats of the Great Basin (Yoakum 1992c). Changes in livestock grazing practices apparently result in few substantial changes in cover of perennial forbs in stands where sagebrush competition is a key limiting factor (Winward 1991, Laycock 1991). Deficient forb cover is suspected of limiting productivity of pronghorn and sage grouse because (Ellis 1970, Crawford et al. 1992, Drut et al. 1994). Significant increases in forb cover can be accomplished by substantial reduction in sagebrush cover (Blaisdell et al. 1982, Bunting et al. 1987, Pyle 1993a).

By reducing the amount and height of residual herbaceous cover in uplands, cattle grazing can adversely impact wildlife species that depend on this component of the environment. Gregg et al. (1994) found that sage grouse nest success on the Refuge was influenced by the amount and height of grass cover. DeLong (1993a), using artificial sage grouse nests, also found that nest predation was lower for nests that had higher amounts of tall grass around nests.

Bitterbrush growth can be enhanced by intensive use of grasses and forbs by livestock during the growing season (Smith and Doell 1968). Additionally, periodic grazing of bitterbrush in late summer and fall by deer or cattle can stimulate leader growth the following year (McConnel and Smith 1977). Heavy summer and fall grazing by deer or livestock in consecutive years can impact leader production, flower production, and seedling establishment of bitterbrush (McConnel and Smith 1970, 1977). Stands comprised of old-aged bitterbrush plants do not increase growth in response to livestock use of bitterbrush or use of under-story herbaceous plants (McConnell and Smith 1977). Old-aged plants comprise most bitterbrush stands in late and very late succession stages on the Refuge. The only sites on Hart Mountain NAR where bitterbrush seedlings are commonly observed are sites subject to fire of low severity.

Wetland Habitats. Livestock grazing can influence the quality of habitat available to wildlife associated with riparian and emergent wetlands. Indirect effects of grazing on wildlife range from positive to negative. Type and magnitude of responses to grazing are related to many interacting factors including the composition of wildlife communities; difference in requirements among species for habitats; extent, composition, and condition of wildlife habitat; and the historical regime of livestock management (Thomas et al. 1979c, Hall 1985, Platts 1989, USFWS 1990, Bock et al. 1993). Positive influences associated with periodic use of riparian meadows and emergent wetlands by cattle consist of increases in the duration of green growth of forbs used by sage grouse for food and improvement of seasonal foraging areas for some species of waterbirds (Evans 1986, Kantrud 1990, USFWS 1990). Negative effects usually are associated with (1) temporary removal of cover required by species for reproduction and concealment (Kirsch et al. 1978, Medin and Clary 1990, USFWS 1990, Kantrud 1990); and (2) frequent, intensive removal of vegetation that results in long-term alteration of progression stages, and, consequently, diminished area comprised of riparian wetland (Winegar 1977, Thomas et al. 1979c, Gebhardt et al. 1989, Schulz and Leninger 1991).

Livestock grazing can adversely influence riparian nongame bird species richness and abundance through loss of foraging and nesting cover, direct disturbance of low nesting birds, soil compaction, lowering of water tables, and depletion of mature stands of shrubs and trees by long-term attrition (Mosconi and Hutto 1981, Bull and Skovlin 1982, Taylor 1986, Taylor and Littlefield 1986). Other studies, however, have reported no significant difference between grazed and ungrazed areas in terms of population parameters of widespread species of birds associated with riparian habitat (Sedgewick and Knopf 1987, Knopf et al. 1988).

Although riparian and snowpocket aspen habitats support the most diverse communities of birds on the Refuge, the species composition and population numbers of these riparian avifaunas typify heavily disturbed, rather than healthy, riparian habitats (Dobkin 1994). There is very low overall diversity of bird species in the Refuge's riparian habitats and the bird populations are disproportionately represented by a small number of abundant, widespread species - such as American robin, red-winged blackbird, and house wren, which together make up more than one third of all the breeding bird in these habitats on the Refuge (Dobkin 1992).

In contrast, riparian-dependent bird species of conservation concern such as MacGillivray's warbler, lazuli bunting, and willow flycatcher are very rare or entirely absent from woody riparian habitats over most of the Refuge (Dobkin 1992, 1993). These and other similar species of "neotropical migrants" (Dobkin 1994) are long-distance migratory birds that depend on woody riparian areas in the American West to provide breeding season habitats, and then migrate to Latin America for the winter. These riparian birds of particular conservation interest are associated with riparian habitats that are minimally disturbed and impacted by livestock grazing (Bock et al. 1993). At Hart Mountain NAR, such habitats are the most structurally complex and consist of multi-layered (i.e., uneven aged) aspen with lush shrub and herbaceous understories, or composed of dense willow and alder thickets (Dobkin 1992, 1993).

Studies indicate that small mammal composition and abundance is influenced not only by the amount of riparian habitat (Brown 1978), but also by the height and density of cover resources within and among riparian and emergent wetlands (Cornely et al. 1983, Schulz and Leninger 1991). Reduction in height and density of herbaceous vegetation reduces diversity of small mammals in riparian and emergent wetlands (Kauffman et al. 1982, Medin and Clary 1989, 1990).

In southeastern Oregon, wetlands are the primary habitat of several small mammals species including water shrew, vagrant shrew, western jumping mouse, Belding's ground squirrel, montane vole, long-tailed vole, northern pocket gopher (Maser et al. 1984b). Whereas shrews, jumping mice, and voles are sensitive to reduction of cover height and density, pocket gophers and ground squirrels are tolerant of reduction in cover height and density (Hanley and Page 1981, Cornely et al. 1983, Kauffman et al. 1982, Jenkins and Eshelman 1984, Maser et al. 1984b, Medin and Clary 1989, 1990, Schulz and Leninger 1991). However, all species are adversely affected by land-use practices that reduce the area composed of wetland habitat, which can result from catastrophic flooding, improper road design, mismanagement of livestock, and other factors (Winegar 1977, Gebhardt et al. 1989, Kovalchik and Elmore 1992, Leonard et al. 1992).

Livestock grazing in riparian wetlands can negatively effect fish populations of Rock and Guano Creek (Daily 1979, Biederbeck and Daily 1980, Jones 1993). Removal of streambank vegetation at any level of livestock use can adversely influence the quality of in-stream habitat available to trout (Platts 1989). Although limited information exists on fish populations of Hart Mountain NAR, habitat quality is a primary limiting factor (Daily 1979, Biederbeck and Daily 1980, Jones 1993). Armour et al. (1991) provides additional support for this assessment. Increased streambank stability, shading, perennial flow, sinuosity coupled with reduced sedimentation increases the amount and quality of habitat available to fish on the Refuge (Bowers et al. 1979, Jones 1993). Effects of management actions on fish habitat are discussed further under the Wetland Habitat Section.

D. FENCES

Fences tend to impact wildlife (Kindschy et al. 1982). Location and design of fences influences magnitude of impact (Spillett et al. 1967, Kindschy et al. 1982). Potential impacts of fences on wildlife are probably greatest in riparian and emergent wetlands, where wildlife activities are concentrated (Thomas et al. 1979c, Maser et al. 1984a), and where the need for fencing to control livestock distribution traditionally is greatest (Platts 1989).

Pronghorn movement can be restricted by fences, causing changes in behavior and mortality (Spillett et al. 1967, McNay and O'Gara 1982). For example, 2 pronghorn mortalities were attributed to fences located in wetland habitats of the Refuge in 1992. Fences on bighorn sheep range can restrict movements and cause mortality; rams tend to be effected more than ewes because of horn-size differences (Hansen 1982, Van Dyke et al. 1983). Other known cases of wildlife mortality observed on the Refuge and attributed to fences include waterfowl, prairie falcon, and sage grouse. Properly located and designed fences can minimize problems at least as far as ungulates are concerned (Kindschy et al. 1982, Leckenby et al. 1982, Van Dyke et al. 1983).

E. WATER DEVELOPMENT

Water developments such as water-holes and guzzlers have increased the geographic dispersion and seasonal availability of water for pronghorn and other wildlife on the Refuge (Refuge files). Refuge personnel have observed intensive use of water-holes by pronghorn and sage grouse. Use of guzzlers by bighorn sheep and chukar has been reported. Competition among livestock, feral horses, and wildlife presumably occurs when water supplies are limited by drought or other factors (Refuge files).

F. EFFECTS OF HUNTING AND FISHING

Hunting and fishing can have significant impacts on some species of wildlife (Bailey 1984:178). If properly managed, however, impacts to populations are minimal (Bailey 1984:174). None of the harvest levels prescribed in any of the alternatives would limit populations of pronghorn, mule deer, or bighorn sheep (L. Conn, personal communication). For example, the number of pronghorn bucks maintained on the Refuge is considered minimally influenced by past and current harvest levels based on analysis of sex ratios (refer to Appendix G, L. Conn, personal communication). Harvest of bighorn rams could be increased substantially without jeopardizing the productivity of the bighorn herd on the Refuge (Payer 1992).

Fishing could, under some circumstances, negatively impact trout populations on the Refuge, especially during drought (Lassuy 1990, Burley 1992, Jones 1993). Limited information exists on fish populations and harvest patterns on the Refuge, and thus impacts of harvest regulations has not been determined. Based on consultation with fisheries personnel of the Service and ODFW, angling regulations were changed on Rock Creek and Guano Creek in 1991. The objectives of the regulation change were to increase protection afforded to trout populations, to maintain recreational fishing use, and to emphasize a quality recreational experience. On these streams, current regulations include a daily bag limit of 2 trout of 6-10 inch length/day taken by barbless artificial lures and flies. Formerly regulations permitted 5 trout greater than a 6 inch minimum length/day taken by artificial lures or bait.

G. EFFECTS OF TRANSPLANTING

Continuation of the bighorn sheep capture and transplanting program would not impact future population size if herds are maintained at current levels, or are increased. Current removal efforts (harvest and translocation) may, in fact, maintain productivity of the herd because it includes animals of all ages and sexes (Payer 1992).

H. EFFECTS OF PREDATOR CONTROL

Predators, as a class of wildlife, include a diversity of wildlife species. On the Refuge, 46 species of omnivores and carnivores are classified as predators of birds, bird eggs, and mammals. This list of predator species includes mammals, birds, and snakes that use the Refuge year-round or on a seasonal basis.

Predators are one of many sources of mortality to wildlife (Bailey 1984:168). Factors that influence the effect of mortality from predation include: population size of predator and its prey, the cumulative effect of predation on a prey species' population, the health of the prey species' population, and habitat conditions during periods of increased vulnerability such as fawning by ungulates.

Predation of pronghorn fawns may be a factor limiting populations on marginal pronghorn rangelands or in areas where numbers of predators are high in relation to pronghorn numbers (O'Gara and Yoakum 1992). Fences also can increase predation of pronghorn fawns (McNay and O'Gara 1982). At Hart Mountain NAR, predation is known to occur on pronghorn fawns (Einarsen 1948, Yoakum 1957). Predator/prey relationship studies on adjacent rangelands report similar findings (McNay 1980, Trainer et al. 1983). However, none of these reports provide sufficient information to substantiate that predation on fawns is the limiting factor controlling pronghorn populations. A predator control program on the Refuge during the 1950s and 1960s resulted in increased fawn survival through summer (McNay 1980, Refuge files). However, only slight increases in pronghorn populations were noted during this same period of time (Refuge files). Apparently fawns that survived because of predator control died of other causes between late summer and spring. Udy (1953) investigated the results of predator control on pronghorn fawns and concluded that rangeland conditions affected pronghorn populations more than predation in the Great Basin of Utah. The cumulative effects of predation ultimately appears regulated by habitat quality (Beale and Smith 1973, Yoakum 1980, O'Gara and Yoakum 1992).

There are numerous reports substantiating that predators are a regulating influence on mule deer in Great Basin (Robinette et al. 1977, Austin et al. 1977, Trainer et al. 1978, Lemos et al. 1978). However, Connolly (1981) in the many mule deer/predator cases he evaluated, concluded that "In no case has predation by coyotes or mountain lion been documented as the principal cause of mule deer population decline." Connolly further stated "Mule deer numbers ultimately are limited by quantity and quality of habitat."

Available evidence suggests that improvements in habitat would mediate many of the effects of predation (Leckenby et al. 1982, Yoakum 1982). For ground nesting birds, tall, dense vegetation seems to provide visual, scent and mobility barriers between predators and prey (Bowman and Harris 1980, Sugden and Beyersergen 1987, Crabtree et al. 1989, and Gregg 1994). For example, Gregg (1994) found that successful sage grouse nests were associated with higher amounts of tall grass cover compared to unsuccessful nests at Hart Mountain NAR. Parallel results were obtained in a study making use of artificial nests to study the relationship between vegetative structure and nest predation on the Refuge (DeLong 1993a).

I. RECREATION MANAGEMENT

Campgrounds in riparian areas generally reduces quality of the area for wildlife through direct disturbance by people, trampling of vegetation, soil erosion and compaction, and loss of vegetation (Aitchison 1977, Aitchison et al. 1977, and Settergren 1977 as cited by Thomas et al. 1979c). Without evidence to the contrary, this is the assumed situation on the Refuge.

Campgrounds can have negative impacts on birds in riparian areas. Some species such as Lazuli buntings, song sparrows, and fox sparrows have been shown to be associated with non-campground areas (Blakesley and Reese 1988). Unregulated use of camps degrades vegetation through soil compaction and vegetation trampling, which reduces foraging substrate and nest cover for riparian birds (Bull and Skovlin 1982).

As stated by Thomas et al. (1979c), "road construction probably has a more critical and long-lasting impact on riparian zones than any other management activity". Although there are some benefits of roads to wildlife, they generally adversely impact wildlife. Negative impacts include habitat degradation, disturbance to wildlife, and mortality due to collisions. Roads through narrow aspen corridors may reduce structural diversity.

Hiking along roads, trails, or in the backcountry undoubtedly affects wildlife. Human disturbance can effect habitat use by bighorn sheep (Van Dyke et al. 1983). However, impacts are considered minimal because of the presently low amount of hiking and backpacking that occurs on the Refuge.

J. SPECIAL AREA MANAGEMENT

Further study of recommended Wilderness and Research Natural Areas, and the possible inclusion of these areas as Wilderness or Research Natural Areas generally would not have substantial impact on wildlife of Hart Mountain NAR. However, more acres that are incorporated into Wilderness and Research Natural Areas would mean less acres that would be available for future road developments and other facilities. This would ensure relatively undisturbed areas well into the future. Designation of an area as a Wilderness Area or Research Natural Area would not preclude the use of prescribed burning, though it would prevent the use of mechanical treatments and herbicides. Use of chainsaws for juniper control would be permitted.

PART FIVE - RECREATION

A. RECREATION OPPORTUNITY SPECTRUM

Primitive and Semi-Primitive Non-Motorized areas provide opportunities for solitude and primitive types of recreation in a natural environment with little evidence of human activities. Semi-Primitive Motorized areas provide more opportunities for motorized recreation while still maintaining a predominately natural environment. Roaded Natural areas provide a predominately natural environment, but contact with others is high, and more evidence of human activities is present.

Oregonians prefer more natural and less crowded recreation setting over those that are less natural and more crowded; however, it appears that Oregon is in short supply of primitive and semi-primitive recreational areas. Lake and Harney counties may not yet be experiencing such shortages due to their remoteness from any population center; but, preferences for more natural and less crowded recreation opportunities is evident in these counties (Oregon State Parks and Recreation Division, 1988: 114).

B. CAMPGROUND MANAGEMENT

Camping experiences are affected by the design of campgrounds. Campground design (or no design) affects visitors in different ways. Distance between camper; limitations on where people can camp within a campground, versus freedom of choice; and number of conflicts between campers and Hot Springs users and other user groups can affect quality of the camping experience. The visual qualities of a camping area are negative if uncontrolled camping leads to excessive erosion, plant deterioration, and site degradation. Proper design would help eliminate these problems. Through locating similar visitor groups together and segregating them from non-compatible use areas, activity enjoyment is enhanced (Rutledge, 1971:17). An example of this design concept would be eliminating conflicts between horse campers and tent campers by separating them from each other.

Creating more campgrounds on the Refuge would give visitors more choices of where to camp, and would lower the number of people at one particular campground. If many campgrounds are established, however, it may hamper other recreation activities. Having campgrounds at more isolated spots on the Refuge could interfere with other peoples' wildlife viewing, hiking, or sightseeing.

D. HOT SPRINGS BATHHOUSE

Any changes in management of the Hot Springs Bathhouse would affect recreation because this is one of the most popular activities on Hart Mountain. Redesigning the Hot Springs would make the area more visually appealing to visitors. Closing the Hot Springs would have a negative affect on recreation.

E. ROAD MANAGEMENT

Many recreation experiences are affected by road status. Open roads can affect recreation experiences by providing opportunities for motorized recreation, allowing people easier access to wildlife viewing areas. Roadsides also provide habitats that are different from those in adjacent areas, and are inhabited by a variety of small mammals such as ground squirrels, kangaroo rats, deer mice, and sagebrush voles (Maser et al. 1990b). These smaller mammals provide food for other animals. From this standpoint, increased wildlife diversity along roads can increase opportunities for viewing wildlife.

Open roads provide access into hunting areas. By closing roads and limiting access points, however, wildlife habitat is increased, which provides more opportunities for hunters. The issue is to provide acceptable access to hunting areas without diminishing wildlife use of these areas. Vehicle traffic is especially critical in narrow riparian corridors where regular traffic can cause some species, including mule deer, to abandon these areas. Aspen habitat for mule deer can increase hunting opportunities. Complete elimination of access points would diminish hunting opportunities on the Refuge.

Closing roads to vehicle traffic can reduce the number of sites which hunters can drive depending which roads are closed, how many other roads access the same areas, and the length of the road that would be closed. Closing roads that lead to lakebeds and waterholes would restrict use of the area to hunters willing to hike into these areas. Most lakebeds on the Refuge presently are accessible by four-wheel drive vehicles. Closing roads to some lakebeds could provide opportunities for hunters seeking non-motorized hunting experiences.

Closing roads can affect recreation experiences by providing more opportunities for non-motorized types of recreation. Roadless areas provide opportunities for visitors to experience solitude and primitive types of recreation.

F. INTERPRETATION

Directional signing currently is low on the Refuge. Providing more directional signs on the Refuge would decrease confusion of visitors on where they are and how to get to certain places. It would also lessen the chances of visitors getting lost. Additional brochures and information sheets would increase knowledge of the Refuge and surrounding area. Publications have the potential for offering great interpretive depth and detail, and have a take-home value; they can be read at the leisure of a visitor and can provide an important reference during a visitor's stay (Sharpe 1982:284).

G. HIKING TRAIL DEVELOPMENT

Developing hiking trails provide more hiking opportunities for visitors who do not like to "create their own path". Many visitors, based on public comment, would like to know where hiking trails are located (Refuge files). Developed trails may lead to more people using areas where trails are created, therefore increasing the chance of meeting others on trails. Other hiking opportunities not associated with trails would not be significantly affect by development of hiking trails because of the large size of the Refuge.

H. HUNTING AND FISHING MANAGEMENT

Decreasing or increasing fishing opportunities would mainly affect anglers. Changes in the hunting program, however, would affect hunters as well as other recreationists. Increasing hunting opportunities would draw more hunters to Hart Mountain. Some of these hunters would be first time visitors to the area and may tell others of Hart Mountain NAR, possibly drawing more visitors to the area. Also, adding hunting seasons would increase the encounter rate on tableland areas which may diminish some visitors' experiences.

Decreasing hunting opportunities could improve conditions for wildlife photography and viewing. Animals would be less fearful of humans because of hunting, and may be better subjects for photography and wildlife viewing.

Many visitors do not agree with allowing hunting on wildlife refuges, while others just do not like to visit during hunting season. Decreasing or eliminating hunting opportunities would allow others, who normally stay away during hunting season, to enjoy Hart Mountain in late summer and early fall.

I. WILDLIFE VIEWING OPPORTUNITIES

Changes in wildlife populations can increase or decrease wildlife viewing opportunities. Increasing habitat diversity would increase wildlife diversity which can provide more opportunities for viewing wildlife. Few or no changes in habitat management on the Refuge probably would not increase the amount of wildlife using the Refuge, thereby not changing wildlife viewing opportunities. Changes in wildlife habitat also would affect recreation by determining where wildlife can be observed.

J. AESTHETICS

Prescribed burning can have negative short term affects on recreation due to impaired visibility in localized areas and blackened landscapes for a portion of one year for people not accustomed to wildland fires. Prescribed burning can have positive long term effects as it would increase ground cover of grass and wildflowers, and create mosaics of different habitat types, making the area more visually appealing to recreationists. Some areas may be invaded by cheatgrass which would diminish the visual qualities of burned areas.

Herbicide use may, in the short term, negatively affect some recreation opportunities due to temporary site closures, changes in vegetation (vegetation turns brown for short periods), and changes in wildlife use. Recreation would be affected by having negative visual qualities and less wildlife viewing opportunities.

Over the long term, however, vegetation would be enhanced and variation in vegetation over the landscape would be increased, creating a positive visual affect on recreation. The increased number of wildlife species resulting from increased habitat diversity would increase and enhance wildlife viewing opportunities for visitors.

Mechanical treatment of vegetation would negatively affect recreation in the short term while heavy equipment is being used, and while the landscape is disturbed. The long term affect, however, would be positive, as the wildlife viewing opportunities in treated areas would increase.

Livestock grazing can affect recreation experiences by influencing where people choose to camp, hike, or view wildlife. According to public comment, the presence of cattle can have a negative impact on visitors' experiences. Riparian areas are popular places for day hikes, visiting, wildlife viewing, and camping, and cattle in these areas may disturb recreationists. Fences on the Refuge may hinder recreation experiences for those seeking a natural appearing environment.

K. SPECIAL AREA MANAGEMENT

Wilderness Study Areas (WSAs) and Research Natural Areas (RNAs) are only being reviewed in this EIS as areas for future study. Under this guideline, effects to recreation are discussed in terms of "if" areas are designated. If WSA areas are increased, there would be no negative effect to recreation. The areas chosen for future WSA consideration are all roadless areas under the relevant alternative, therefore, future study would not affect motorized recreation. In the long term, areas considered for Wilderness recommendation may attract more visitors. Designating alone, an area as a Wilderness Study Area, may attract more users.

PART SIX - LIVESTOCK GRAZING PROGRAM

The major factor that could affect the livestock grazing program is the restrictions placed on livestock grazing under each alternative, namely the range or maximum number of AUMs to be permitted any given year. Alternative C has further preconditions to livestock grazing. Details are given under each alternative in Section Two.

Prescribed burning, mechanical treatments and herbicides would temporarily reduce herbaceous vegetation. However, over the long term, forb and grass cover would increase, benefiting the livestock program.

Exposure of livestock to herbicides would be alleviated by not allowing cattle to graze in treated units during the year that herbicides are applied; or if the unit is large, ensuring that livestock only use untreated portions of the unit. Herbicides generally would enhance forage availability to livestock (see Vegetation section).

Exclusion of livestock from particular grazing units for a set number of years after prescribed burning, mechanical treatment and herbicides would reduce opportunities for livestock grazing. However, the amount and quality of forage would increase over pre-existing conditions. In grazing units encompassing vegetation types that are scheduled to receive relative small amounts of shrub removal, there likely would be a net benefit to livestock operators. On the other hand, if relatively large amounts of treatment are scheduled, conflicts may occur.

PART SEVEN - CULTURAL RESOURCES

Wooden structures and parts of structures are susceptible fire, and some surface or near surface artifacts may be damaged by fire (USBLM 1991:3-59). Impacts to artifacts depends on material comprising the artifact, temperatures reached during burning, and duration of exposure to extreme temperatures. All wooden structures would be avoided during prescribed burning operations.

Treatments that disturb the soil have the potential for damaging and disrupting the relative positions of artifacts. Disturbing soils may also expose artifacts which increase the possibility of theft. Livestock grazing can increase the chance of surface artifacts being trampled. Structures on the Refuge would be avoided during aerial application of herbicides, and it is unlikely that herbicides would affect artifacts on or below the soil surface.

The extent that recreation management would impact cultural resources would depend to a large degree on the amount of land that people have access to. The greater the amount of access, the greater the likelihood of artifacts being found and taken off the Refuge. Increasing road access would increase the chance of recreationists finding artifacts, and potentially damaging cultural resources.

APPENDIX K
RECREATION OPPORTUNITY SPECTRUM SETTINGS

	Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Evidence of Humans	Setting essentially an unmodified natural environment. Structure extremely rare.	Natural setting may have subtle modifications. Structures rare and isolated.	Natural setting may have dominant alterations, but not to the extent that they draw the attention of motorized observers. Structures rare and isolated.	Natural setting may have modifica-tions which range from being easily noticed to strongly dominant. Structures are generally scattered.	Natural setting is culturally modified. Structures are readily apparent and may range from scattered to dominant clusters.	Setting is strongly structure dominated. Natural elements are visually sub-ordinate.
Social Setting	Contact with others is low.	Contact with others is low.	Low to moderate contact with others.	Contact with others is moderate to high on roads, and low to moderate on trails and away from roads.	Contact with others is moderate to high on roads and trails. Moderate away from developed sites.	Large numbers of users on-site and in nearby areas.
Managerial Setting	Minimum on-site restrictions and controls primarily off-site.	Minimum on-site restrictions and controls present but subtle.	Minimum on-site restrictions and controls present but subtle.	On-site restrictions and controls are noticeable but harmonize with the natural environment.	On-site restrictions and controls obvious and numerous. In harmony with man-made environment.	Restrictions and controls obvious and numerous.

Remoteness	An area at least 3 miles from all roads with motorized use.	An area at least 1/2 mile but no further than 3 miles from all roads with motorized use; can include primitive roads if usually closed to motorized use. High probability of experiencing solitude, tranquility, closeness to nature.	An area w/in 1/2 mile of primitive roads used by motor vehicles, but not closer than 1/2 mile from better than primitive roads. Moderate opportunity for solitude, tranquility, closeness to nature.	An area designated w/in 1/2 mile from better than primitive roads. Opportunity to get away from others but with easy access.	No distance criteria.	No distance criteria.
Size	5,000 acres	2,500 acres	2,500 acres	No size criteria.	No size criteria.	No size criteria.

APPENDIX L
SOCIO-ECONOMIC IMPACTS OF ALTERNATIVE MANAGEMENT PLANS AT HART MOUNTAIN NAR

(Note: page numbers listed in Table of Contents refer to page numbers in upper right hand corner)

SOCIO-ECONOMIC IMPACTS OF ALTERNATIVE MANAGEMENT PLANS AT HART MOUNTAIN NATIONAL ANTELOPE REFUGE

Developed for:

The U.S. Fish and Wildlife Service

Developed by:

Meyer Resources, Inc.

Davis, California

February, 1994

Table of Contents

I. Study Terms of Reference

This study assesses the socio-economic effects of alternative management plans for Hart Mountain National Antelope Refuge, located near Lakeview in South Central Oregon. The analysis will give particular attention to impacts on wildlife-based recreation and preservation, on cattle grazing and on the tax base of Lake and Harney counties, Oregon.

This assessment is based on information presently available to the study. As more information becomes available, the estimates developed here may need to be altered. Nonetheless, we judge present information sufficient to reach valid comparative conclusions with respect to the management alternatives under consideration.

II. Hart Mountain National Antelope Refuge

Hart Mountain Refuge was established as a 275,000 acre preserve in 1936. The terrain of the HMNAR is often precipitous, particularly on the west side, where it rises from about 3,600 feet of elevation in Warner Valley to a height of 8,065 feet. Hart Mountain is well watered by springs. It supports over 330 species of wildlife. In addition to antelope, the lower elevations to the east support kangaroo rats, burrowing owls and a variety of snakes and lizards. Higher elevations of the refuge support mule deer, bighorn sheep, golden eagles, prairie falcons and a numerous smaller bird species. Coyotes, bobcats, jackrabbits and cottontails are among the other species that populate the refuge.

The flora and fauna of HMNAR support a range of recreation pursuits including hunting and fishing, camping, hiking and backpacking, and wildlife observation and photography. Sections of the HMNAR have also been leased for livestock grazing.

III. An Economic and Demographic Profile of Lake County, Oregon

Lake County is located in south central Oregon. It is bounded by Klamath County to the west, Harney County to the east, and California and Nevada to the south. Its largest population center is Lakeview, which is approximately two hours drive east from Klamath Falls. Lake County possesses a 5,292,800 acre land base, slightly over 75 percent of which is in public ownership[1]. Selected demographic characteristics for Lake County, and for the State of Oregon, are presented in Table 1 on the following page.

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[1] Riggs (1991), p. 1.

Table 1

Selected Demographic Characteristics for Lake County, Oregon
1990 Census

	Lakeview	Lake County	State of Oregon
Population	2,526	7,186	2,842,321
Median Age	36.0	36.3	34.6
Race: White	95.1%	95.0%	92.8%
Black	0.1%	0.1%	1.6%
Native American	2.6%	2.8%	1.4%
Males per 100 Females	95.5	101.0	96.7
Persons per Household	--	2.57	2.52
Percent Graduated from High School (25 yrs. & older).	75.1%	75.0%	81.5%
Median Household Income (1989)	$23,256	$24,659	$27,250
Percent of Families Below Poverty Level (1989)	8.9%	9.4%	8.7%
Fully owned homes	38.6%	24.6%	23.4%
Median monthly home costs - no mortgage	$190	$174	$226
Median monthly home costs - with mortgage	$544	$501	$650
Median gross rent	$334	$299	$408
Percent of home owners resident in unit 20+ years	26.7%	20.1%	19.7

Sources: U.S. Bureau of the Census, 1992. 1990 Census of Population - General Population Characteristics, Oregon, 1990 CP-1-39.
: U.S. Bureau of the Census, 1992. 1990 Census of Population and Housing - Summary Social, Economic and Housing Characteristics, Oregon, 1990 CPH-5-39.

It can be observed from the above information that Lake County is sparsely populated. In fact, the Oregon Department of Human Resources reported a population decline for the county on 1990, the last year for which they have such estimates[2]. Median education levels and income tend to be lower than for the State as a whole, as are accommodation costs. Unemployment in Lake County is reported to have fluctuated between 8.4 percent and 10.6 percent in the 1986-1990 period[3].

Again using Oregon Department of Human Resources data, we display a profile of Lake County economic income, by source, together with changes in relative importance between 1980 and 1989 (Table 2).

Table 2

Income By Source, Lake County, Oregon

Income Source	1980	1989	Percent Change
	-----$'000-----		%
Manufacturing*	9,899	14,099	+42.4
Farm	13,671	12,707	-7.1
Federal Government	6,564	10,662	+72.4
State & Local Gov't.	6,974	9,952	+42.7
Services	3,978	7,383	+85.6
Trade	5,209	7,265	+39.5
Construction	3,094	4,268	+37.9
Transportation & Utilities	2,186	4,161	+90.3
Finance, Insurance, Real Estate	907	364	-59.9
Dividends, Interest, Rent	11,991	19,363	+61.5
Transfer Payments	10,067	18,914	+87.9
Per Capita Income	**9,667**	**14,443**	**+49.4**

*Principally, lumber and wood products.

Source: Oregon Dept. of Human Resources, 1992a.

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[2] Oregon Department of Human Resources (1992), p. 7.

[3] Ibid., p. 24.

Data from Table 2 indicate that the retirement sector has been an increasingly important source of personal income in Lake County[4]. Manufacturing is also important, as is farming, although the latter has declined somewhat. Income from government activities, most notably staff of the BLM Regional Office, Fremont National Forest and Sheldon/Hart National Wildlife Refuge, is also substantial. Per capita income in Lake County has not kept up with inflation, and stood at $14,443 in 1989, compared in $16,003 for the State of Oregon.

Tables 3, 4 and 5 present selected statistics on farming and ranching in Lake County from the 1987 U.S. Census of Agriculture.

Table 3

Agricultural Characteristics for Lake County and Oregon

Characteristic	Lake County		Oregon	
	1987	1991	1987	1991
Number of farms/ranches	373		32,014	
Land in farms/ranches (acres)	852,592		17,809,165	
Average farm/ranch size (acres)	2,286		556	
Farms/ranches by size:				
: 1 to 9 acres	18		5,476	
: 10 to 49 acres	49		11,448	
: 50 to 179 acres	80		7,219	
: 180 to 499 acres	81		3,617	
: 500 to 999 acres	42		1,560	
: 1,000 acres or more	103		2,694	
Total Products Sold ($'millions)	31.2	37.0	1,846.1	2,551.9
:Crops	7.0	11.0	1,048.6	1,734.7
:Livestock	24.2	26.0	797.5	817.2
Average Sales Per Farm/Ranch ($)	83,609		57,664	
Percent of Operators who principally farm/ranch.	61.7		48.0	

Source: U.S. Bureau of the Census, 1987 Census of Agriculture.
: Oregon University Extension, 1992. 1991 Oregon County and State Agricultural Estimates.

[4] Ibid., p. 42.

Table 4

Selected Production from Farms and Ranches in Lake County and in Oregon - 1987

Type of Production	Lake County	Oregon
Cattle and calves inventory	107,350	1,503,625
: Beef cows	55,157	618,857
: Milk cows	50	95,325
Cattle and calves sold (#)	54,292	955,484
Hogs and pigs inventory	232	86,293
Sheep and lambs inventory	3,047	470,291
Chickens, 3+ months, inventory	612	3,049,585
Wheat for grain harvest (bushels)	144,824	51,875,186
Barley for grain harvest (bushels)	99,617	12,272,482
Oats for grain harvest (bushels)	99,235	2,777,234
Hay (dry tons)	224,166	2,340,999

Source: U.S. Dept. of Agriculture, 1987 Census of Agriculture.

Table 5

Gross Agricultural Revenue in Lake County - 1991

Product	Gross Revenue ---$'000---
Cattle and calves	25,258
Other livestock	766
Hays and silage	9,527
Grains	590
Other crops	861
Total gross sales	37,002

Source: Oregon State University Extension Service, 1992. 1991 Oregon County and State Agricultural Estimates.

It can be observed from these data that ranches and farms in Lake County are large, relative to Oregon as a whole. Ranches are almost entirely focused on cattle, while farm acreage produces significant quantities of hay and grains.

IV. An Economic and Demographic Profile, Harney County, Oregon

Using a similar sequence of information, profile data for Harney County, Oregon are presented in Tables 6 through 11.

Table 6

Selected Characteristics for Harney County, Oregon, 1990 Census

Population	7,060
Median Age	35.6
Race: White	94.8%
Black	--
Native American	3.7%
Males per 100 Females	100.2
Persons per Household	2.54
Percent Graduated from High School (25 yrs & over)	78.0%
Median Household Income (1989)	$22,334
Percent of Families below Poverty Level (1989)	8.3%
Fully Owned Houses	26.4%
Median monthly home costs (no mortgage)	$177
Median monthly home costs (with mortgage)	$458
Median gross rent	$290
Percent of home owners resident in unit 20+ years	21.7%

Sources: See Table 1.

The Native American population in Harney County is higher than that of Lake County primarily because of the existence of an 11,786 acre Reservation for the Burns Paiute Tribe.

Table 7

Harney County, Oregon, Covered Employment and Payroll - 1990

	Average Employment	Total Payroll -$'000-
Agriculture - Crops	16	176.2
Agriculture - Livestock	75	924.4
Other Agric., Forestry & Fishing	16	234.9
Construction	83	1,705.1
Lumber and Wood Products Manuf.	567	13,349.2
Other Manufacturing	23	336.6
Transportation, Communication and Utilities	82	2,302.8
Wholesale Trade	64	1,053.3
Retail Trade	424	4,516.5
Finance, Insurance & Real Estate	60	754.2
Services	268	2,629.3
Federal Government	249	6,346.2
State Government	84	1,866.5
Local Government	455	7,610.7

Source: Oregon Dept. of Human Services, 1992b.

Table 8

Regional Economic Profile - Harney County, 1989

	Income $'000
Nonfarm Personal Income	308,264
Farm Income	36,355
Transfer Payments	67,520
Dividends, Interest & Rent	68,852

Source: Oregon Dept. of Human Resources, 1992b.

Table 9

Agricultural Characteristics for Harney County

Characteristic	1987	1991
Number of farms/ranches	412	
Land in farms/ranches (acres)	1,519,876	
Average farm/ranch size (acres)	3,689	
Farms/ranches by size:		
: 1 to 9 acres	26	
: 10 to 49 acres	45	
: 50 to 179 acres	58	
: 180 to 499 acres	60	
: 500 to 999 acres	52	
: 1,000 acres or more	171	
Total Products Sold ($'millions)	28.6	31.7
: Crops	2.3	4.1
: Livestock	26.4	27.6
Average Sales per Farm/Ranch ($)	69,469	
Percent of Operators who principally farm/ranch.	60.9	

Source: See Table 3.

Table 10

Selected Production from Farms & Ranches in Harney County - 1987

Type of Production	Harney County
Cattle and calves inventory	118,202
: Beef cows	66,854
: Milk cows	120
Cattle and calves sold (#)	59,409
Hogs and pigs inventory	205
Sheep and lambs inventory	3,347
Chickens, 3+ months, inventory	857
Wheat for grain harvest (bushels)	47,618
Barley for grain harvest (bushels)	51,339
Oats for grain harvest (bushels)	90,963
Hay (dry tons)	158,209

Source: U.S. Dept. of Agriculture, 1987 Census of Agriculture.

Table 11

Gross Agricultural Revenue in Harney County - 1991

Product	Gross Revenue ---$'000---
Cattle and calves	28,500
Other livestock	548
Hays and silage	3,067
Grains	147
Other crops	399
Total Gross Sales	32,661

Source: See Table 5.

V. Recreation in Lake and Harney Counties

1. Demand for and Supply of Outdoor Recreation in Oregon

The Oregon State Parks and Recreation Division incorporates Lake and Harney counties, together with Malheur County, in Statewide Comprehensive Outdoor Recreation Plan (SCORP) Region 11. Oregon SCORP assesses current and expected future demand for outdoor recreation, by activity and by Region, and relates it to recreational supply[5]. This assessment is further delineated by characterization of alternative recreational settings, based on Recreation Opportunity Spectrum (ROS) analysis, originally developed by the U.S. Forest Service. The ROS settings incorporated in demand studies utilized in Oregon SCORP are:

Primitive/Semi-Primitive:

A predominantly natural environment where there is some chance of meeting other people. Access is by trail or cross-country. Some primitive roads may exist, but generally are closed to motorized use. If recreation facilities are provided, they are minimal and rustic.

Roaded Natural:

This includes forest, range and coastal settings which generally appear natural or slightly altered. Access is by trail, road and highway. One can expect to meet moderate amounts of other people. Recreational facilities such as developed campgrounds may exist, but there may also be some opportunities to camp away from others with no facilities.

Roaded Modified:

Nature has been obviously altered through such activities as logging, mining, farming or grazing. Road access is prevalent and one can expect to meet other people in trucks, cars and motorbikes. There may be some chance to get away from others in remote camping spots.

Rural/Urban:

Includes cities, towns, large resorts and major ski areas with buildings and roadways on site or nearby. One should expect to meet large numbers of people. Recreation facilities are often highly developed and motor vehicle access is common.[6]

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[5] Oregon State Parks and Recreation Division, 1988.

[6] Ibid., p. 46.

Wilderness areas have not been included in the Oregon SCORP ROS analysis[7].

Oregon SCORP reports that, on a statewide basis, demand for recreation activities in the State are expected to grow faster than State population. Estimates of projected growth, for eleven major recreation activity groupings, are displayed in Table 12.

Table 12

Projected Growth in Demand for Recreation Activity in Oregon

Activity	Annual Growth Rate ---in percent---
Sightseeing, picnicking	12.2
Hiking, walking, climbing	8.9
Nature study, food gathering	8.5
Non-motorized riding for recreation	6.8
Sports, games, other	6.3
Camping	5.5
Water activities	5.2
Fishing	4.9
Riding or Driving motor vehicles off-Road	2.9
Snow activities	2.4
Hunting or shooting	2.1
Projected Oregon Population Growth	**1.2**

Source: Oregon State Parks and Recreation Division (1988), p. 45.

Oregon SCORP further identifies that Oregonians prefer more natural and less crowded outdoor recreation settings over those that are

[7] Ibid., p. 38.

less natural and more crowded. Tables 13 and 14 report the actual distribution of major recreation activities, by type of ROS setting, and contrasts that with the setting that Oregon recreators report they would prefer. Data for Oregon as a whole and is provided in Table 13. Data for the Region 11 Lake County/Harney County/Malheur County area is provided in Table 14.

Table 13

Comparison of Actual vs Preferred Outdoor Recreation Settings
-State of Oregon-

Activity	Used/ Preferred	Demand for Recreation Activity: Primitive/ Semi-Primitive	Roaded Natural	Roaded Modified	Rural/ Urban
		----------use in percent----------			
Sightseeing	USED	8.4	49.7	21.6	20.3
	PREFERRED	17.6	51.1	21.3	10.0
Hiking	USED	25.0	25.9	17.3	31.8
	PREFERRED	54.7	26.3	10.1	8.9
Nature Activities	USED	25.8	30.9	23.9	19.5
	PREFERRED	47.9	30.9	14.3	6.9
Non-Motorized Riding	USED	15.5	20.5	17.7	46.3
	PREFERRED	24.4	26.9	17.2	29.5
Sports/ Games	USED	2.1	8.4	5.1	84.4
	PREFERRED	3.6	14.6	6.1	75.7
Camping	USED	22.4	43.0	28.7	6.0
	PREFERRED	42.5	34.9	20.4	2.2
Water Activities	USED	10.8	41.5	20.3	27.4
	PREFERRED	28.3	40.0	16.8	15.0
Fishing	USED	25.4	35.4	31.5	7.7
	PREFERRED	48.7	28.8	19.7	2.9
Off Road Vehicles	USED	23.1	31.0	40.0	5.9
	PREFERRED	31.9	29.6	35.2	3.3
Snow Activities	USED	12.4	18.1	20.0	49.5
	PREFERRED	20.7	21.2	16.7	41.4
Hunting/ Shooting	USED	42.0	17.9	36.1	4.1
	PREFERRED	62.7	13.9	20.8	2.6

Source: Oregon State Parks and Recreation Division (1988), p. 47.

Table 14

Comparison of Actual vs Preferred Outdoor Recreation Settings
-Region 11: Lake, Harney and Malheur Counties-

Activity	Used/ Preferred	Primitive/ Semi-Primitive	Roaded Natural	Roaded Modified	Rural/ Urban
		Demand for Recreation Activity ----------use in percent----------			
Sightseeing	USED	7.6	47.2	34.0	11.3
	PREFERRED	17.3	38.5	36.5	7.7
Hiking	USED	26.5	20.8	30.2	22.6
	PREFERRED	44.0	22.0	24.0	10.0
Nature Activities	USED	13.9	19.4	55.6	11.1
	PREFERRED	45.5	18.2	36.4	0.0
Non-Motorized Riding	USED	16.1	16.1	41.9	25.8
	PREFERRED	25.8	19.4	35.5	19.4
Sports/ Games	USED	0.0	7.5	5.0	87.5
	PREFERRED	7.9	15.8	5.3	71.1
Camping	USED	24.2	27.6	41.4	6.9
	PREFERRED	50.0	11.5	30.8	7.7
Water Activities	USED	5.0	40.0	30.0	25.0
	PREFERRED	20.0	45.0	20.0	15.0
Fishing	USED	17.0	29.8	44.7	8.5
	PREFERRED	46.5	27.9	23.3	2.3
Off Road Vehicles	USED	25.1	12.5	53.1	9.4
	PREFERRED	46.7	10.0	40.0	3.3
Snow Activities	USED	17.7	47.1	17.7	17.7
	PREFERRED	38.9	38.9	11.1	11.1
Hunting/ Shooting	USED	37.3	14.0	48.8	0.0
	PREFERRED	58.2	9.3	32.6	0.0

Source: Oregon State Parks & Recreation Division (1988), p. I-8.

Oregon State Parks and Recreation Department (1991) has published estimates of actual "activity occasions"[8], for Oregon and for Lake County/Harney County/Malheur County Region 11. These data, for selected activities, are displayed in Table 15.

Table 15

Estimated Recreation Activity, Oregon and Region 11

Activity	Lake/Harney/Malheur Counties Est. 1987	Lake/Harney/Malheur Counties Proj. 2000	State of Oregon Est. 1987	State of Oregon Proj. 2000
	--use in thousands of activity occasions--			
Freshwater Boat Fishing	120	144	2,775	4,177
Freshwater Bank Fishing	226	271	4,868	6,144
Nature, Wildlife Observation	139	196	6,531	11,128
Visits to Interpretive Centers	16	17	2,411	3,688
Outdoor Photography	259	371	4,621	8,014
Day Hiking on Trails	45	54	4,505	8,527
Overnight Hiking on Trails	69	83	1,019	1,422
Overnight Hiking, No Trails	90	118	601	745
Climbing, Mountaineering	14	16	422	580
Camping, Recreation Vehicle	357	506	5,644	8,899
Camping, Tent with Motorized Vehicle	165	224	3,514	4,809
Camping: Organized Group	25	29	956	1,087
Camping, Horseback	62	69	421	496
Snowmobiling	25	30	211	236
Snow All Terrain Vehicle Riding	26	30	879	1,201
Cross Country Skiing	8	10	597	818
Sledding, Snowboarding Snow Play	39	50	1,368	2,037

... Cont'd. on page 15 ...

[8] Defined as "participation in a given activity by one person for any part of a 24 hour period".

Table 15 Cont'd.

Activity	Lake/Harney/Malheur Counties Est. 1987	Lake/Harney/Malheur Counties Proj. 2000	State of Oregon Est. 1987	State of Oregon Proj. 2000
	--use in thousands of activity occasions--			
Motorcycling, Off Road	20	22	1,159	1,685
All Terrain Vehicle, Off Road	31	39	1,563	2,197
Four Wheel Driving, Off Road	165	220	2,325	3,212
Bicycle Riding, On Road	255	456	12,410	23,675
Bicycle Riding, Off Road	48	54	1,742	2,307
Horseback Riding	53	66	3,080	3,601
Picnicking	126	152	5,286	7,131
Sightseeing	353	433	10,168	14,780
Train, Bus Touring	116	119	326	355
Big Game Hunting	61	65	2,352	2,951
Bow Hunting	11	11	238	249
Hunting: Water Fowl, Upland Birds, Small Game.	68	69	1,153	1,178

Source: Oregon State Parks and Recreation Department (1991).

Statewide, it appears that Oregon is already in short supply of primitive, semi-primitive and roaded natural recreational areas[9]. Lake and Harney counties, remote from major population centers, may not yet be experiencing such shortages, although preference for more natural and less crowed outdoor recreational opportunities is evident there, as elsewhere in the State.

Finally, Dean Runyan Associates and The Lyon Group (1989) provide estimates with respect to overnight travel by Oregonians to the Lake/Harney/Malheur counties area (Table 16).

[9] Oregon State Parks and Recreation Department (1991), p. 114.

Table 16

Origin of Travel to the Lake/Harney/Malheur Counties Area by Oregon Residents

Oregon Area of Travel Origin	Percent of Lake/Harney/Malheur Visitors Day Travel %	Overnight Travel %
South Coast	3	3
Central Coast	2	3
North Coast	--	--
Portland	23	34
Willamette Valley	18	21
Southern Oregon	15	11
Central Oregon	23	21
Southeast Oregon	11	--
Northeast Oregon	8	6

Source: Dean Runyan Associates and The Lyon Group (1989).

2. Visitors from Out of State

Table 17 provides estimates of the origin of out of state visitors coming to Oregon for pleasure. In Table 18, the chief motivations for pleasure travel identified by visitors from out of state are identified. In this latter table, percentages do not add to 100%, as individual respondents were able to identify more than one travel motivation.

Table 17

Estimated Origin of Out of State Visitors Coming to Oregon for Pleasure

Origin	Percent of Visitors
California	30.3
Washington	12.7
Canada	5.8
Texas	4.4
Arizona	4.2
Florida	3.8
Illinois	2.6
Idaho	2.4
Minnesota	2.3
Colorado	2.2
New York	2.2
Foreign (ex. Canada)	2.2
Missouri	2.1
Nevada	2.0

Source: Dean Runyan Associates and The Lyon Group (1989).

Table 18

Motives of Out of State Travellers Who Visit Oregon for Pleasure

Motive	Percent of Respondents
Relax/Sightsee	86.3
Small Town Shopping	56.6
Museum/Historic Site	49.3
Visit Friends/Relatives	44.9
Hike	42.8
Picnic	41.8
Metro Shopping	37.4
Wildlife Viewing	29.5
Camping	29.3
Visiting Restaurants/Clubs	26.4
Boat/River Run	16.3
Fresh Water Fishing	10.0
Hunting	0.3

Source: Dean Runyan Associates and The Lyon Group (1989).

3. Hunting, Fishing and Wildlife-Based Non-Consumptive Recreation in Oregon

U.S. Fish and Wildlife Service (1992) provide 1991 estimates for hunting, fishing and non-consumptive recreation in Oregon (Table 19). In Table 20, using the same source, data on activity days for hunting and fishing in Oregon are displayed.

Table 19

Total Participation in Fish and Wildlife-Based Recreation in Oregon - 1991

Type of Participation	Number of Participants		
	Residents	Non-Residents	Total
	------in thousands------		
Hunting	237	16	253
Fishing	516	201	717
Non-Consumptive Use	1,059	882	1,941

Source: U.S. Fish and Wildlife Service (1992).

Table 20

Hunting and Fishing Activity Days in Oregon - 1991

Activity	Resident	Non-Resident	Total
	---in thousands of days---		
Hunting	2,468	86	2,554
Fishing	6,384	779	7,163

Source: U.S. Fish and Wildlife Service (1992).

In 1992, as of October, approximately 3,500 State licenses to hunt or fish had been purchased from agents in Lake County, 4,000 in Harney County. These license sales, by type, are displayed in Table 21, together with information for Oregon as a whole.

Table 21

1992 Sales of Oregon Hunting and Fishing Licences
-through October-

Type of License	Lake County	Harney County	Oregon
	--number of licenses--		
Resident combination	1,142	1,424	167,151
Resident angler	668	631	292,361
Resident hunter	698	802	135,415
Resident juvenile angler	96	158	31,309
Resident juvenile hunter	12	14	1,444
Non-Resident angler	74	86	19,145
Non-Resident hunter	126	154	8,905
Non-Resident bird hunter	89	92	3,604
Resident 1-4 day angler	146	115	76,053
Non-Resident 1-4 day angler	409	444	144,238
Non-Resident 10 day angler	105	79	15,843
Total Angler Licenses	2,640	2,937	809,072
Total Hunter Licenses	2,067	2,486	316,519
Total Licenses	3,565	3,999	958,440

Source: Oregon Department of Fish and Wildlife.

Oregon Department of Fish and Wildlife (1992) identifies statewide trends for hunters of deer, elk and bear. These data are presented in Table 22.

Table 22

Hunting Trends for Selected Species in Oregon

Year	Deer Hunters	Deer Harvest	Elk Hunters	Elk Harvest	Bear Hunters	Bear Harvest	Cougar Hunters	Cougar H'vest
	-------------	numbers of hunters or animals	--------------					
1982	301,181	85,231	121,691	16,926	16,756	1,313	98	57
1983	278,335	81,473	128,095	17,041	20,500	1,420	85	54
1984	a	a	a	a	a	a	a	79
1985	275,356	81,696	133,676	20,671	a	a	a	62
1986	276,053	81,820	134,285	15,670	20,748	1,376	307	117
1987	254,138	83,265	101,603	13,889	17,666	954	337	166
1988	259,349	83,943	113,718	17,970	15,920	803	325	132
1989	248,518	72,374	114,110	18,100	16,781	664	356	144
1990	274,281	90,646	110,504	18,336	17,080	888	363	155
1991	254,825	78,089	112,573	20,983	9,569	1,172	365	155*

Notes: a = Data not available.
* = In Eastern Oregon, over the period 1987-1991, an average of 165 hunters have taken an average of 74 cougar per year.

Source: Oregon Department of Fish and Wildlife, 1992.

The same publication reports that 2,864 hunters expended 9,000 hunter days to take 1,861 antelope in Oregon in 1991. Of these hunters, 427 were bow hunters, who spent 1,961 days to take 36 antelope - and 60 used muzzleloaders, spending 261 days to take 5 antelope. Finally, the publication reports that 53 Oregon hunters took 50 California Bighorn rams in 1991, 6 from Hart Mountain - and that 8 hunters took 8 Rocky Mountain Bighorn rams in the same year.

In 1991, the Oregon Department of Fish and Wildlife also sponsored a survey-based analysis of fishing in the state of Oregon, by The Research Group. This analysis reported data statewide and by defined region. One region, **Southeast Oregon**, includes Lake and Harney Counties, as well as Klamath, Malheur and Baker Counties. Table 23 reports user data from that survey.

Table 23

Sport Fishing Trips to Southeastern Oregon - 1988/89

Target Species	Residents Living in Southeastern Oregon		Persons from Outside Southeastern Oregon	
	Trips	Days	Trips	Days
	------in thousands of trips or days------			
Trout	107,978	176,843	185,121	433,171
Warmwater fish	85,173	106,763	67,534	160,183
Sturgeon	--	--	520	520
Other fish	6,233	8,295	4,597	8,268
Southeastern Total	**199,385**	**291,901**	**257,771**	**602,141**

Source: The Research Group, 1991.

4. Economic Impacts from Recreation and Tourism

Dean Runyan Associates and The Lyon Group (1989) estimate that, in 1988, the average out of state travelling party in Oregon spent $134.72 per day, or $46 per person. The average expenditure for Oregon overnight travellers was estimated at $107.88 per party day. Oregonians taking day trips for pleasure were estimated to spend $70.92 per party. Further data are provided in Table 24. Aggregate impacts from 1991 travel expenditures in Harney and Lake counties are displayed in Tables 25, 26 and 27.

Table 24

Estimated Expenditure per Party Day in Oregon - 1988

Expenditure By Category	Type of Accommodation: Hotel/ Motel	Friends/ Relations	Campgrounds: Commercial	Campgrounds: Public	All Overnight	Day Visits
	--------in 1988 dollars per party per day-------					
I. Oregon Resident Travellers:						
Accommodation	53.88	2.80	1.15	0.63	26.80	--
Camping fees	0.44	0.09	11.82	5.37	2.14	--
Eating Out	34.60	19.77	14.67	9.61	24.83	20.15
Groceries	10.12	10.08	10.16	16.33	11.89	7.03
Vehicle Cost	12.19	11.17	13.38	14.02	12.36	13.10
Recreation	14.24	6.79	3.65	3.30	8.88	9.24
Shopping	23.67	21.20	9.67	5.42	17.44	19.34
Other	3.13	2.95	8.76	3.06	3.54	2.06
Total	**152.27**	**74.85**	**73.26**	**57.74**	**107.88**	**65.96**
II. Out of State Travellers:						
Accommodation	56.75	11.02	1.50	5.32	35.48	--
Camping fees	0.97	1.41	12.69	8.99	3.98	--
Eating Out	40.19	25.85	16.34	13.77	31.36	13.41
Groceries	8.02	10.61	12.96	11.59	9.61	9.18
Vehicle Cost	20.00	15.91	23.79	18.68	19.38	22.91
Recreation	12.46	6.91	9.62	9.63	10.60	1.78
Shopping	23.21	21.70	16.78	11.45	20.00	4.74
Total	**166.32**	**97.29**	**96.44**	**84.16**	**134.72**	**53.57**

Source: Dean Runyan Associates and The Lyon Group (1989).

Table 25

Aggregate Travel Impacts in Harney and Lake Counties - 1991

	Harney County	Lake County
Expenditures ($'000)	10,112	7,501
Payroll ($'000)	1,626	1,226
Employment (jobs)	205	155
Local Tax Receipts ($'000)	70	53
State Tax Receipts ($'000)	427	305

Source: Dean Runyan Associates (1992).

Table 26

1991 Travel Impacts in Harney and Lake Counties
by Type of Business

Line Item	Harney County Revenue	Harney County Payroll	Harney County Jobs	Lake County Revenue	Lake County Payroll	Lake County Jobs
	---$'000---		no.	---$'000---		no.
Accommodation	1,667	392	53	1,304	307	42
Eating/Drinking	1,906	468	69	1,476	362	53
Food Stores	1,481	158	13	984	105	8
Air Transportation	--	--	--	8	2	0
Ground Transport.	2,029	149	17	1,429	105	12
Recreation	890	220	32	643	159	23
Retail Sales	2,139	239	21	1,657	185	16
County Total	**10,112**	**1,626**	**205**	**7,501**	**1,226**	**155**

Source: Dean Runyan Associates (1992).

Table 27

1991 Travel Impacts in Harney and Lake Counties
by Type of Accommodation

Accommodation Type	Harney County Revenue	Harney County Payroll	Harney County Jobs	Lake County Revenue	Lake County Payroll	Lake County Jobs
	---$'000---		no.	---$'00---		no.
Hotel/Motel/B&B	3,282	624	82	2,660	507	67
Private Campground	213	32	4	724	108	13
Public Campground	5,003	718	87	2,603	374	45
Friends/Relatives	1,168	182	23	1,193	186	23
Day Travel	445	69	9	312	49	6
Other	--	--	--	8	2	0
Totals	**10,112**	**1,626**	**205**	**7,501**	**1,226**	**155**

Source: Dean Runyan Associates (1992).

The Research Group (1991) provide economic impact data specific to hunting and fishing in the Southeastern Oregon region inclusive of Lake, Harney and Malheur counties. These data are displayed in Tables 28 and 29.

Table 28

Purchases by Persons Fishing in Southeastern Oregon

Target Species	Residents Living in Southeastern Oregon	Persons from Outside Southeastern Oregon
	-------thousands of dollars-------	
Trout	3,309	16,844
Warmwater fish	2,477	6,207
Sturgeon	--	5
Other fish	136	349
Southeastern Total	**5,923**	**23,406**

Source: The Research Group, 1991.

Table 29

Expenditure and Impact on Personal Income Per Sport Fishing Trip Within/To Southeastern Oregon

Trip Phase	Trip Expenditure		Impact on SE
	In Southeast Region	Total	Personal Income
	------------in dollars----------		
Resident			
: At home	24.89	24.89	9.11
: Enroute	7.84	7.84	3.40
: At destination	5.69	5.69	2.88
: Total Southeastern	38.42		15.39
Non-Resident			
: At home	--	17.91	--
: Enroute	7.96	15.92	4.01
: At destination	15.82	15.82	9.73
: Total Southeastern	23.78		13.73

Source: The Research Group, 1991.

VI. Visitors to Hart Mountain National Antelope Refuge

1. Number of Visitors

FWS staff at Hart Mountain NAR have estimated visitorship to the refuge annually, using registration and road counter observations. Recent improvements in traffic counting suggest that visitor data reported in previous annual reports may have overestimated. Applying improved estimating parameters to these historic data result in the following estimates of visitation to the refuge (Table 30).

Table 30

Estimated Visitors to Hart Mountain NAR, 1985 - 1991

Period	Estimated Visitors Per Year
1982-1984	12,880
1985-1987	13,936
1988-1990	15,043
1991-1993	17,200

These data are based on extrapolation from voluntary registrant information reported in annual narrative reports of the U.S. Fish and Wildlife Service, and should be considered general estimates. Hunter counts are more exact. The most recent five years of data, also taken from U.S. Fish and Wildlife Service annual reports, are presented in Table 31.

Table 31

Number of Hunters at Hart Mountain NAR - 1987-1991

Year	Pronghorn Hunters	Mule Deer Hunters Archers	Mule Deer Hunters Muskets	Bighorn Sheep Hunters	Total
1987	20	103	138	16	277
1988	20	104	135	12	271
1989	20	85	92	12	209
1990	17	120	92	12	241
1991	19	105	100	14	238

2. Origin of Visitors

Analysis of FWS registration data indicates that approximately 75 percent of visitors to Hart Mountain NAR are Oregonians (Table 32). These data indicate visitorship from Lake and Harney counties at about 7 percent of total visitors. This local share may be somewhat understated, as a lower fraction of local visitors may sign the registration book.

Table 32
Origin of Visitors to Hart Mountain NAR

	Percent of Total Visitors			
Residence of Visitors	1990	1991	1992	3 Year Average
Lake or Harney County	6.4	7.7	6.2	6.8
Other Oregon	68.6	67.1	68.3	68.0
California	11.5	11.1	9.5	10.7
Washington	5.5	5.7	6.1	5.8
Nevada	0.6	0.8	1.0	0.8
Other U.S.	5.7	4.9	6.2	5.6
Foreign countries	1.5	2.6	2.7	2.3

Applying these proportions to the 17,200 visitors estimated for 1991, we obtain the following estimates of visitorship (Table 33).

Table 33
Estimated Visitors to Hart Mountain NAR, By Home Residence

Home Residence	No. of Visitors
Lake or Harney Counties	1,170
Other Oregon	11,696
California	1,840
Washington	998
Nevada	138
Other U.S.	963
Foreign countries	395
Total visitors	17,200

Examination of registration data indicates that enjoyment of the flora and fauna of this remote high desert refuge, together with camping, are the dominant motivators for visits. Other significant motivators are often interlinked with these purposes - and it is not meaningful to dissect visitor motivations on an activity by activity basis. Nonetheless, it may be useful to identify and rank those elements most often identified in the mix of motives compelling visitorship. This is done in Table 34.

Table 34

Reasons Most Often Identified for Visiting Hart Mountain NAR

	Rank of Motivation		
Motivation	1990	1991	1992
Enjoying nature/wildlife	2	1	1
Camping	1	2	2
Hunting	3	3	4
The hotsprings	4	4	3
Photography	5	5	6
Hiking & Backpacking	6	6	5

3. Spending by Visitors to Hart Mountain NAR

Combining the data from previous tables, it is possible to estimate local spending generated by Hart Mountain NAR. This is achieved via the following formula.

Spending by Visitors from Lake or Harney Counties

(1) $TE_l = (P_l)\ (D_l)\ (E_{ld})$,

where;

TE_l = total expenditure by local visitors,

P_l = number of local parties visiting the refuge (from FWS) = 468,

D_l = average days local parties stay = 1, and,

E_{ld} = expenditure per party per day in \$1992 (updated by the CPI from Table 24) = \$76.42.

Spending by Visitors from Elsewhere in Oregon

(2) $TE_o = (P_o)\ (C)\ (D_{oc})\ (E_{oc}) + (P_o)\ (N)\ (D_{on})\ (E_{on})$,

where; TE_o = total expenditure by visitors from elsewhere in Oregon,

P_o = number of Oregon parties visiting the refuge from outside Lake and Harney counties (FWS) = 4,678,

C = proportion of visitors that camp (from FWS) = .19,

D_{oc} = average days of stay by non-local Oregonians who camp (developed from Dean Runyan Associates, 1989) = 3.5 days,

E_{oc} = expenditure per camping party per day in $1992 (updated by the CPI from Table 24) = $66.90,

N = proportion of visitors that don't camp (from FWS) = .81,

D_{on} = average days of stay of non-local Oregonians who don't camp = 1,

E_{on} = expenditure per non-camping party per day in $1992 (based on updated average for visitors staying in hotels/motels or with relatives/friends, updated using CPI from Table 24) = $131.57.

Spending by Visitors from Outside Oregon

(3) $TE_x = (P_x)\ (C)\ (D_{xc})\ (E_{xc}) + (P_x)\ (N)\ (D_{xn})\ (E_{xn})$,

where; TE_x = total expenditure by visitors from outside Oregon,

P_x = the number of parties visiting the refuge from outside Oregon (from FWS) = 1,734,

D_{xc} = average days of stay of campers from outside Oregon (developed from Dean Runyan Associates, 1989) = 3.5,

E_{xc} = expenditure per camping party per day in $1992 (updated by the CPI from Table 24) = $97.50,

D_{xn} = average days of stay by visitors from outside Oregon who don't camp = 1,

E_{xn} = expenditure per party per non-camping party from outside Oregon (calculated as per E_{on}) = $152.70.

These calculating procedures are likely conservative, as we attempt to isolate expenditure impacts on local counties from impacts in Oregon overall, or in the United States as a whole. To this end, we reduce average travel time of 7.3 days per trip for non-Oregon parties[10] to the average for Oregon parties of 3.5 days. Further, we assume that when visitors leave the refuge they leave the local area, and truncate expenditure calculations at that point.

Applying these formula, we obtain the annual expenditure totals displayed in Table 35.

Table 35

Estimated Annual Local Area Expenditures Associated with Visits to Hart Mountain NAR

Origin of Visitor	Estimated Expenditure --in $ thousands--
Lake and Harney Counties	35.8
Other areas of Oregon	706.7
Outside Oregon	326.9
Total Expenditures in the Local Area	1,069.4

4. Non-Market Benefits Associated with Hart Mountain NAR

Hart Mountain National Antelope Refuge does not charge recreators in the manner that a private operator might do. In such cases, economists recognize that recreational consumers usually obtain enjoyment and satisfaction in excess of what they spend for their recreational trip. Economists term this additional enjoyment **consumer's surplus** and have developed methods to estimate such surpluses in dollar terms. Such estimates are also described as non-market values, and are recognized in federal evaluation processes[11]. We have discovered no recent estimates of non-market value directly relevant to wildlife-based activities in southeastern Oregon. Bonneville Power Administration (1986) identified prior non-market estimates of the value of a hunter day

[10] Dean Runyan Associates and The Lyon Group (1989), p. 5.

[11] See, for example, Department of the Interior, 1986. "Final Rule for Natural Resource Damage Assessments under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980" (CERCLA), Federal Register, vol. 51, no. 148 (August 1), pp. 27674-27753.

value directly relevant to wildlife-based activities in southeastern Oregon. Bonneville Power Administration (1986) identified prior non-market estimates of the value of a hunter day in Oregon[12]. The mid-point of these estimates, adjusted to 1992 price levels, is $59 per recreation day. Loomis (1991) estimated the non-market value of a day deer hunting in California at $68.73. U.S. Department of Interior (1989) estimated consumers surplus associated with non-consumptive enjoyment of wildlife in Oregon at $19.50 per day, updated to 1992 dollars. For this analysis, we will apply the $59 per day mid-point estimate to total 1991 hunting days at Hart Mountain NAR (estimated from Table 31 at 2 days per hunter). We will apply the $19.50 consumers surplus value to all non-consumptive recreators - assuming a stay of 3.5 days for campers and 1 day for non-campers. Results of these calculations are displayed in Table 36.

Table 36

Estimated Non-Market Value of Visits to Hart Mountain NAR

User Category	Visitors	Days	Value/Day $	Total Value $'000
Hunters	238	476	59.00	28
Non-consumptive campers.	3,223	11,280	19.50	220
Non-consumptive, not camping.	13,739	13,739	19.50	268
All Visitors				516

VII. Impacts from Alternative Management Plans at Hart Mountain National Antelope Refuge

1. Management Alternatives

Five management alternatives have been considered by FWS. They are described fully in prior EIS sections. For our purposes, we are interested in their potential impact in six areas that are potentially linked to socio-economic value. The attributes of each alternative are generally characterized in Table 37.

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no. 148 (August 1), pp. 27674-27753.

[12] Bonneville Power Administration (1986), p. 65.

Table 37

Selected Attributes of Management Alternatives
-Hart Mountain National Antelope Refuge-

Impact	Management Alternative A	B	C	D	E
Camping opps. (sites)	56-74	103-148	64-102	59-92	None
Annual Hunting (Animals available)	160-220	415	160-220	160-220	None
General Rec. (% non-motorized or primitive)	33	26	32	45	86
Uplands vegetation:* -Reproduction index:	1.0	1.121	1.193	1.459	.963
-Foraging index:	1.0	1.137	1.234	1.564	.948
Riparian/wetlands vegetation (rank)	5	4	2	1	2
Cattle grazing (in annual AUM's)	12,834	4,075	625	0	0

*Based on estimates of number of species supported by each habitat type times number of acres of that habitat type provided by each respective management plan after full implementation.

**All calculations are based on data provided by staff of FWS, Hart Mountain Refuge.

2. Ranking of Decisional Alternatives

Some management plan alternatives lend themselves directly to economic impact assessment. Others support only ordinal (ranking) measurement. Table 38 uses the information developed above to rank impacts under each management alternative, with 1 indicating **most desirable** and 5 indicating **least desirable**.

Table 38

Ranking of Impacts from Alternative Management Plans at Hart Mountain National Antelope Refuge

Impact	Management Alternative A	B	C	D	E
Camping opportunity	4	1	2	3	5
Hunting opportunity	3	1	3	3	5
General recreation quality	3	5	4	2	1
Uplands vegetation	4	3	2	1	5
Riparian vegetation	5	4	2	1	2
Cattle grazing	1	2	3	5	5

Decision theory provides a range of theoretical bases for assessment of alternatives using ordinal information[13]. A maximizing approach (termed **maximax** in the literature) chooses the maximum ranking payoff across all interests. Use of this decisional approach in the present case would focus attention on Management Alternative D, followed by Alternatives B and C (tied).

A more conservative **minimax** approach minimizes the maximum (worst) expected impacts across interests. In this sense, its priority is to minimize losses, rather than to maximize gains from each management alternative. Use of this decisional approach in the present case would focus attention on Management Alternative C, followed by Alternative D.

It should be emphasized that while decision theory applies rules of logic to choices between alternatives, results can be affected by both scoping of alternatives and of impacts. It should therefore be used to illuminate effects from decision making not to preempt the role of decision makers themselves.

3. Detail Underlying Our Ranking Analysis

Data on impacts associated with each alternative discussed here have been provided by FWS staff. These data are briefly summarized in this section.

[13] See, for example, Keeney, R.L., 1982. "Decision Analysis: an Overview", Operations Research 30; pp. 803-835.

i) Camping

FWS staff have analyzed the number of opportunities available for camping at any point in time, for each management alternative. These opportunities were originally estimated in terms of number of cars that could be accommodated. Data based on these estimates are outlined in Table 39.

Table 39

Camping Carrying Capacity at Hart Mountain Refuge
-Alternative Management Plans-

	Management Alternative				
	A	B	C	D	E
Number of cars	65	140*	100	85	None
Number of persons**	162	350	250	212	None

* Includes a camp per half mile along Black Canyon Road (9 miles) and along the road between Post Meadows and Big Flat (3.5 miles).

**Based on 2.5 persons per car from 1991 FWS visitor data.

ii) Hunting

Estimated hunting opportunities under each management alternative have also been estimated by FWS staff, based on 1988-93 tag data and recommendations from the Oregon Department of Fish and Wildlife. These estimates are displayed in Table 40.

Table 40

Estimated Animals Available to Hunters at Hart Mountain Refuge - Under Alternative Management Plans

Species/Hunt	A	B	C	D	E
	Management Plan				
	--------number of hunting tags---------				
Pronghorn					
:Rifle	20	70	20	20	None
:Archery	20	70	20	20	None
Bighorn Sheep	20-30	25	20-30	20-30	None
Mule Deer					
:Muzzleloader	50	100	50	50	None
:Archery	100	150	100	100	None

iii) General Recreation Quality

Prior Table's 13 and 14 identify the preference of residents of Harney, Lake and Malheur counties, and of Oregon residents in general, for more relatively remote and primitive recreation opportunities where possible. That prior section also identifies that Oregon is already experiencing a shortfall in supply of such relatively remote/primitive recreation opportunity, relative to the demand for it[14]- although that shortfall may not yet apply for local county residents. Since approximately two-thirds of visitors to Hart Mountain refuge are by Oregonians living outside Harney and Lake counties, it is appropriate to examine the degree to which alternative management plans at Hart Mountain contribute to Oregon's need for remote/primitive recreational opportunity - as an indicator for the general quality of recreation provided by the Refuge.

FWS Refuge staff have recently completed a Recreation Opportunity Spectrum (ROS) analysis for each management alternative under consideration. ROS analysis has been described earlier in this document, is relied on by the Oregon State Parks and Recreation Division, and provides the basis for the assessment of relative contribution to general recreation quality of each management alternative considered here. Results of the FWS assessment are displayed in Table 41.

[14] See prior Section V.1.

Table 41

Recreation Opportunity Spectrum (ROS) Analysis for Management Alternatives at Hart Mountain Refuge

ROS Category	Management Alternative				
	A	B	C	D	E
	percent of area				
Roaded natural	11	11	11	11	11
Semi-Primitive motorized	56	63	57	44	3
Semi-Primitive non-motorized	33	26	32	45	75
Primitive	0	0	0	0	11

iv) Upland Vegetation

Provision of adequate refuge habitat is a directed responsibility for Hart Mountain National Antelope Refuge staff. Type and quality of available habitat, in turn, affects dependent populations of fish and wildlife, and directly affects the enjoyment of refuge visitors.

FWS staff have estimated the number of acres by upland vegetation type and succession stage, for each management alternative at Hart Mountain - together with the number of species that each habitat-specific succession stage would support. Those estimates were presented separately for **reproductive support** and **foraging support** of animals. FWS estimates assessed relative habitat acreages using two benchmarks: 15 years into the Management Plan; and 50 years into the future, at which point a maximum number of refuge acres would be in early or mid-succession stages of upland vegetation. The number of years required for each individual category of upland vegetation to reach its maximum succession stage have been estimated by FWS staff, and are displayed in Table 42.

Table 42

Number of Years Required to Achieve Maximum Number of Acres in Early or Mid-Succession Stages of Upland Vegetation, by Vegetation Type - Hart Mountain NAR

Upland Vegetation Type	Number of Years
Wyoming big sagebrush	50
Low sagebrush	40
Mountain big sagebrush	25
Big sagebrush - bitterbrush	40
Wheatgrass	40
Mountain shrub	25

We weight habitat acreage in each succession stage by the estimates of "number of species supported" to develop indicators of overall relative habitat productivity for each management alternative considered. These indicators are presented in Table 43 for the 15 year and 50 year benchmarks. They give habitat productivity under Alternative A an Index value of 1.0 and display estimated productivity indices for other management alternatives relative to that base index value. Note that all habitat types save Wyoming big sagebrush reach maximum acreage in early and mid-succession stages prior to the 50 year benchmark (Table 42).

Table 43

Indices of Habitat Productivity for Management Alternatives - Upland Areas of Hart Mountain National Antelope Refuge-

	Management Alternative				
	A	B	C	D	E
Reproduction					
After 15 years	1.000	1.041	1.071	1.179	0.985
After 50 years	1.000	1.121	1.193	1.459	0.963
Foraging					
After 15 years	1.000	1.047	1.084	1.223	0.979
After 50 years	1.000	1.137	1.234	1.564	0.948

These indices do not specify interspecies relationships or weight between species. However, they likely provide a reasonable approximation of relative value based on species diversity. It can be observed that required restoration at Hart Mountain will require many years to complete, with only Option D offering significant benefits over the first 15 years. It can also be observed that Option E (the "leave it alone" option) is predicted to result in less upland habitat productivity than Option A (the present baseline).

v) Riparian/Wetland Vegetation

FWS staff has not provided a restoration schedule for acreages of riparian habitat under each management option in a manner analogous to their treatment of upland vegetation. Rather, they have ranked each management alternative by riparian habitat types expected to be impacted. These rankings are displayed in Table 44. A ranking of 1 indicates the most desirable management alternative. A ranking of 5 indicates least desirable.

Table 44

Ranking of Management Alternatives by Impact on Riparian Vegetation - Hart Mountain National Antelope Refuge

Vegetation Type	Management Alternative A	B	C	D	E
Aspen	5	4	2	1	3
Mixed Deciduous Shrub	5	4	2	1	3
Willow	5	4	2	1	3
Bluegrass-ryegrass	5	4	2	1	3
Sedge-rush-bluegrass	5	4	2	1	2
Silver sagebrush	5	4	3	1	1
Cattail-bulrush	5	4	3	1	1
Aquatic Non-Vegetated					
:High gradient streams	5	4	2	1	3
:Moderate grad. streams	5	4	3	1	2
:Low gradient streams	5	4	3	1	1

4. Estimates of Dollar-Based Economic Impact

i) Direct Expenditures Associated with Recreation and Tourism

Our estimates of expected expenditure on recreation and tourism are indexed to the scenario detail previously presented. First, we associated the number of recreation/tourism days at Hart Mountain NAR estimated in Table 36 with Alternative A. Then we estimated the number of recreation/tourism days for Alternatives B through E using the following protocol:

15 Years into the Management Plan:

- For **camping**, multiply Alternative A estimates by the ratio of the **number of sites estimate** for Alternatives B through E to the Alternative A number of sites estimate (Table 37).

- For **hunting**, multiply Alternative A estimates by the ratio of **median number of tags estimate** for alternatives B through E to the Alternative A median number of tags estimate (Table 37).

- For **other recreators/tourists**, we follow FWS staff advice, weight the reproduction index as twice as important as the foraging index, and multiply Alternative A estimates by the ratio of this **weighted joint index for upland vegetation**, for alternatives B through E, to the Alternative A weighted joint index (Table 43).

50 Years into the Management Plan:

- For **camping**, same as for 15 years, except use estimates of **maximum number of sites** for Alternatives B through E.

- For **hunting**, same as for 15 years, except use estimates of **maximum number of tags** for Alternatives B through E.

- For **other recreators/tourists**, same as for 15 years, except use **50 year reproduction and foraging estimates** from Table 43, rather than 15 year estimates.

The results of these calculations are displayed in Table 45.

Table 45

Estimates of Recreator/Tourist Visitor Days at Hart Mountain NAR - Alternative Management Scenarios

Type of Visitor	Management Alternative A	B	C	D	E
	---number of days---				
At 15 Years:					
Hunters	476	1,038	476	476	--
Campers	11,280	21,779	14,404	13,102	--
Other visitors	13,739	14,330	14,783	16,404	13,505
Total visitors	25,495	37,147	29,663	29,982	13,505
At 50 Years:					
Hunters	476	1,038	551	551	--
Campers	11,280	25,684	17,701	15,966	--
Other visitors	13,739	15,470	16,569	20,526	13,161
Total Visitors	25,495	42,192	34,821	37,043	13,161

Referencing the local expenditure levels identified in Table 35, and adjusting for alternative visitor levels displayed in Table 45, estimated local expenditure levels by recreators/tourists associated with each Management Plan Alternative at Hart Mountain NAR are displayed in Table 46.

Table 46

Estimated Annual Local Expenditures by Recreators/Tourists at Hart Mountain NAR - Alternative Management Plans

	Management Alternative A	B	C	D	E
	---thousands of dollars---				
At 15 Years:	1,069	1,558	1,244	1,257	566
At 50 Years:	1,069	1,769	1,460	1,553	552

Changes to net income to local businesses would be less than the differences displayed here by the amount of "supplies" associated with various levels of servicing. It is likely, however, that costs for labor and capital servicing would be little effected over the ranges of expenditure displayed for these Management Alternatives. Consequently, we would expect net economic effects to differ little from the figures displayed in Table 46.

ii) Direct Revenue Impacts on Cattle Grazing

This report does not enter the considerable debate on cattle grazing on public lands. Some prior analysis has suggested that grazing fees should be raised (eg. Carlson, Horning and Alberswerth, 1992). Conversely, Enterprise Budget Data from Oregon State University (1991), and specific to Cow/Calf production in the Lakeview area, indicates that the typical rancher is operating at a loss, if fixed costs are fully assessed against income.

Riggs (1991) estimates that approximately 3 percent of the beef cattle in Lake County grazed Hart Mountain six months per year, 1986 through 1990. Thus Hart Mountain accounts for a small proportion of total grazing capacity in the area, and the scope of changes envisioned by Management Plan alternatives will neither see an end to ranching in the region nor substantially impact overall federal revenue from grazing.

Given the circumstances described above, our procedure here will be to set the 12,834 AUM's associated with Alternative A as the base level of production, and then estimate rancher costs associated with reductions from that base level.

Our first step is to estimate the number of cows associated with AUM's under each alternative considered in this document. Riggs (1991) identified that an annual average of 1,682 head grazed Hart Mountain 6 months of the year over the period 1986-1990. FWS have provided estimates of the number of cows that would graze on the refuge under Alternatives B and C. The results of these calculations are presented in Table 47.

Table 47

<u>Estimated Number of Cows Grazing Hart Mountain NAR Annually - Alternative Management Plans</u>

Alternative	Annual No. of Cows
A	1,682
B	1,121
C	313
D	--
E	--

The costs for ranchers associated with reduced grazing below the levels identified in Alternative A will occur in one of two ways:

- Ranchers will cut back local production by the indicated number of cows. Their loss will equal forgone revenue minus associated variable costs.

- Ranchers will switch to private pasture for the six months of grazing provided by Hart Mountain NAR under Alternative A, incurring an additional cost to their operation in the process.

To calculate ranch losses per cow from reduced production, we reference Cow-Calf Enterprise Budget EM 8470 for the Lakeview Area (Oregon State University, 1991). That report indicates gross sales income per cow of $361.57 (pg. 2). Because alternative grazing levels identified for Hart Mountain NAR will have marginal impact on total cattle grazing in the area, and in keeping with our approach to recreational impact estimation, we will be somewhat restrictive in deducting costs from this gross revenue figure (Table 48).

Table 48

Estimated Net Loss Per Cow - Reduced Production re. Grazing at Hart Mountain NAR

Line Item	$ per Cow
Gross Loss	361.57
Less Variable costs:	193.60
:Forest Grazing	7.01
:Hay	138.29
:Hay pasture	36.87
:Salt and minerals	1.92
:Vaccine, calves	2.60
:Vet & Preg. Test	4.03
:Supplies	2.88
Net Loss per Cow	$167.97
Net Loss updated to $1992	$170.66

To calculate increased cost per cow from switching to private pasture, we reference Obermiller (1992). When all factors are accounted for, that report, working in 1990 dollars, estimates that cattle grazing on private lands in the Harney/Lake county area costs $.92/AUM more than on public lands (pg. 11). Updating to $1992 dollars via the Consumer Price Index increases this estimate to $.96/AUM.

Results from these calculations are displayed in Table 49. It can be observed from this table that the availability of grazing opportunities on private lands will play a key role in determining the magnitude of losses to ranching from Management Alternatives B through E. For ranchers who can make alternative arrangements on private pasture, net negative impacts will be minimal. Where ranchers cannot find alternative pasture, and act to cut back production in the Lakeview area, losses will more closely approach those of line (1) in the following table. We suspect that, initially, some ranchers may be able to gain relief by switching to alternative pasture, at least in some years. We believe that the higher impact estimate will likely prove more valid over the longer term, however.

Table 49

Estimated Annual Losses to Ranchers due to Alternative Management Plans for Hart Mountain NAR

Rancher Reaction	Management Alternative A	B	C	D	E
	thousands of dollars				
Reduce production	--	95.7	233.6	287.0	287.0
Graze private lands	--	3.2	7.9	9.7	9.7

iii) Direct Dollar Impacts - A Summary

Net change in local direct dollar impacts associated with Management Alternatives B through E, as compared to status quo Alternative A, are summarized in Table 50.

Table 50

Changes in Local Net Economic Impact - Management Alternatives B through E, Relative to Status Quo Alternative A

	Management Alternative A	B	C	D	E
	thousands of dollars				
Recreation/Tourism					
-At 15 years	--	489	175	188	-503
-At 50 years	--	700	391	484	-517
Agriculture					
-Reduce Production	--	-96	-234	-287	-287
-Shift Grazing	--	-3	-8	-10	-10
Joint Dollar Impact					
-At 15 years.					
:Reduce Ag. Prod.	--	393	-59	-99	-790
:Shift Grazing	--	486	167	178	-513
-At 50 years.					
:Reduce Ag. Prod.	--	604	157	197	-804
:Shift Grazing	--	697	383	484	-527

Examination of Table 50 indicates that Alternative E represents a prescription for disaster for local businesses. Consideration of the other alternatives presents a classic example of a rural community in transition. In any but the shortest time frames, Alternatives B, C and D will lead to increased revenue for local businesses. Yet, if alternative pastureland is not available, the ranching sector of the economy will experience costs of the potential magnitude identified here.

iv) Additional Economic Issues

Changes in business revenue will, over time, also shift total local payroll and employment. Using ratios derived from Table 25, we present estimates of increased payroll (Table 51) and employment (Table 52) associated with each Management Alternative. These estimates are adjusted by 10% to allow for the fact that agricultural incomes in the area are apparently higher than in retail and service sectors (Table 7).

Table 51

Estimated Increased Local Payroll from Implementation of Management Alternatives B through E

	Management Alternative				
	A	B	C	D	E
	thousands of dollars				
At 15 Years					
:Reduce Ag. Prod.	--	58	-9	-15	-116
:Shift Grazing	--	71	24	26	-75
At 50 Years					
:Reduce Ag. Prod.	--	89	23	29	-118
:Shift Grazing	--	102	56	70	-77

Table 52

Estimated Increased Local Employment from Implementation of Management Alternatives B through E

	Management Alternatives				
	A	B	C	D	E
	number of jobs				
At 15 Years					
:Reduce Ag. Prod.	--	9	-1	-2	-18
:Shift Grazing	--	11	4	4	-12
At 50 Years					
:Reduce Ag. Prod.	--	14	4	5	-18
:Shift Grazing	--	16	9	11	-12

Finally, direct revenues generate indirect income and employment as monies are spent and respent in the economy. Gross revenue multipliers generally approximate twice the direct revenue impact. Income multipliers are substantially less. No explicit multipliers have been derived for Lake or Harney counties. Gross multipliers were previously derived for Klamath County in 1968 (Oregon State University Extension Service, 1984). Selected results for economic sectors of interest to this analysis are provided in Table 53.

Table 53

Selected Gross Output Multiplier Values for Klamath County

Economic Sector	Output Multiplier
Agriculture	2.627
Lodging	2.511
Cafes and Taverns	2.793
Automotive	1.606
Retail Services	2.180

We believe that updated calculation would reveal the absolute magnitude of these estimates to be overstated. We can, however, conclude that, in general, impacts in agriculture may have a slightly higher additional indirect effect than in most other economic sectors. This tentative conclusion is not sufficient to change the balance of beneficial and adverse impacts discussed previously in this report.

5. Impact on Non-Marketed Values

It was previously identified that Hart Mountain NAR generates significant non-market values through provision of nature and wildlife based recreational opportunity (Section VI.4). Combining our estimated changes in recreation days under each Management Alternative (Table 45) with estimates of non-market value per day (Table 36) we present estimates of the annual non-market value added to base Alternative A by each Management Alternative B through E (Table 54).

Table 54

Estimated Annual Non-Market Value Added by Each Alternative B through E, Relative to Base Alternative A

	Management Alternative				
	A	B	C	D	E
	thousands of dollars				
At 15 Years	--	249	81	88	-194
At 50 Years	--	348	185	228	-259

Finally, we combine results for market based impacts from Table 50 with the non-market impacts reported in Table 54 above to display total annual economic benefits from each Management Alternative B through E, relative to base Alternative A (Table 55).

Table 55

Total Annual Market and Non-Market Economic Impacts of Management Alternatives B through E, Relative to Alternative A

	Management Alternative				
	A	B	C	D	E
	thousands of dollars				
At 15 Years					
:Reduce Ag. Prod.	--	642	22	-11	-984
:Shift Grazing	--	735	248	266	-707
At 50 Years					
:Reduce Ag. Prod.	--	952	342	425	-1,063
:Shift Grazing	--	1,045	568	702	-786

VIII. References

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APPENDIX M
LIVESTOCK GRAZING PROGRAM OF HART MOUNTAIN NAR 1971-1990

INTRODUCTION

Many references were made in public comments (Appendix O) and in the FEIS to the pre-1991 cattle grazing program on Hart Mountain NAR. Appendix I was enlarged based on public comments received during the public comment period, and makes references to the 1971-1990 livestock grazing program. As such, this appendix was added to provided readers with more information on the 1971-1990 program.

Cattle grazing was identified by the 1970 Hart Mountain National Antelope Refuge Resource Management Plan (USFWS 1970) as the primary means by which vegetation would be managed on the Refuge. The use of cattle to improve the vigor of desirable forage plants and to enhance forage quality formed the basis of the 1970 Plan for Hart Mountain NAR (USFWS 1970). A major underlying assumption of the Plan was that "light to moderate grazing by livestock during the growing season will hold back plant development making the forage more nutritious and palatable to wildlife. To do this, each unit would have to be grazed each year. Rotation of deferred grazing systems would accomplish this objective and also provide for improved plant vigor and range conditions."

Within the framework of the deferred rotation grazing system, each unit would be grazed by cattle for one or two years during the growing season, according to the Plan. Also according to the Plan, cattle grazing would be deferred until after the growing season the following year, which would allow plants to maintain or increase in vigor (USFWS 1970).

Anderson et al. (1990a) reported that cattle grazing systems were adjusted in 1979 to improve management of livestock grazing. They characterized the 1979-1987 cattle grazing program as follows. Turn-out into lower elevation units that were deferred the previous year was about April 15 to May 1, although adjustments were made time to time. Higher elevation units were used for mid- to late-season cattle grazing. According to Anderson (1990b), adjustments were made to improve preconditioning treatment so that regrowth would follow early grazing, weather permitting. An important guideline for preconditioning is that livestock must be removed by about mid-growing season. Vertical dotted lines were provided in Table M-2 (pages M-6 to M-23) to allow readers to evaluate the extent to which treatments were applied in units that encompass mostly upland habitat. Note that the line provides only an approximation because mid-growing season would have varied by year depending on availability of moisture and other conditions.

Tables M-1 and M-2 illustrate actual use patterns. Figure 1 illustrates precipitation patterns.

Table M-1. Summary of livestock grazing program of Hart Mountain National Antelope Refuge, Lake County, Oregon, 1971-1990.

Management Area[a]	Acres[a]	Use Period (1971-1990)	Frequency of Use (Years)[b]
Wyoming big Sagebrush			
Rock Creek	36,145	1971-1979	6/9
West Rock Creek	**16,945**	1980-1990	10/11
East Rock Creek	**19,200**	1980-1990	7/11
Medicine Buttes	**14,280**	1971-1990	8/20
Low Sagebrush			
Blizzard Ridge	**34,130**	1971-1990	17/20
Poker Jim	21,935	1971-1972	2/2
North Poker Jim	**11,390**	1973-1990	11/18
South Poker Jim	**10,545**	1973-1990	16/18
Desert/Spanish Lks/L. Guano	48,540	1971-1985	15/15
Desert Lake	**50,025**	1986-1990	3/5
Spanish Lake	**13,300**	1986-1990	4/5
Lower Guano Creek	**1,372**	1986-1990	3/5
Reservoir Lake	**4,365**	1972-1990	17/19
Riffle Canyon	**4,230**	1972-1990	14/19
Big Sagebrush-bitterbrush/Riparian			
Paiute/Eagle Peak	9,470	1971-1979	9/9
Paiute	**4,655**	1980-1990	19/20
Eagle Peak/Robinson Draw	4,815	1980-1985	5/6
Eagle Peak	**2,886**	1986-1990	5/5
Robinson Exclosure	**1,929**	1986-1990	0/0
Deer Cr/Guano Cr/Hammersly	18,930	1971-1985	14/15
Deer Creek	**11,582**	1986-1990	3/5
Guano Creek	**5,594**	1986-1990	4/5
Hammersly	**1,754**	1987-1990	3/4
Green Springs	**2,800**	1972-1990	18/19
Mountain Big Sagebrush/Riparian			
Willow Creek	**976**	1971-1990	17/20
Buck Pasture Exclosure	**142**	1971-1990	0/20
Hot Springs/Hot Springs Camp	2,685	1971-1979	9/9
Hot Springs	**2,569**	1980-1990	9/11
Hot Springs Camp	**116**	1980-1990	0/11
North Mountain	**8,056**	1971-1990	20/20
South Mountain	**8,247**	1971-1990	17/20
Crater	**3,534**	1972-1990	12/19

Season of Use (%)[c]			Days of Use/Year[d]			AUMs/Year[d]		
Spring	Summer	Fall	Ave	Min	Max	Ave	Min	Max
92	8	0	54	10	91	443	316	660
51	40	9	69	49	102	566	105	857
47	41	12	51	15	67	264	30	445
53	47	0	43	25	91	397	230	589
48	38	14	60	15	138	524	110	936
93	7	0	79	72	86	847	795	899
95	5	0	56	35	81	535	343	716
79	21	0	52	5	96	501	5	934
62	36	2	94	24	168	1443	98	2465
45	55	0	42	37	45	417	241	588
24	13	63	33	17	51	454	178	614
0	33	67	36	17	72	82	65	98
30	47	23	34	10	86	209	60	300
63	29	8	38	16	61	204	74	373
0	68	32	100	67	123	1310	743	1830
2	54	44	64	26	123	636	238	903
0	76	24	68	41	110	729	549	893
14	48	38	40	15	56	385	150	547
0	0	0	0	0	0	0	0	0
4	62	34	76	30	148	1001	338	1765
83	17	0	51	40	61	902	644	1234
0	88	12	42	25	56	489	312	671
0	99	1	31	21	45	208	59	401
5	60	35	51	20	122	418	116	635
4	66	30	35	14	92	191	84	353
0	0	0	0	0	0	0	0	0
9	85	6	35	20	66	373	96	615
4	87	9	40	15	67	285	206	392
0	0	0	0	0	0	0	0	0
2	85	13	54	15	122	399	47	767
0	89	11	51	30	87	633	172	1172
3	63	34	43	9	139	203	32	367

Table M-1 (cont'd). Summary of livestock grazing program of Hart Mountain National Antelope Refuge, Lake County, Oregon, 1971-1990.

Management Area[a]	Acres[a]	Use Period (1971-1990)	Frequency of Use (Years)[b]
Meadow			
Flook Ranch	**1,595**	1971-1990	16/20
Lyons Meadow	**1,115**	1971-1990	17/20
North Post Meadow	**593**	1972-1990	18/19
South Post Meadow	**572**	1972-1990	17/19
Big Flat	1,802	1972-1980	9/9
Big Flat	**1,369**	1981-1990	10/10
Goat Creek	**433**	1981-1990	10/10
Wire Corral Flat	**2,055**	1971-1990	7/20
Deming Exclosure	**110**	1971-1990	0/20
Footslope of Mountain			
Stone Corral	**5,178**	1976-1990	13/15
Stein	**2,108**	1971-1990	0/20
Lost Hills/CCC Camp	5,850	1971-1973	3/3
Lost Hills	**5,402**	1974-1990	14/16
CCC Camp	**448**	1974-1990	17/17
Bighorn Pasture	**583**	1971-1990	0/20
Hart Lake	**6,297**	1971-1990	19/20
Crump Lake	1,015	1971-1977	7/7
Crump Lake	**1,015**	1978-1990	0/13
Narrows	**2,280**	1971-1990	0/20
Shirk Ranch			
Shirk	**1,400**	1971-1990	19/20

[a] Existing grazing units and their acreages are in bold type; in cases where old units had been partitioned, the acreage of the original unit is presented in smaller type.

[b] Number of years in which livestock were grazed during the period 1971-1990, or the number of years from the first year that the grazing unit was established until 1990.

Season of Use (%)[c]			Days of Use/Year[d]			AUMs/Year[d]		
Spring	Summer	Fall	Ave	Min	Max	Ave	Min	Max
30	58	12	44	5	203	215	62	573
2	47	51	40	6	123	317	105	629
0	38	62	61	10	117	529	27	1163
0	46	54	61	16	118	300	104	579
8	50	42	178	149	210	2344	1600	3114
11	54	35	133	76	198	1127	252	3018
0	55	45	44	10	90	214	100	358
5	12	83	36	5	60	77	41	138
0	0	0	0	0	0	0	0	0
36	55	9	167	167	167	140	132	232
0	0	0	0	0	0	0	0	0
29	44	27	69	5	187	128	36	268
36	55	9	167	167	167	100	100	100
23	0	77	13	5	31	63	20	153
0	0	0	0	0	0	0	0	0
32	8	60	118	42	260	21	3	49
21	13	4	104	23	298	68	13	96
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	-	-	-	2142	989	3595

[c] Values reflect the average percent of days that livestock grazing took place in each season relative to the average number of days that livestock grazing took place per year.

[d] Values reflect only those years in which livestock were grazed.

Table M-2. Season and amount of use of livestock grazing on Hart Mountain National Antelope Refuge grazing units, 1971-1990. Units are organized by the major vegetation type that each encompasses. Verticle dotted lines illustrate mid-growing season based on calender date (growing seasons are based on Anderson 1978).

WYOMING BIG SAGEBRUSH

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
ROCK CREEK (growing season 4/1 - 7/1) -- partitioned into West and East Rock Creek after 1979									
1971			527						
1972			660						
1973	RESTED								
1974		464							
1975	RESTED								
1976		371							
1977	RESTED								
1978		317							
1979			316						
WEST ROCK CREEK									
1980	RESTED								
1981		670							
1982							852		
1983		845							
1984						436			
1985		857							
1986			458						
1987			553						
1988		105		293					
1989					382				
1990		207							
EAST ROCK CREEK									
1980						115			
1981	RESTED								
1982	RESTED								
1983						30			
1984	RESTED								
1985						156			
1986		440							
1987					297				
1988			368						
1989		445							
1990	RESTED								

MEDICINE BUTTES (growing season 4/1 - 7/1)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971	RESTED								
1972	RESTED								
1973	RESTED								
1974	RESTED								
1975			364						
1976			292						
1977			230						
1978			331						
1979	RESTED								
1980					450				
1981		425							
1982		493							
1983	RESTED								
1984	RESTED								
1985	RESTED								
1986	RESTED								
1987	RESTED								
1988	RESTED								
1989			589						
1990	RESTED								

LOW SAGEBRUSH

BLIZZARD RIDGE (growing season 4/1 - 7/1)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971				110					
1972	RESTED								
1973	RESTED								
1974				489					
1975		390							
1976									201
1977			211						
1978				325					
1979		182						620	
1980		832							
1981					530				
1982			936						
1983					895				
1984		761							
1985				588					
1986						373			
1987		720							
1988	RESTED								
1989		455							
1990		293							

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
POKER JIM (growing season 4/1 - 7/1) -- partitioned into North and South Poker Jim after 1972									
1971		899							
1972		795							
NORTH POKER JIM									
1973	RESTED								
1974		648							
1975				391					
1976			667						
1977	RESTED								
1978		716							
1979		443							
1980			693						
1981	RESTED								
1982		389							
1983	RESTED								
1984		535							
1985	RESTED								
1986		602							
1987	RESTED								
1988		463							
1989	RESTED								
1990		343							
SOUTH POKER JIM									
1973		675							
1974				535					
1975		640							
1976				387					
1977		791							
1978	RESTED								
1979	RESTED								
1980						159			
1981			934						
1982				348					
1983			853						
1984		52							
1985		856							
1986	45			290					
1987		794							
1988	5								
1989		431							
1990	25		202						

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
DESERT/SPANISH LAKE (growing season 4/15 - 7/15) -- partitioned into Desert Lake, Spanish Lake and Lower Guano Creek after 1985									
1971			1320						
1972			1653						
1973			1086						
1974			1888						
1975			2148						
1976			1330						
1977			1332						
1978		98							
1979			1091						
1980			782						
1981			1389						
1982			2465						
1983			2224						
1984			1683						
1985			1173						
DESERT LAKE									
1986			588						
1987		422							
1988	RESTED								
1989						241			
1990	RESTED								
SPANISH LAKE									
1986				178					
1987								614	
1988								594	
1989		431							
1990	RESTED								
LOWER GUANO CREEK									
1986				98					
1987								83	
1988	RESTED								
1989				65					
1990	RESTED								

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
RESERVOIR LAKE (growing season 4/15 - 7/15)									
1971	missing	data							
1972	RESTED								
1973			48	129					
1974	RESTED								
1975			232			51			
1976							298		
1977			212						
1978						186			
1979						205			
1980					167				
1981			238						
1982						142			
1983						300			
1984				214					
1985						119			
1986				96		85			
1987								299	
1988			242						
1989							235		
1990				60					

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
RIFFLE CANYON (growing season 4/15 - 7/15)									
1971	missing	data							
1972			373						
1973								179	
1974		233							
1975	RESTED								
1976		214							
1977	RESTED								
1978			95						
1979			74						
1980			248						
1981	RESTED								
1982			320						
1983				179					
1984	RESTED								
1985			291						
1986				96					
1987			208						
1988						185			
1989				158					
1990	RESTED								

BIG SAGEBRUSH-BITTERBRUSH/MOUNTAIN BIG SAGEBRUSH/RIPARIAN

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
PAIUTE/EAGLE PEAK (growing season 4/15 - 7/15) -- partitioned into Paiute and Eagle Peak Creek after 1979									
1971						1303			
1972						1830			
1973						1453			
1974						1154			
1975						1296			
1976						1410			
1977						743			
1978						1660			
1979						937			
PAIUTE									
1980							893		
1981							776		
1982							903		
1983							464		
1984					650				
1985							814		
1986						553			
1987							635		
1988								238	
1989					437				
1990	RESTED								
EAGLE PEAK									
1980					893				
1981					746				
1982	RESTED								
1983					549				
1984							878		
1985					580				
1986							542		
1987					448				
1988									150
1989						547			
1990			240						

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
DEER CREEK/GUANO CREEK (growing season 4/15 - 7/15) -- partitioned into Deer Creek and Guano Creek after 1985. Guano Creek partitioned into Guano Creek and Hammersely after 1986.									
1971						1059			
1972						536			
1973						338			
1974						1608			
1975	RESTED								
1976						1765			
1977							776		
1978						1208			
1979							915		
1980				714					
1981							1233		
1982							1349		
1983							1226		
1984						338			
1985					950				
DEER CREEK									
1986	RESTED								
1987			829						
1988			1234						
1989			644						
1990	RESTED								
GUANO CREEK									
1986						312			
1987				571		100			
1988				511					
1989						460			
1990	RESTED								
HAMMERSLY									
1987						163			
1988				401					
1989					59				
1990	RESTED								

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
GREEN SPRINGS (growing season 4/15-7/15)									
1971	missing	data							
1972						395			
1973				153					
1974		139				351			
1975						635			
1976				298		382			
1977							295		
1978							235		
1979						616			
1980						603			
1981								116	
1982							263		
1983								383	
1984							593		
1985								525	
1986					297				
1987								525	
1988					297				
1989					433				
1990	RESTED								

MOUNTAIN BIG SAGEBRUSH/RIPARIAN

WILLOW CREEK (growing season 4/15 - 7/15)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971							122		
1972				177					
1973				233					
1974	RESTED								
1975							131		
1976	RESTED								
1977				207					
1978							226		
1979							198		
1980					239				
1981						353			
1982								97	
1983						293			
1984				118					
1985	RESTED								
1986								219	
1987				188					
1988							158		
1989				202					
1990						84			

HOT SPRINGS (growing season 4/15 - 7/15)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971				387					
1972					615				
1973			348				188		
1974					350				
1975						175			
1976					383				
1977					324				
1978				494					
1979				96					
1980				260					
1981	RESTED								
1982	RESTED								
1983					386		6		
1984				293					
1985						336			
1986						325			
1987						206			
1988					238				
1989						277			
1990				242					

NORTH MOUNTAIN (growing season 5/1 - 8/1)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971					402				
1972					277				
1973					767				
1974							550		
1975					706				
1976							490		
1977					300				
1978					624				
1979				96					
1980						361			
1981					467				
1982						477			
1983							185		
1984						287			
1985				548					
1986					476				
1987					520				
1988						152			
1989					170				
1990					47	81			

SOUTH MOUNTAIN (growing season 5/1 - 8/1)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971					545				
1972					334				
1973					1024				
1974	RESTED								
1975					930				
1976						247			
1977					799				
1978						390			
1979					959				
1980					966				
1981					1172				
1982	RESTED								
1983						172			
1984						606			
1985								518	
1986						437			
1987					700				
1988					575				
1989				383					
1990	RESTED								

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
CRATER (growing season 4/15 - 7/15)									
1971	missing	data							
1972						367			
1973						297			
1974					285				
1975						363			
1976					271				
1977					55				
1978	RESTED								
1979	RESTED								
1980								256	
1981							207		
1982						147			
1983								67	
1984	RESTED								
1985						93			
1986	RESTED								
1987						32			
1988	RESTED								
1989	RESTED								
1990	RESTED								

MEADOW

FLOOK MEADOW (growing season 4/15 - 7/15)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971			261						
1972			89					257	
1973			573						
1974					157				
1975				160					
1976				355					
1977				235					
1978	RESTED								
1979	RESTED								
1980			192						
1981	RESTED								
1982				167					
1983					150				
1984				137					
1985					155				
1986			160			20			
1987			160						
1988	RESTED								
1989				146					
1990			62						

LYONS MEADOW (growing season 4/15 - 7/15)

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1971								629	
1972								359	
1973								255	
1974								384	
1975								479	
1976								292	
1977								358	
1978	RESTED								
1979	RESTED								
1980	RESTED								
1981				358					
1982						380			
1983					336				
1984				334					
1985							208		
1986				272					
1987						131			
1988									105
1989								189	
1990	RESTED								

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
NORTH POST MEADOW (growing season 4/15 - 7/15)									
1971	part of S.	Post							
1972							547		
1973							810		
1974							480		
1975							576		
1976							755		
1977								297	
1978									342
1979						178		53	
1980							24	327	
1981							394		
1982								343	
1983					50			380	
1984					38			998	
1985						750			
1986						1163			
1987								345	
1988							641		
1989					27				
1990	RESTED								

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
SOUTH POST MEADOW (growing season 4/15 - 7/15)									
1971						610			
1972					319				
1973								435	
1974								480	
1975							279		
1976								579	
1977								297	
1978							192		
1979					178			53	
1980				164				215	
1981	RESTED								
1982								192	
1983					83			21	
1984					84				
1985				22				437	
1986						126			
1987								383	
1988								326	
1989					239				
1990	RESTED								

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
BIG FLAT (growing season 4/15 - 9/1) -- grazing distributed among 3 subunits during 1983-1990. Grazing distributed among 7 subunits prior to 1983.									
1971	missing	data							
1972						2716			
1973						2470			
1974						3090			
1975						2379			
1976						1600			
1977						1798			
1978						3114			
1979						2047			
1980						1886			
1981						3018			
1982						2135			
1983						608			
1984						700			
1985						473			
1986						252			
1987						997			
1988						1150			
1989						1292			
1990						643			
GOAT CREEK -- partitioned from Big Flat after 1980; grazing distributed among 3 subunits									
1981								165	
1982					100				
1983							208		
1984							358		
1995							109		
1986							244		
1987					259				
1988						331			
1989						116			
1990					253				

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
WIRE CORRAL (growing season 4/15 - 7/15)									
1971	25						37		
1972	RESTED								
1973	RESTED								
1974	RESTED								
1975	RESTED								
1976	RESTED								
1977	RESTED								
1978	RESTED								
1979	RESTED								
1980	RESTED								
1981								41	
1982	RESTED								
1983						57		11	
1984								56	
1985							138		
1986								87	
1987							85		
1988	RESTED								
1989	RESTED								
1990	RESTED								

FOOTSLOPE OF MOUNTAIN

STONE CORRAL (growing season 4/1 - 7/1)									
1971	missing	data							
1972	missing	data							
1973	missing	data							
1974	RESTED								
1975	missing	data							
1976	RESTED								
1977				132					
1978	RESTED								
1979				132					
1980				132					
1981				132					
1982				132					
1983				132					
1984				132					
1985				132					
1986				132					
1987				132					
1988				132					
1989				132					
1990				132					

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
LOST HILLS (growing season 4/1 - 7/1) -- partitioned into Lost Hills and CCC Camp after 1973									
1971				150				118	
1972								79	
1973								36	
LOST HILLS									
1974	RESTED								
1975	missing	data							
1976	RESTED								
1977				100					
1978	RESTED								
1979				100					
1980				100					
1981				100					
1982				100					
1983				100					
1984				100					
1985				100					
1986				100					
1987				100					
1988				100					
1989				100					
1990				100					
CCC CAMP									
1974									22
1975									76
1976									37
1977	36							81	
1978								63	
1979								48	
1980	16							79	
1981								66	
1982	81							6	
1983								153	
1984								97	
1985	15								
1986								31	
1987	40							48	
1988	5							23	
1989	24							6	
1990	13						7		

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
HART LAKE (growing season 4/1 - 7/1)									
1971		13						25	
1972		24						25	
1973		10							11
1974		10						14	
1975		6						12	
1976		5						14	
1977		5							
1978		8						15	
1979		5						9	
1980		3							
1981								23	
1982								15	
1983		12						11	
1984					23				
1985	15							23	
1986				26					
1987								23	
1988								5	
1989	RESTED								
1990								15	

Year	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
CRUMP LAKE (growing season 4/1 - 7/1)									
1971	20 February - 15 March (85 AUMs)								
1972	1 January - 31 May (76 AUMs)								
1973	6 January - 31 October (70 AUMs)								
1974	1 January - 5 April (53 AUMs)								
1975	20 February - 25 March (84 AUMs)								
1976	1 February - 31 March (96 AUMs)								
1977	16 January - 31 March (13 AUMs)								
1978	RESTED								
1979	RESTED								
1980	RESTED								
1981	RESTED								
1982	RESTED								
1983	RESTED								
1984	RESTED								
1985	RESTED								
1986	RESTED								
1987	RESTED								
1988	RESTED								
1989	RESTED								
1990	RESTED								

Year	winter
SHIRK RANCH	
1971	1626
1972	2018
1973	989
1974	2051
1975	2835
1976	2876
1977	1303
1978	1359
1979	2472
1980	2014
1981	3595
1982	2511
1983	3400
1984	2460
1985	2529
1986	2138
1987	2011
1988	1379
1989	1128
1990	RESTED

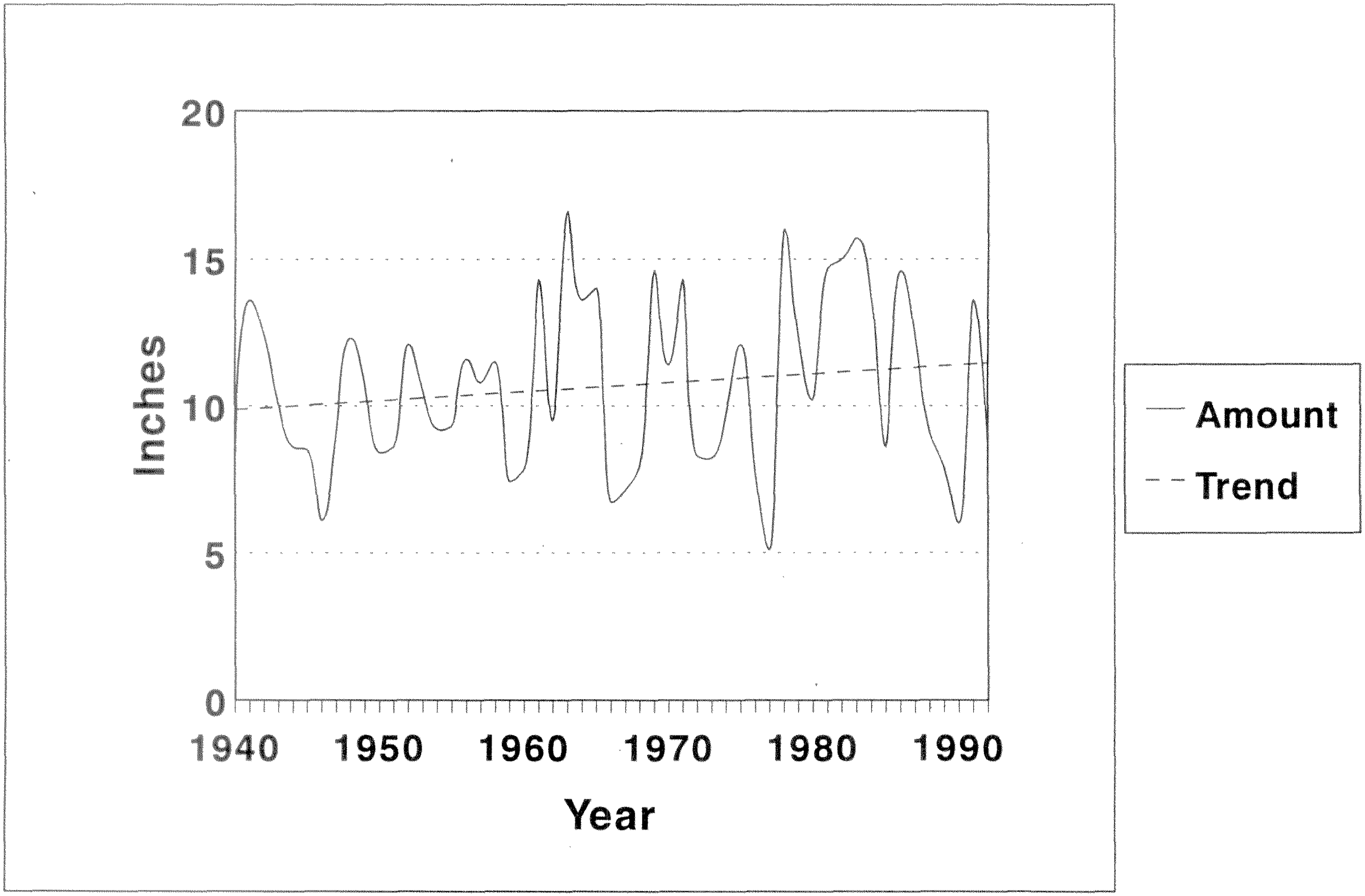


Figure M-1. Total annual crop-year precipitation, Hart Mountain NAR Headquarters, 1940-1992.

APPENDIX N
SUPPLEMENTAL INFORMATION ON THE PROPOSED ACTION

PROPOSED MONITORING PROGRAM

The purpose of monitoring program is to provide technical information to managers for evaluation of short and long-term response of wildlife populations and wildlife habitats to management actions. The subjects of monitoring consist mainly of species and habitats that were monitored historically in addition to those that were inventoried during the development of the Comprehensive Management Plan. The scope of monitoring actions described herein was based on the assumption that the minimum level of annual funding identified in Alternative D would be available consistently. This funding level would maintain (1) one supervisory biologist, (2) one seasonal biologist, and (3) assistance from the fire management staff on monitoring of habitat response to fire. Additionally, it was assumed that one to two volunteers would be available to assist biologists and managers with inventory and monitoring actions during spring and summer, the principal period of collection of field data.

WILDLIFE MONITORING

The wildlife inventory plan is the primary guidance for wildlife monitoring activities on National Wildlife Refuges (USFWS 1982). It consists of a set of narrative accounts that list the species (or assemblages of species) to be monitored and describes the objectives, priorities, field methods, data storage techniques, analytical methods, reporting procedures, and costs associated with monitoring. Although the Refuge has an inventory plan, it was developed in the 1970s and needs revision to meet the needs of the new comprehensive plan, which emphasizes management of game and nongame species of wildlife. Refuge biologists and managers are responsible for implementation Wildlife Inventory Plans, and for ensuring that results are routinely reported in memorandum and annual narrative reports. Wildlife Inventory Plans require approval by management at the Refuge and Regional level of the Service. Three strategies will guide the monitoring program of wildlife in the next fifteen years. The four strategies include:

(1) Development and implementation of a Wildlife Inventory Plan;

(2) Reconnaissance surveys of sensitive species;

(3) Modeling wildlife-habitat relationships in operational plans to assess the influence of habitat management on species richness; and

(4) Solicitation of cooperative research assistance to address information gaps and outstanding management concerns.

Selection of species to be monitored was based on review of Refuge goals and objectives in conjunction with projected staffing levels (Table N-1). Population and ecological characteristics of featured game species will be monitored because they are described in the Executive Order (pronghorn), they are considered sensitive to management actions (sage grouse, trout), or they are subject to recreational hunting (pronghorn, bighorn sheep, mule deer), which requires routine assessment of productivity, recruitment, and population size. Monitoring procedures described in the old inventory plan will be continued where appropriate.

Examples of new procedures that apply to game include monitoring of composition and quality of diet of game species, survey and census of sage grouse leks, and survey of distribution and age structure of trout populations. A cooperative study was initiated in 1993 to determine seasonal composition and quality of diets of ungulates on multiple study areas at Hart Mountain NAR and Sheldon NWR. Results from 1993 analyses will be used as a baseline for comparison and evaluation of change in composition and quality of ungulate diets that result from prescribed burning and exclusion of feral horses and cattle. In the case of sage grouse, lek surveys and censuses were added to improve estimation of population trend. ODFW has assisted the Refuge with monitoring trout populations and trout habitat. Cooperative arrangements would be sought to re-survey trout and trout habitat at five to ten year intervals.

Other species and assemblages of species that will be systematically monitored include waterbirds (including waterfowl), riparian-dependent birds, small mammals, and diurnally active carnivores. Procedures of monitoring these species and assemblages were developed over the past ten years, with the exception of waterbird monitoring. Waterbird monitoring will continue as it has since the early 1970s except that objectives will be revised to focus work on breeding populations at Shirk Ranch, Big Flat, Long Lake, Desert Lake, Paiute Reservoir.

Population characteristics of migrant and breeding birds will be inventoried on plots and transects established in riparian areas during 1991-93 to assess changes in community composition. Two breeding bird census plots established in 1985 will be censused annually to describe post-fire succession of bird and plant communities. Two breeding bird survey routes established in 1993 will be surveyed annually provided trained volunteers are available for assistance. Diurnal predators (e.g., facultative and obligate egg and flesh-eaters) will be monitored annually between April and July to determine trend in observation rate using standard procedures developed by Northern Prairie Research Center (Sargeant et al. 1993). Crepuscular rabbits and rodents will be surveyed quarterly on 2 transects established in 1986 to estimate trend in population size and to compare these trends with population trend of other vertebrates.

Objectives described thus far clearly emphasize fish, birds, and mammals as subjects of monitoring concern. It is not our intention to de-emphasize other taxonomic groups such as herptiles (i.e., amphibians, lizards, and snakes). However, herptiles were not historically monitored, they were not inventoried systematically during development of the EIS, and none are considered sensitive species based on the criteria listed in part 1 of Appendix H. To address the shortcoming in basic knowledge of herptiles, occurrence of herptile species will be systematically monitored. Incidentally observed herptiles will be recorded on a standardized form, data will be transferred to a computer database, and distribution of species will be delineated on computer generated maps.

Although no federally threatened and endangered species breed at Hart Mountain NAR, several species do breed on the Refuge that are considered Category 2 candidates for listing under the Endangered Species Act (see part 1 of Appendix H). Policy of Region 1 of the Fish and Wildlife Service maintains that Category 2 species that occur on Refuges will be managed as if they were officially threatened and endangered. Consequently, populations of these species would be surveyed when a management plan prescribes a major alteration (e.g., prescribed burning) in habitat conditions of a site presumed to harbor a sensitive species.

Maintenance and restoration of species richness is identified as a goal of Hart Mountain NAR in the Comprehensive Management Plan. In this plan, a wildlife-habitat relationships model was developed to (1) identify the association between wildlife species and habitat conditions, and (2) to predict the influence of alternative management strategies on species richness. A similar strategy will be applied to incorporate goals established for species richness during development and implementation of operational management plans. Consequently, species richness will be considered, wildlife-habitat relationships will be modeled, and model results will be applied to evaluate alternative strategies of habitat management.

The Service will continue to foster descriptive, comparative, and experimental research to improve knowledge of the ecology and management of wildlife of Hart Mountain NAR. Refuge staff will actively solicit assistance from research-oriented organizations to resolve questions related to management of natural resources. Individuals and organizations interested in using the Refuge as an outdoor laboratory for research and education purposes are urged to contact the Refuge Manager, describe their proposal in a study plan, and request a special use permit.

HABITAT MONITORING

Two strategies were developed to measure progress toward achievement of Refuge habitat goals and objectives (Chapter 1). Strategy I consists of monitoring landscape-level changes in the distribution and amount of succession and progression stages of upland and wetland vegetation types. Strategy II consists monitoring change in habitat characteristics of vegetation types on a site-by-site and project-by-project basis. Quantitative sampling is limited in Strategy I but receives increased emphasis in Strategy II. Collectively, the two strategies provide a framework for systematic evaluation of management actions on a short-term and long-term basis. The following discussion describes the two strategies of habitat monitoring.

<u>Strategy I</u>

Objectives are twofold: (1) to monitor change in the amount and distribution of succession stages and progression stages on the Refuge landscape; and (2) to describe habitat characteristics such as ground, shrub, and tree cover in succession and progression stages in fifteen years, the end of the planning period. The first objective of Strategy I entails routine delineation of sites subject to stand-replacement disturbance on maps, comparison of changes in habitat conditions on these sites through time, and periodic re-classification of vegetation types to foster continued resource planning applications. For example, suppose a site classified as late succession Wyoming big sagebrush was burned. Strategy I would ensure that the fire perimeter was mapped in detail, that this information was transferred to computer, and that the succession stage was correctly classified (grass-forb vs. shrub-grass cover dominance) after periodic inspection of vegetal conditions on the burned site. Results from monitoring actions along with management recommendations would be reported in annual narrative reports and memos periodically submitted to Refuge Managers that summarize results in detail and describe possible management implications.

To execute the first objective, succession and progression stages need to be characterized at the beginning of the planning period, vegetation types need to be mapped and map information needs to be transferred to a computer database. This was accomplished during development of the EIS in 1992. In the future, accuracy of classification of succession stages in uplands will be relatively high for two reasons: (1) attributes of succession stages are broad and readily recognized in the field with minimal training; and (2) stand-replacement change in habitat conditions are of large magnitude, which fosters interpretation of vegetal composition. Appropriate computer technology (i.e., GIS) and computer expertise will be available to handle on-going analysis of computerized vegetation information in 1994. Additionally, supplementary data collected via Strategy II will be used to facilitate interpretation of changes in vegetation types that occur in the absence of a major stand-replacement disturbance (e.g., site progression in riparian areas).

The second objective of Strategy I involves a single-sample survey of habitat conditions on the Refuge that would occur at the end of the 15-year planning horizon. Results would be reported in the next Comprehensive Management Plan. Other specific actions associated with implementation of the second objective include:

(1) Cover of vegetation components would be estimated from random sampling of succession and progression stages of most vegetation types on a Refuge-wide basis;

(2) The condition of >95% of Refuge riparian areas would be evaluated on an extensive basis, as was done in 1992;

(3) Evaluation of habitat conditions would be augmented with site-specific data collected with Strategy II monitoring.

Sampling of vegetation cover would afford managers information about what quantitative level of cover is associated with succession and progression stages of vegetation types. An additional use of such data would be to supplement the evaluation of land-scape level management objectives. Procedures of study design, methodology of sampling, and techniques of analysis and interpretation described by Delong (1993b) would be modified slightly to include sampling of both upland and wetland habitats.

In fifteen years, 95% of riparian areas of the Refuge will be re-surveyed using the methods described by Pyle (1994). Riparian complexes will be traversed on foot; riparian conditions will be observed, described, and photographed; Rosgen stream type will be classified; and resource condition will be evaluated. Evaluation of survey results would be augmented with analyses made on permanent plots, which are described in the following section.

<u>Strategy II</u>

Strategy II consists of systematic monitoring of riparian areas and sites subject to stand-replacement disturbance such as prescribed burning. It entails routine collection of data on permanent plots to foster evaluation of the type and rate of change in response variables. Consequently, it provides the evaluation mechanism required to measure short-term progress toward achievement of project objectives, monitoring results, and Refuge habitat objectives. Strategy II will be composed of the following monitoring actions:

(1) Assessment of change in characteristics of vegetation and stream channels on 40 permanent plots set in riparian areas;

(2) Assessment of change in habitat done in conjunction with assessment of change in riparian bird communities on permanent plots established between 1991-93 in riparian areas;

(3) Assessment of change in characteristics of aquatic habitat of Guano Creek and Rock Creek;

(4) Assessment of change in sites subject to prescribed burning, mechanical treatment, and herbicide application and adjacent sites where no treatment occurs (control);

The following discussion describes these four actions in greater detail.

Procedures described by Pyle (1994) would be followed to implement intensive, site-specific monitoring of characteristics of vegetation and stream channels on permanent plots in riparian areas. Monitoring design consists of establishment of one permanent plot in forty different riparian complexes. Collectively, these forty plots will include representation of principal valley types, riparian vegetation types, and progression stages of riparian vegetation types. Each plot will be randomly located in the center one-third of a valley unit. Although the length of a plot will be fixed at a 100-m distance parallel to the valley axis, width of a plot will correspond to the valley width, which differs among valley units. Sampling objectives will include:

(1) Estimation of streambank stability;

(2) Measurement of a variety of characteristics of stream channels;

(3) Measurement of distance comprised of riparian community types along a streambank transect;

(4) Measurement of distance and elevation above bankfull of riparian community types on 3 transects oriented perpendicular to valley axis;

(5) Repeat photographs taken from permanently marked locations in the plot.

Data was collected for a total of seventeen plots established in 1993. Data will be collected on the remaining twenty-three plots in 1994. Plots will be re-sampled at intervals of five years. At the end of five years, data will be analyzed, and differences in characteristics between years will be evaluated. Evaluation of change on plots will be used to augment the evaluation of change in riparian complexes of the Refuge done in fifteen years, the end of the planning period. Plots subject to management actions such as prescribed burning, willow planting, or check-dam development will be sampled more intensively. Plots subject to such an action will have (1) repeat photographs taken immediately after the "event" and (2) vegetation and stream characteristics sampled during the first growing season post-event.

Composition of bird communities was related to characteristics of riparian habitats on 48 permanent plots during 1991-93 (Dobkin 1993a). Habitat characteristics will be monitored on these plots every five to eight years when bird communities also are sampled. Cooperative assistance will be sought with The High Desert Ecological Institute of Bend, Oregon, to assist with sampling in the field, analysis of data, and evaluation of results.

During 1991-92, Oregon Department of Fish and Wildlife surveyed characteristics of in-stream habitat of Rock Creek and Guano Creek (Aquatic Inventories Project, Refuge files). A cooperative agreement would be arranged between the Service and ODFW to re-survey Rock Creek and Guano Creek in 5-10 years. This project would include development of reports that evaluated differences in habitat conditions between years.

All stand-replacement habitat manipulations that would occur under implementation of Alternative D will be monitored following procedures described by Pyle and Lentz (1994b). This report describes 3 levels of monitoring procedures that differ in terms of objectives, techniques, and sampling intensity. The first level, considered the minimum standard for all prescribed burns, relies mainly on permanent photo-points to describe response of vegetation to burning. The second level involves repeat photography used in conjunction with quantitative sampling methods to estimate cover, frequency, or density of vegetation in primary vegetation types of a site before and after burning. The third level of monitoring requires study of the interaction of wildlife and habitat response to burning. The following discussion describes how level of monitoring efforts will be allocated.

Level of monitoring effort allocated to individual prescribed burns will be determined by several interacting factors including access to a site, technical knowledge of fire response, probability that the site may be invaded by introduced plant species, and certainty of vegetation response (Table N-2). As indicated by this table, knowledge and certainty of fire effects differs among vegetation types. This difference is attributed to the availability of technical information or field observations of the short and long-term effects of burning. Because the response of vegetation to fire is not well understood for many vegetation types at this time, vegetation types would be subject to quantitative monitoring methods where a site can be reasonably accessed by vehicle, horse, and foot. As a guideline, burn sites that required more than one hour of riding to by horse or walking to by foot would receive a minimum of monitoring (level 1), no matter what the demand for quantitative information. This determination was made because of the limited resources available for monitoring burn response, the increased responsibilities of monitoring a large number of sites as more sites were burned, and the need to make efficient use of time available to monitoring. This condition does not apply to research investigators who have different objectives.

Objectives of the second level of monitoring will be developed in specific burn plans for a site and principal vegetation types targeted for burning. Objectives of monitoring are based on objectives listed in site-specific burn plans. Monitoring objectives would spell out the specific vegetation types of concern, parameters to be sampled, sampling design and techniques. Sampling design will involve random establishment of sample plots prior to burning. As a guideline, ten plots/vegetation type will be used as a standard for sampling intensity. It is acknowledged that this sampling intensity limits precision and confidence of estimates of response variables for individual prescribed burning projects. However, precision of estimates will increase as more sites are burned and analyses incorporates data from multiple sites.

Although the total number of monitoring plots/burn site will increase in relation to the number of objectives and vegetation types on that site, it is unlikely that more than a total of thirty plots/burn site will be sampled. For example, a burn plan may have an objective for changing vegetation composition in two vegetation types on a site. Although a standard plot size and layout will be used for monitoring each site, sampling methods will differ depending on what response variables were identified as objectives in the plan for the prescribed burn. For example, line-intercept estimation of shrub cover and ocular estimation of cover of native grass species would be appropriate where objectives aimed to reduce cover of sagebrush and to increase cover of native grass species.

The third level of monitoring involves determination of the interaction between response of habitat and wildlife to stand-replacement disturbance. Questions of interaction are most reliably resolved through scientific experimentation. Reliable answers usually require that hypotheses are established, experiments are designed, bio-physical characteristics are sampled intensively, estimates are tested, and hypothesis are evaluated. Execution of such projects usually requires a commitment of time and money that cannot be met by the Refuge alone. Because of constraints imposed by experiment costs and complexity, this level of effort consists mainly of cooperative arrangements organized between the Service and interested research organizations. Consequently, complex management questions will be addressed by establishing cooperative relationships between the Refuge and interested research organizations.

An exception consists of monitoring of sensitive species. Requirements of sensitive species will be addressed during planning of projects and through reconnaissance surveys. First, sites proposed for habitat alteration will be reviewed during planning to determine whether a sensitive species is suspected to occur, and if so, what the impacts of alternative prescriptions are on that species. For example, the use of fire in sage grouse nesting habitat would require development of burn prescriptions that would, upon execution, have a high probability of maintaining an interspersion of unburned habitat in the project area. Sites suspected of harboring a sensitive species also may be subjected to reconnaissance monitoring by Refuge staff before and after habitat manipulation to describe the response of a species to manipulation. For example, alluvial floodplains that support cover of basin big sagebrush also frequently support populations of pygmy rabbit. If such a site was proposed for burning, the site would be surveyed and active pygmy rabbit dens would be mapped prior to burning. After burning, the site would be re-surveyed, active dens would be mapped, and response of pygmy rabbit would be evaluated.

Table N-1. List of standard wildlife inventory and monitoring procedures, Hart Mountain NAR.

Species	Frequency	Time of year	Method	Objectives
Bighorn sheep[a]	Annual	March	Aerial survey	Population size
	Annual	June	Aerial survey	Lambs/100 ewes; rams/100 ewes
	Annual	October	Aerial survey	Population size
Mule deer	Annual	November	Ground survey	Fawns/100 adults; distribution
	Annual	March	Aerial survey	Fawns/100 does; bucks/100 does; distribution
Predators	Annual	April-July	Ground survey	Number/100 observation hours
Pronghorn	Annual	July	Aerial survey	Fawns/100 does; bucks/100 does; population size
	Annual[a]	February	Aerial survey	Population size
	Periodic[b]	Monthly	Aerial survey	Distribution & habitat use
	Periodic	May	Aerial survey	Distribution of fawning does
Sage grouse	Annual	April	Ground census	Males/lek
	Annual	June-July	Ground survey	% hens with broods; chicks/hen; chicks/brood
	Periodic	April	Aerial survey	Lek distribution; leks/area abundance
Small mammals	Annual	Quarterly	Ground survey	Number/100 km
Songbirds	Annual	June	Ground survey	Species no./area
	Annual	August-October	Ground survey	Species/100 net hours (riparian)
	Periodic	April-June	Ground census	Species no./area; total birds/area; total species/area (upland)
	Periodic	April-June	Ground census	Species no./area; total birds/area; total species/area (riparian)
Trout[a]	Periodic	June-July	Ground survey	Distribution; age structure
Waterbirds	Annual	April-July	Ground survey	Breeding pairs/area; fledging young/area; total birds/area

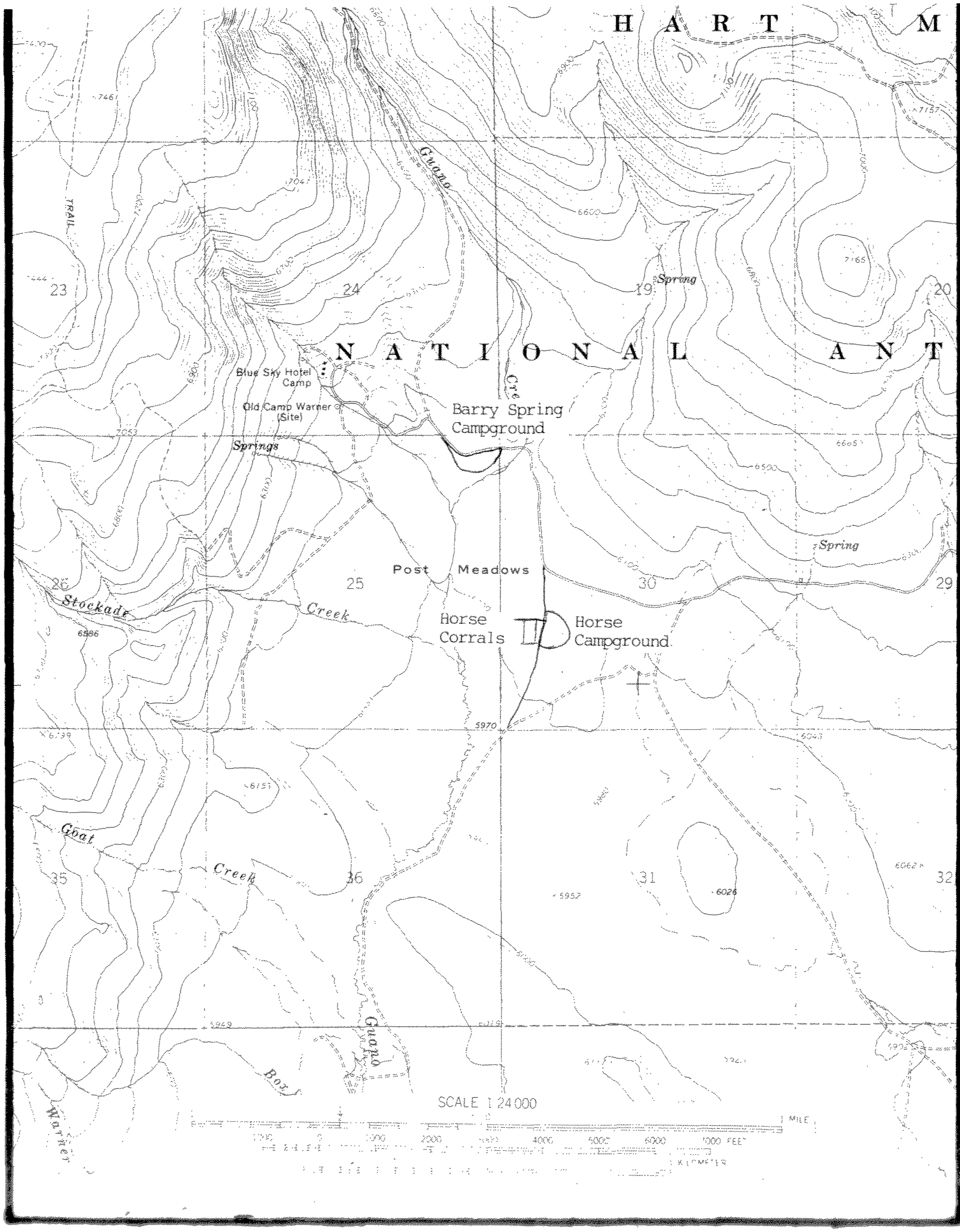
[a] Cooperative project with Oregon Department of Fish and Wildlife.
[b] Periodic surveys occur every 5-10 years.

Table N-2. Relationship between knowledge of response of vegetation types to prescribed burning and allocation of monitoring effort, Hart Mountain NAR.[a]

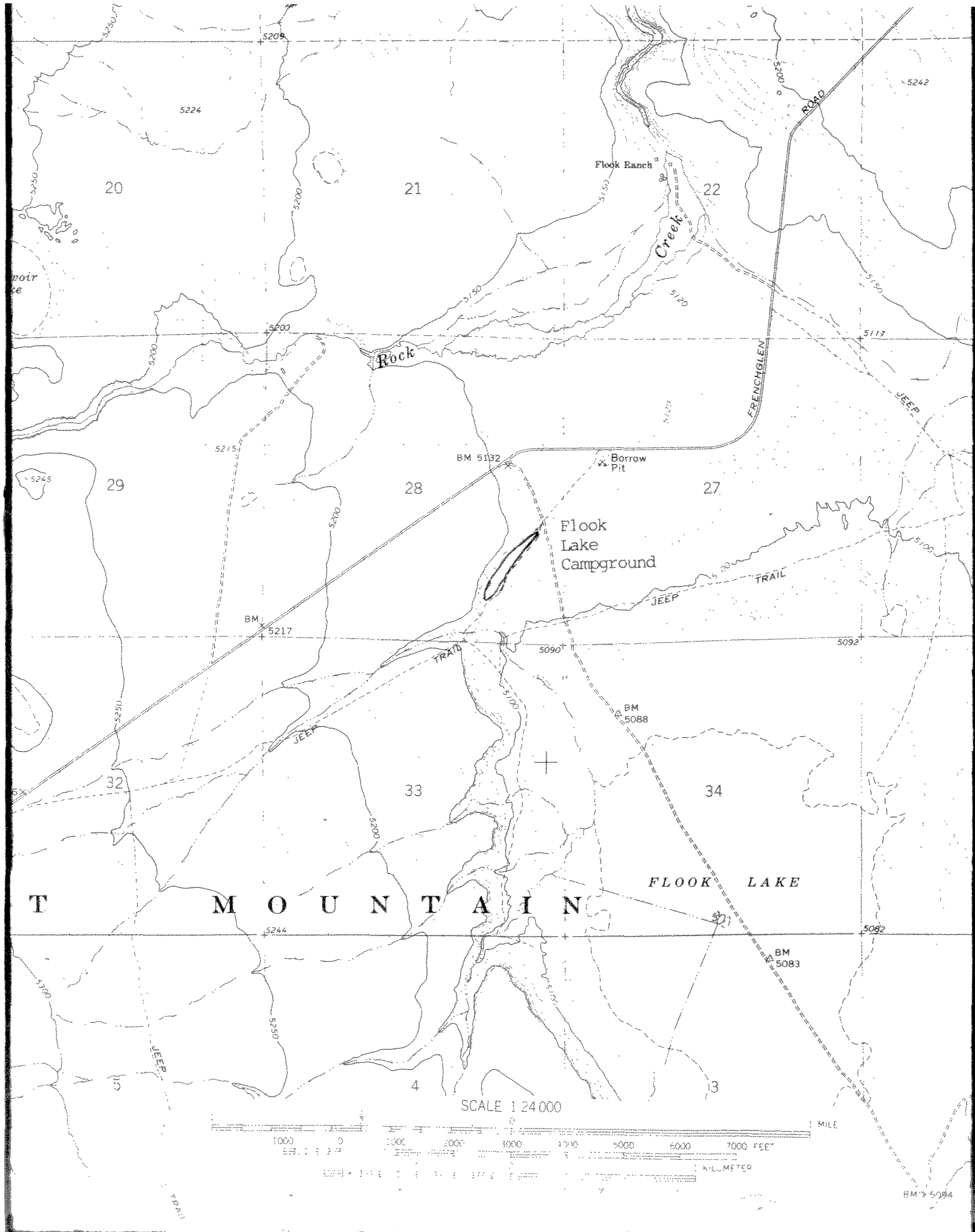
Land-type and vegetation type	Technical knowledge of species fire response	Probability of maintaining native species	Management certainty of positive vegetation response	Anticipated monitoring effort[b]
Upland				
Low sagebrush	low	high	mod	Level II
Mountain big sagebrush	mod	high	high	Level I
Mountain shrub	low	high	mod	Level II
Ponderosa pine[c]	high	high	high	Level I
Sagebrush-bitterbrush	mod	mod	mod	Level II
Wheatgrass	mod	mod	mod	Level II
Wyoming big sagebrush	mod	low	low[d]	Level II
Wetland				
Aspen[e]	low	high	high	Level II
Bluegrass-ryegrass	mod	mod	mod	Level II
Sedge-rush-bluegrass	low	high	high	Level II
Silver sagebrush	mod	high	mod	Level II
Willow	mod	high	high	Level II

[a] Deals exclusively with vegetation types likely to be targeted for stand-replacement prescribed burning in the next 15 years.
[b] Level I (qualitative habitat data); Level II (quantitative habitat data); Level III (quantitative habitat and wildlife data). Level III would be applied in conjunction with cooperative research efforts or where sensitive species are known to occur.
[c] Prescribed low-intensity surface fire.
[d] Relative to late successional stands with low amounts of perennial species; does not consider maintenance of native species by seeding after disturbance.
[e] Knowledge of response to fire in Great Basin.

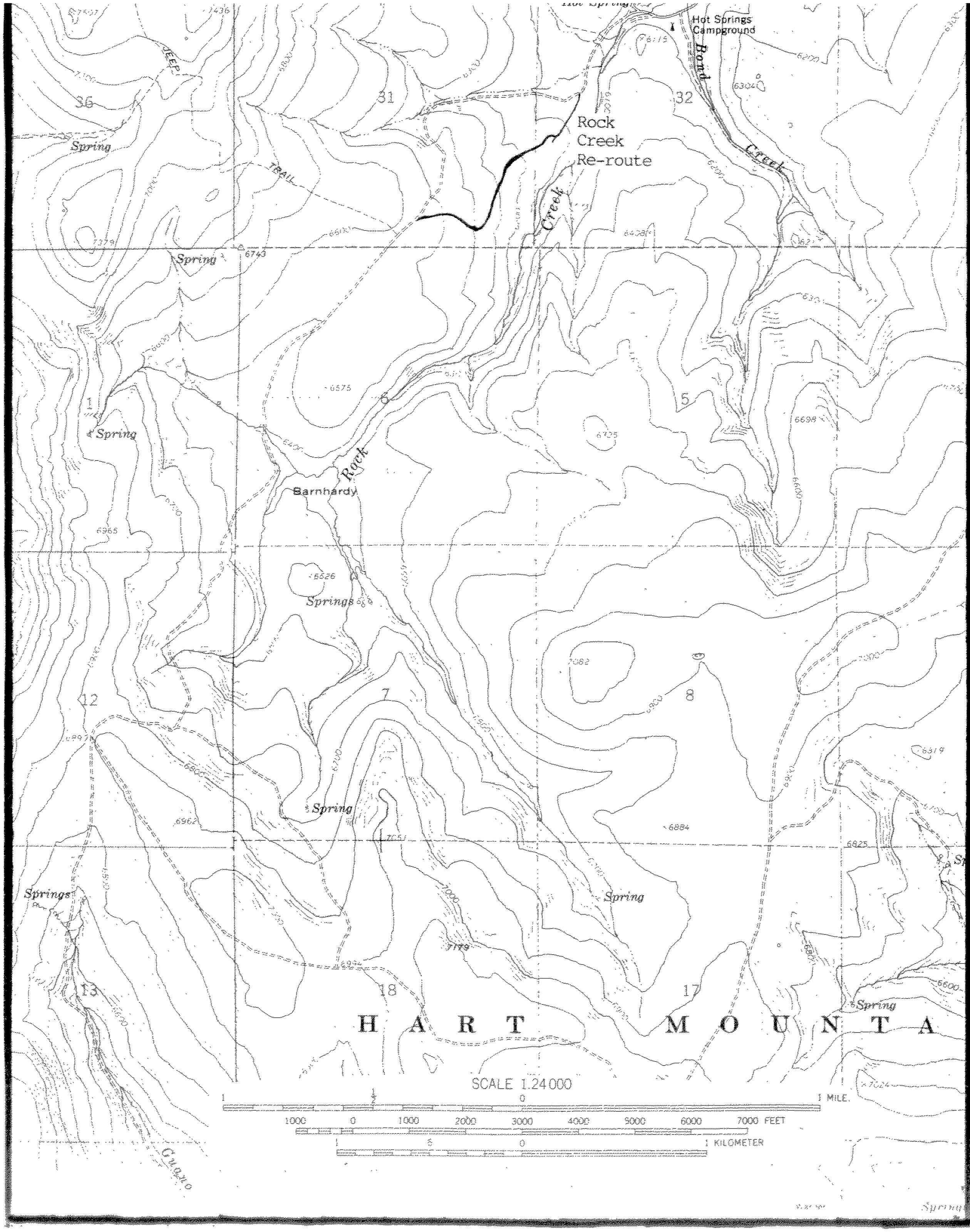
PROPOSED RE-ROUTED ROADS AND PROPOSED CAMPGROUNDS



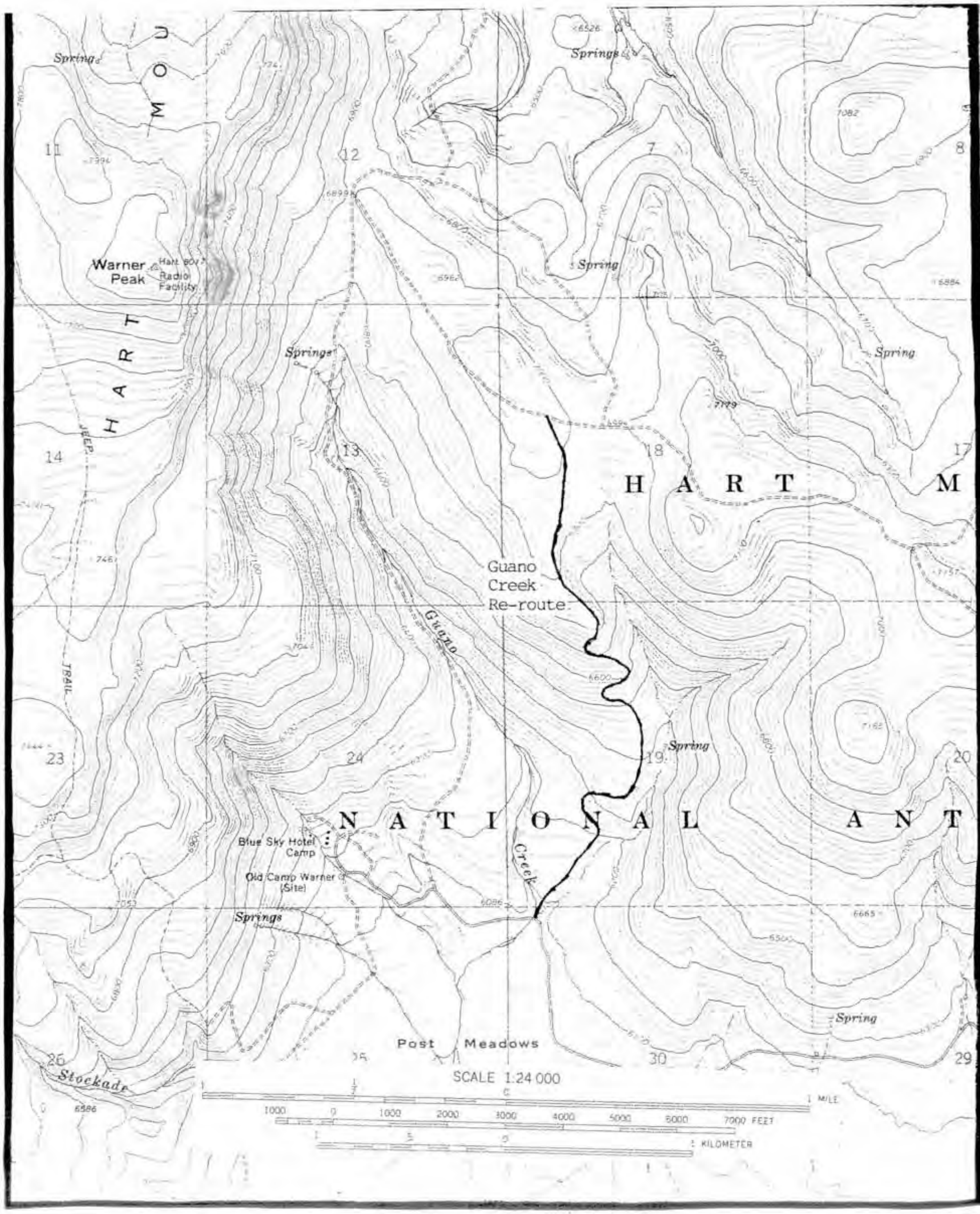
Map N-1. Hart Mountain NAR, Alternative D, proposed Barry Spring Campground and Post Meadow Horse Campground.



Map N-2. Hart Mountain NAR, Alternative D, proposed Flook Lake Campground.



Map N-3. Hart Mountain NAR, Alternative D, proposed Rock Creek re-route south of Hot Springs Campground.



Map N-4. Hart Mountain NAR, Alternative D, proposed Guano Creek re-route south of Skyline Drive and north of Blue Sky Road.

APPENDIX O
COMMENTS ON DEIS AND SERVICE RESPONSES

Comments received during the public comment period (August 13 to October 12, 1993) for the DEIS were considered during the preparation of the FEIS. Comments were received from elected officials, Federal agencies, State and local governments, national and state conservation and recreation organizations, regional and State organizations, local and civic organizations, and from individuals. In all, 749 letters were received (many with more than one signature), 47 people commented during seven meetings held by the Service, and 28 people commented during two meetings held by the Lake County Board of Commissioners. An additional 12 letters were submitted as part of the Lake County Commissioner's Official Response and Public Comment.

Each letter and public commenter was assigned a correspondence identification number. These numbers are listed in the left-hand column in the Listing of Public Commenters section.

Similarly, each representative comment was assigned a number, and these are listed in the left-hand column under the Representative Comments and Service Responses section. The correspondence identification number, displayed in parentheses () at the end of each comment identifies the person or persons who wrote or verbalized the comment. Most comments were directly quoted. If a verbal comment was recorded by Service personnel, quotation marks were not used. Verbal comments during the Lake County Commissioners' meetings were recorded verbatim by the County Clerk, and therefore quotation marks were used. Comments included in this appendix were selected as representative. Enough comments are included to ensure that all concerns, agreements and suggestions were addressed in our responses.

Sixty-eight percent of the comments that were received came from western Oregon, 14 percent came from eastern Oregon outside of Lake and Harney Counties, 10 percent came from 21 other states, and 7 percent came from Lake and Harney Counties. Of the 914 people that presented their opinion regarding Alternative D, about 93 percent expressed their support for it. About 7 percent expressed their dissatisfaction with Alternative D and/or expressed their support for another alternative.

The discrepancy between the number of people that presented their opinion regarding Alternative D and the number of correspondence ID numbers exists because (1) many letters had more than one signature and all signatures were used in calculations, (2) some people used more than one forum (e.g., open house meeting, letter) to present their comments, and (3) not all people that commented expressed their opinion regarding Alternative D. Regarding number 2, opinions of individuals were counted only once.

CONTENTS OF APPENDIX O

MANAGEMENT PRACTICES

SPECIAL MANAGEMENT AREAS

PUBLIC USE OF THE REFUGE

LISTING OF PUBLIC COMMENTERS

Correspondence ID Number	Name	Organization Represented
LETTERS		
1	Clifford Mitchell	
2	Doug Ernst	
3	O.V. Deming	
4	Inge King	Audubon Society of Corvallis
5	Homer J. and Marguerite E. Campbell	
6	Robert D. Ohmart	Arizona State University
7	George Keister, Larry Conn, and Mitch Willis	Oregon Department of Fish and Wildlife
8	Dr. Brian L. Horejsi	Speak Up For Wildlife Foundation
9	Jeff McKenzie	
10	Tom Geha	
11	Mr. & Mrs. Eugene Javens	
12	Maria Nazzaro	
13	Alan Parolini	FB&D Technologies, Inc.
14	George & Rhonda Ostertag	
15	Nancy Beamer	
16	Elaine Hallgarth	
17	Dean A. Boe	
18	Lanny Sinkin	
19	Gerald Morsello	
20	David Goldstein	
21	Stephanie Wesloh	
22	Harold H. Winegar	
23	Viviane Simon Brown	
24	Dr. Robert G. Amundson	
25	Glen A. & Kathleen Horner	
26	Eaton Conant	
27	Dr. E. B. Robinson, Jr.	
28	George Reynolds	
29a	Doris Kittredge	
29b	Lynn Bell	Wordsmith Communication Services
30	Jim Myron	Water Resources Consulting
31	Carol Winkler	
32	Kathy Veit	U.S. Environmental Protection Agency
33	Doug Heiken	
34	Edward Wood	
35	Jay F. Penniman	
36	Ken Cerotsky	
37	Linda L:. Ficere	
38	Judy Meredith	
39	Susan Purie	
40	U. Frost	
41	Barbara Powell Sherman	
42	Howard W., Young	
43	Susanne DeVoney	
44	Stanley Wonderley	
45	Lisa Kehm	
46	Chris Lauck	
47	Elaine Rees	
48	Doug Heiken	
49	Joseph R. Minato	
50	Kim R. Smith	
51	Amy Klauke	
52	Brad Evans	

53	Marilyn A. Heiken	
54	Judy Johnson	
55	Cynthia J. Gray-Taylor	
56	Rob Gould	
57	Chris Friess	
58	Marcia Hoak	
59	Mari Baldwin	
60	Mark DeVaney	
61	Madelle Friess	
62	Norma Fuvai	
63	Robert Sherman	
64	Charles R. Gates	
65	D. Daner	
66	William D. Barry	
67	Raymond Smitke	
68	R. M. Bonk	
69	Jerri Libert	
70	Scott Erickson	
71	Eric W. Hartmann	
72	Candice Guth	
73	Paul R. Adamus	
74	Jacquelyn Bonomo and Peter M.K. Frost	National Wildlife Federation
75	Gary Anderson	Oregon Deptartment of Fish and Wildlife
76	Douglas Schoen	
77	Jill M. Riechers	
78	James D. Folk	
79	Bill Phillips	
80	Ira D. Luman	
81	Bea Hess	
82	Thea Schwartz	
83	Elizabeth Claman	
84	Faith Davenport	
85	Jan A. Cumming	
86	Mark Wagner	
87	Marge Ladau	
88	Joe Lowry	
89	Joe Amicarella	
90	Alice Elshoff	
91	Mr. & Mrs. A.C. DeJong	
92	Greg Vaughn	
93	Craig Koch	
94	Ronald Gerber and Debby A. Todd	
95	June & Ed Herriwepon	
96	A.V. Eaton	
97	Mr. & Mrs. H. Niiranen	
98	Walter C. Mintkeski, P.E.	
99	Frank & Nancy Koch	
100	Walter J. & Rosemarie C. Dunden	
101	Dan Sherwood	
102	Mary Millman	
103	Rita Mittlemen	
104	Marion Myers	
105	Elizabeth Irby	
106	Thomas W. Lingenfelder Marjorie M. Lingenfelder	
107	Evelyn Gilhooly	
108	MP	
109	Enid Griffin	
110	Alice Aughinbaugh	
111	Kile E. Snider	
112	Peggy Robinson	
113	Alice G. Sacks	
114	Mr. & Mrs. Elliot Aronin	

115	Archie Buttons	
116	Jane Fowler	
117	Michele McKay and family	
118	Evelyn J. Strauss	
119	Patricia Ott	
120	Charles Pitzer	
121	Joan Ottinger	
122	James Davis	
123	Mabel Pool	
124	Robert Harvey	
125	Frederick M. Gordon	
126	Steve McKenna	
127	Rod Mondt	The Wildlands Project
128	Lee Klingler	
129	Fran Greenlee	
130	John Ross	
131	James & Mary Plummer	
132	Sandy S. McConas, and Mr. & Mrs. David R. McConas	
133	William C. Haglan	
134	William Hart	
135	Roy Schmidt	
136	Ethel Hiatt	
137	Kent Erskine	
138	Mark G. Minnis	
139	K. Bock	
140	Bobb F. Brown	
141	Richard Lance	
142	Kent Gill	
143	Tom Angenent	
144	Mr. & Mrs. John Leonard	
145	Barbara Vail	
146	Catherine Nollenberger	
147	Sheila I. Dempster	
148	S. Stoplis	
149	Cherie Reeves-Rutledge	
150	Daniel Loftus	
151	Steph C. Brand	
152	Robert E. & Geraldine Powell	
153	Mildrene Herbold	
154	Janice Melnick	
155	Maris & Ireta Graube	
156	Cody Folsom	
157	Robert Conatson	
158	R. Marriner Orum	
159	Wanda Cawein	
160	Rik Hornick	
161	Nancy Peterson	
162	John L. Hammond	
163	Rem. J. Underwood	
164	Loretta Ellett Lemar M. Ellett	
165	Barbara Butzer Ballou	
166	Sherman D. Anderson	
167	Moira Schrock	
168	Joan Jackson	
169	Carl Christy	
170	Sidney Henderson, M.D.	
171	Robert Sonnenburg	
172	David Pogel	
173	Pat & Dick Minthorn	
174	Mr. & Mrs. John Sandrig	
175	John & M.K. Norton	
176	Wilma R. Jozwiak	
177	Kent W. Christoferson	

178	Marty Marzinelli	
179	Joann Landon & Alan Danker	
180	Robert W. Holman, Jr.	
181	Mildred Estrin	
182	Richard Wilhelm	
183	F.A. Cleland	
184	Greg Hendrix	
185	George & Janet Scheumm	
186	Teresa Atwill & Bill Chadwick	
187	Mrs. Suchi Solomon	
188	Quincy Sugarman	
189	Joanne Cleland	
190	Stuart G. Garrett, M.D.	The Native Plant Society
191	Amy Beller	
192	Jane R. Dodge	
193	Art Schimke	
194	S. Lennard	
195	Charlene Holzwarth	
196	James Gamwalt	
197	Julie Hulme	
198	Harold & Beverly Beckley	
199	Joan Hertzberg	
200	Susan E. Cox	
201	John Kingsley Thomas	
202	Mr. & Mrs. Thomas Long	
203	James Marsh	
204	William A. Duetschman, Ph.D.	Oregon Laser Consultants
205	Dr. William Krueger and Dr. John C. Buckhouse	Department of Rangeland Resources, OSU
206	John O'Keeffe	
207	Ann and Andrew Archer	
208	Julia Esterly-Morgan	
209	John Sherman	
210	John Saemann	
211	Heil Haller	
212	Charles M. Patton & Leslie J. Harris	
213	Mr. & Mrs. Ron Bailey	
214	Pam Brandt	
215	Ralph & Dorothy Mason	
216	Don Winn	
217	Karen Horn	
218	Rhona Goldman	
219	Geoff Bernhardt	
220	Mark & Susan Vossler	
221	Mr. & Mrs. Gerard Pagenstecher	
222	Linda Serbus	
223	Braden Pillow	
224	Teresa Kasa	
225	Friedhelm Kirchfeld	
226	S. Smith, Jr.	
227	Gerald J. Bowerly	
228	Leigh Knox & A. Irwin	
229	Richard Corbat	
230	Chuk Sheadman	
231	Mrs. Kenneth W. Seidel	
232	Mikil Terramin	
233	Jennifer J. Walker	
234	Winita Miller	
235	Harold Busby	
236	Miss Linda Shockey	
237	Sigrid I. Weidenweber	
238	Elizabeth Hendricks, Psy.D.	
239	Don Rhodewalt	
240	Janet OCrowley	Connecting Point for Public Lands
241	Byron Rendar	

242	Carol A. Zimmerman, and David A. Rudacille	
243	Cal Elshoff	
244	Nancey Olson	
245	Larry Read	
246	Bhagwati Poddar, Ph.D.	
247	Phillip Johnson	
248	Mary Lou Boice	
249	Saradell Poddar	
250	Kurt P. Herzog	
251	Jeffrey A. Weih	
252	Peter Samuels	
253	Eugene Lewis	
254	Barbara Becker	Mazamas Conservation Committee
255	Beverly J. Beck	
256	Ann Tattersall	
257	Rachel L. Baldwin	
258	William & Genevieve Sattler	
259	George Wuerthner	
260	Paul Fritz	
261	Tom Farrell	
262	Hans Rilling	
263	Mr. & Mrs. Robert W. Dolan	
264	Simon Harding	
265	Kathleen Abbott	
266	David & Charlotte Corkran	
267	Steve Daggett	
268	Juli Bertram	
269	Russ Jolley	Native Plant Society of Oregon
270	James H. Conley	
271	Mrs. Anna L. Case	
272	Carol M. Ingelson	
273	Kathleen Slezak and John Slezak	
274	David Frierman	
275	Jim Oleachea	
276	Jeff Harding	
277	John Neiger	
278	David Imus	
279	Rick & Alison Penfield	
280	Jane Hackett	Obsidians, Inc.
281	Larry Tuttle	Oregon Natural Resources Council
282	Bill Arras	
283	Clyde V. Marshall	
284	Julie Bevan and David Manfield, Ph.D.	
285	Jim Jordan	
286	Jane Dixon	
287	William Peters & Susan Markley	
288	Noel Chatroux	
289	Sondralee Callsen Juve	
290	Richard M. Smith	
291	Geri Baxter	
292	Mary Etter	
293	Margo Aeleu	
294	Fran & Clyde Everton	
295	Bob Helwig	
296	Louis D. Knori	
297	Mirian and Charles Rosenthal	
298	Anne McLaughlin	
299	Brad Kahta, Eleanor Kalita	
300	David Hall	
301	Mr. Loren Ebner	
302	Karl Hartzell	
303	Janet Rees	

304	Elinore B. Gordon	
305	Guy & Roberta Chaffee	
306	Allan Zuschlag	
307	Laura E. Johnson	
308	Jack L. Farris	
309	Annabelle Street	
310	Betty Rademaker	
311	Avis V. Farber	
312	Don B. Johnson	
313	Robert M. Hughes	
314	Jack E. Williams, Ph.D.	
315	Jane Beckwith	
316	Elizabeth M. Stepp	
317	C. Wayne & Shirley Eshelman	
318	Mike Helm	
319	Kathy Gay	
320	Dave Ware	
321	Robert G. Ribe	
322	Richard Cayo	
323	Peter McGovern & Becky Taylor	
324	Noah Greenwald	
325	Tina Stupasky	
326	Richard L. Westcott	
327	Margaret A. Willowmoon	
328	Diana F. Waltman	
329	Jasmine Star	
330	Ernie & Marietta O'Byrne	
331	Greg Stone	
332	Mr. & Mrs. H. Niiranen	
333	Rod & Diane Jones	
334	Lynda C. del Nero	
335	Catherine Boucher	
336	Joan & Gary Ragan	
337	Sue Knight	
338	Sabine du Toit	
339	Elaine Duetschman	
340	Ms. Judith Schierbaum-Seely	
341	Keith Oderman	
342	Eric Scheuering	
343	Eric Scherman	
344	Joann & Mike Wolf	
345	M.K. Hardie	
346	Hardin W. King	
347	Robert W. Siebert	
348	Ann Taylor	
349	Stuart Craghan	
350	Ms. Laura S. Ellis	
351	Thomas F. O'Rourke	
352	Wendy McGarva	
353	Graham Beyh	
354	Hank Barton	
355	Mike & Martha Metcalf	
356	Joe Brown	
357	Melvin R. Adams	
358	Robert W. Phillips	
359	Dick Vander Schaaf	The Nature Conservancy
360	Mary Kate Spencer	
361	Martin Zurn	
362	W.G. Pearcy	
363	Robert Stack	
364	Nicholas A. Dodge	The American Alpine Club
365	Harry H. Wagner	
366	David M. Brown	
367	Steven Talbot	
368	Debra Kronenberg	

369	Dan Casali	
370	Steve Oswalt	
371	Bob Gerl	
372	Katheryne E. McKenzie	
373	Robert J. Solter	
374	Anne March	
375	Colleen Wright and David Glickerman, M.D.	
376	Michael Williams	
377	Bill Lynch	
378	Michael Jay Coe	Outdoor Essentials
379	Eve Vogel	
380	Elizabeth J. Sher	
381	Halley Buckanoff	
382	Carol L. Lash	
383	Bob Salling	
384	Jennifer Clark	
385	Roger Canunsen	
386	David Moskowitz	
387	Cathy Sue Anunsen	
388	Jonanthan Jensen	
389	Rick Rust	
390	David Greenwald	
391	Andrew Quinn	
392	David G. Miller	
393	Jeff Strang	
394	Greg Robart	
395	Mary Bergotten	
396	Steve Marsden	
397	Brenda Russell	
398	John & Marie Struven	
399	Steve Johnson	
400	Sincere Citizen	
401	Candance Cooke	
402	Roxanne McAnhur	
403	Walt Trandum	
404	Rick Jali	
405	Don & Mary Shepherd	
406	Dennis Phillips	
407	Mike Gross	
408	C.K. Matteson	
409	Jack Stone	
410	Gregg Humphrey	
411	Charlotte Harrington-Weresley	
412	Margaret T. McKillop	
413	Carol Lagodich	
414	Cathy Highet	
415	David Webb	
416	Mark Chidlaw	
417	Janna Treisman	
418	Kathy Kale	
419	Marcia Lux	
420	Stacy Smith	
421	Dana Baldwin	
422	Peter Sheldon	
423	Jim Bennett	
424	Martin P. Albert, M.D.	
425	Ruth Acord	
426	Bayard H. McConnaughay	
427	R.L. Schreiaomou	
428	Alex Estene	
429	Edwin L. McCurry	
430	21 employees of:	Anthro Technology Furniture
431	Philip M. Mickel	
432	Missing	

433	Mark Attenad, Secretary	Friends of the Breitenbush Cascades
434	Avis Rana	
435	Linda Scabery	
436	Robert Bickel	
437	John H. Pike	
438	Russell M. Dickson	
439	Diana Coogle	
440	Alan & Myra Erwin	
441	Rebecca Rundquist	
442	Wilbert L. Pool	
443	Dick Wilson	DuPage Audubon Society
444	Robert Shulman	
445	Pamela J. Marcum	
446	Dan Silver, M.D.	
447	Bill Barbour	
448	Dennis F. Smith	
449	Jeff Beckwith	
450	Chad Hanson	
451	Royal Murdock	
452	Stan Kaufman & Julia Reitan	
453	Scott M. Murray	
454	Laura C. Streichert, Ph.D.	
455	Michael McCabe	
456	Maureen Sweeney	
457	Fred J. White	
458	Robert L. Jones Mary Ann Jones	
459	Robert Nisbet	
460	Timothy Lehman	
461	Janet Johnson	
462	Michael L. Horton	
463	Beula A. Maus	
464	Joanna Priestley	
465	Art & Nan Kennedy	
466	Scott Bischke & Katie Gilson	
467	Betty Swinnerton	
468	Bruce Bowler	
469	N.M. Hipperson	
470	Geraldine Orchard	
471	Scott Vasak	
472	Glenn Van Cale	
473	Janet Neuman	
474	John G. Marks	
475	Adele Egan	
476	David Radtke	
477	Joanne Dalsass	
478	Barbara Wolman	
479	Charles Goodrich	
480	Tom Bourgeois	
481	Robert R. Sandberg	
482	Carole E. Hallett	
483	Craig Miller	
484	Sara Vickerman	Defenders of Wildlife
485	Georgiana Nehl and David Browne	
486	Alan Parks, President	Lake County Stockgrowers
487	Beverly R. Vernon	
488	Yale Sacks, M.D.	
489	Denzel Ferguson and Nancy Ferguson	
490	Julie Wasserman	
491	Christopher K. Stangland	
492	Denise Cody	
493	Diane Siebert	
494	Jeanette R. Egger	Environmental Federation of Oregon

495	Mark Kramer	
496	John Churchill	
497	Stan Staniforth	
498	Steve & Kathy Hurley	
499	James Graves & Rita Gauer	
500	David A. Ledder	
501	Joanie Berde	Carson Forest Watch
502	Jack Hoke	
503	Gerald Haram	
504	Stanton A. Cook	
505	William Riggs	Oregon State University, Extension Service
506	Paul L. Campbell	
507	Jack Lyford	
508	Scott O. Praft	
509	Irene Vlach	
510	Catherine Ellison	
511	Kathleen A. Cushman, PhD	
512	Katherine West Bueler	
513	Dr. Pat Sabin, Buck Windom, Mike Getty, Orval Layton, Don Hotchkiss, Willie Riggs, Pete Talbott, John O'Keefe, and Donald Rose	Lake County Chamber of Commerce Hart Mountain Liaison Committee
514	Jessica Clements & Belma Ault	
515	Evelyn Premselaar	
516	David A. Moskowitz	Oregon Trout
517	Diane Valantine	
518	Tim Jefferies	
519	A. Joy Belsky, Ph.D.	Oregon Natural Resource Council
520	Kathleen Worley	
521	Dr. Thomas Pringle	
522	Connie Lonsdale	
523	Loni Strasser	
524	Lyndra Christiansen	
525	Johanna H. Wald	
526	Bob Evinger	
527	Jane St. Clair	
528	James Kimball	
529	Amy Karecki	
530	Debra Burke, C.A. Beith, Wendy Guyer	
531	Scott A. Moore	
532	Don McLeod, Deborah Ross, Melissa Ross	
533	Dennis Lewis	
534	Daniel W. Slater	
535	Mariana D. Bornholdt	
536	Patricia Loveland	
537	Bonnie Reed	
538	Michelle Alexander	
539	Annette M. Saunders	
540	committee 540a - Martin B. Main 540b - Robert R. Kindschy 540c - James C. Lemos 540d - Michael C. Hansen 540e - Chris Carey	The Wildlife Society, Oregon Chapter
541	Terry H. Sodorff	
542	Thomnas P. Gawronski	
543	David McClurg	
544	Lynn Youngbar and children	

545	Chris Beck	
546	Karin Ullian	
547	Grant Wiegert	
548	Carolyn Eckel	
549	LeRoy Johnson	
550	Les Tumidaj	
551	Monet Bossert	
552	Herbert Duane Mohn	
553	Julie Wasserman	
554	Eugene F. Stensager	
555	Frank H. Hirst	
556	Barbara Dudman	
557	Thaddeus Kozlowski	
558	Maureen Taylor	
559	Brian W. White	
560	Catherine M. Sterbentz	
561	Tom Myers	
562	Bradley French	
563	Mr. & Mrs. Lewis M. Hoskins	
564	Ken Serkownek, Ph.D.	
565	Ned Young	
566	Paula Brown	
567	Paul Travis	
568	D. Wayne Linne	
569	Victoria Cummings	
570	Steve Rudman	
571	Mimi Maduro and Michael Stevens	
572	Ruth Ansara	
573	Andrea S. Vargo	
574	Clay Spencer	
575	Earl E. Reeves	
576	Christopher Dobson	
577	Karen Gogren	
578	Lance & Jennifer Barker	
579	Jack H. Boon & Dale H. Boon	
580	Reida & Charles B. Kimmel	
581	Carl Watkins	
582	Frank B. Isaacs & Jane E. Olson	
583	Aurelia Hadley	
584	David Kelly	
585	Michael Carriga	
586	Mary Garrard	
587	Diane A. Perry	
588	Robin Chapman	
589	Sara Baker	
590	A.L. Carlstrom	
591	Charles Mote	
592	Martha Duff	
593	Dave Foreman	
594	Peter Geiser	
595	Susan Hurt	
596	John & Linda Peck	
597	D. Curtis & G. Freitag	
598	Christopher H. Foster	
599	Bridget & Joe Tein	
600	Jean Snider Schadler	
601	Richard Bradbury	
602	Betty Kim	
603	Donald R. Alger	
604	Steven G. Herman, Ph.D.	
605	Don Lucas, Board Member	Soil and Water Conservation District
606	David L. & Sandra Wenzel	
607	David Funk	
608	Jaye J. Exo	

609	Gary B. Adams	
610	Cathy Ellis	
611	Barb Wolman	
612	Steven G. Herman	
613	Robert Foster	
614	Ms. Jill O'Neill	
615	Neva J. Oiler	
616	Tony Oliver & Stephen Swerbing	
617	Susanne Carter	
618	Susan Pitcairn, M.S.	
619	Joanne Wu	
620	Dorothy Marion	
621	Karen Ashford	
622	Linda S. Craig	Audubon Society of Portland
623	Doug Goldenberg	
624	Carrie J. Campbell	
625	Arthur R. Ticknor	
626	Allan R. Sorenson	
627	Mark Egger, Chairman	Washington Native Plant Society
628	Mike Perault	
629	Heather Wolf	
630	Trevin Kewen	
631	Dr. G. David Kerlick	
632	Teri Cobo	
633	Larry Chitwood	
634	Janet Schaefer-West	
635	Peter Stoel	
636	Tim Charnon	
637	Grace Swanson	
638	Hal Hushbeck	
639	Bruce Lumper & Marolyn Wilks	
640	Jeff M. Phillips	
641	Ed Bottum	
642	Paula Carson	
643	Owen S. Hamel	
644	Matt Messerly	
645	Jean Findley	
646	Mitch Williams	
647	P. Street	
648	George Cummings	
649	John R. Swanson	
650	Michael Yost	
651	Steven Van Vactor	Sierra Club, Middle Snake
652	Karen Ponda	
653	Denise Boggs, Program Director	American Wildlands
654	Francis Eatherington	
655	Peggy Robinson	Sierra Club, Oregon Chapter
656	G. R. Hermach	
657	Warren H. Pavlat	Native Plant Society of Oregon
658	Debbie Stoller	
659	Virgina A. Purvis	
660	Mr. & Mrs. William J. Moore	
661	Tom Mathieson	
662	Victoria Barbour, Chair	Sierra Club, Rogue Group
663	Brady Ricks	
664	Kei Yasuda	
665	Billie P. Allison	
666	Masha Isotov	
667	Ethen Perkins, Ph.D.	
668	Kirk Schroeder	
669	Carol Savonen	
670	Ralph H. Perkins	
671	Richard M. Noyes	
672	David H. Kruse, CDP, PhD	
673	H. G. Georgelis	

674	Mary Walter	
675	Trudy Maney	
676	Barbara Sopjes	
677	Henry Freeman	
678	Sally Yost	
679	Holly A. Kenson	
680	Lorance W. Eickworth	
681	Marjorie Iburg	
682	Arthur M. Farley	Aubudon Society, Lane County
683	Jill S. Clark	
684	Nancy Brown	
685	Mary Macke	
686	James W. Ferguson	
687	Dr. & Mrs. Alva L. Roberts	
688	Ed Larglois	
689	Amy Whitworth	
690	Carol Stern	
691	N. Aodagain	
692	Ethan Medley	
693	Mark M. Kelz	
694	Beth Peterson	
695	Stu Sugarman, Board of Director	Oregon Wildlife Federation
696	Rick Goldstein	
697	Dorothy Hofferber	
698	Susan E. Cox	
699	Borden B. Beck	
700	Terry Cain	
701	Christy Dunn	
702	Bill Marlett, Exec. Director	Oregon Natural Desert Association
703	Karen T. Ailor	Eugene Natural History Society, Inc.
704	Jim Neu	
705	Kimberly Grigsby	
706	Mark Ginsberg	
707	R. McCullough & Nancy Lee	
708	Deanna Mueller-Crispin	
709	Jill Barker	
710	Kelly Nolen	
711	Haynes Hendee	
712	David J. Voluck	
713	Tom Ribe	
714	Kamilla Patterson	
715	James Blashfield, Jr., Jean Wright, David Phillips, Stephen Scheer, Jodeanne Bellant, Dale Rawls, Lorene Scheer, Alfredo Armenta, Micheal Murray, John Rogers, and Carol Sherman	
716	Larry Callister	
717	Elizabeth Newcomb	
718	Bob Powne	
719	Alan Hemrich	
720	Brenda Watts	
721	Reed Vander Schaaf	
722	Wally Lemke	
723	Charles T. Downen	
724	Romain Cooper	
725	Diane Valantine	
726	Katherine Somervele	
727	Karen Thompson	
728	Brenda Inglis	
729	Michael J. Sherack	Northwest Environmental Defense Center
730	Dwight & Susan Hammond	
731	Gary Miller	
732	Kathleey Simpson Myron	
733	James L. Hunter, Ph.D.	

734	Sandra Ely	
735	Jill Workman	Sierra Club, Oregon Chapter
736	Dan Heinz	
737	Steve Tabor, President	Desert Survivors
738	Daniel G. Wells	
739	Allen Krege	
740	Richard Goff	
741	Peter F. Zika	
742	Dale F. Oberlay	
743	David Imus	
744	National Park Service	National Park Service
745	Marc C. Liverman	Oregon Department of Fish and Wildlife
746	Gary Cumming	Office of Environmental Affairs, Dept. of Interior
748	By Rarey, Chapter President	Oregon Hunter's Association

U.S. FISH AND WILDLIFE SERVICE OPEN HOUSE MEETINGS (Total of 7)

749	Bill Churchill	
750	Lon Stenberg	
751	Eric Perkins	
752	Lyle Olson	
753	Ann & Jerry Kerr	
754	Connie Lonsdale	
755	Bob Elliott	
756	Gordon DeBoy	
757	Craig Miller	
758	Alice Elshoff	
759	Elaine Reese	
760	Chuck Downen	
761	Bill Marlett	
762	Bill Millsap	
763	Leonard Shrewsbury	
764	Scott Florence	Bureau of Land Management, Lakeview District Office
765	Harold Anders	
766	Jackie and Lynn Ortwein	
767	Delbert Caswell	
768	Mike Getty	
769	anonymous	
770	John Bach	
771	Carol Pierson	
772a	Dan and Jennifer Carper	
772a	Patrick Sabin	Lake County Chamber of Commerce, president
773	Doug Troutman	
774	Bill and Janine Cannon	
775	John O'Keefe	
776	Tom Pringle	
777	Stu Sugarman	
778	Ruth Green	
779	Patrick Rogers, Advocacy Director	Paralyzed Veterans of America

this catagory continues with number 816

OFFICIAL RESPONSE AND PUBLIC COMMENTS COLLECTED AND FILED BY THE LAKE COUNTY COMMISSIONERS

Lake County Board of Commissioners Regular Meeting, September 15, 1993

780a	Jane O'keeffe	Lake County Stockgrowers
780b	Bill Barry	Lake County Stockgrowers
781	Gary Miller	
782	Ann Tracy	
783	Jim Lynch	
784	Hank Albertson	

Lake County Board of Commissioners Special Meeting, September 16, 1993

785	Robert Pardue	Lake County Commissioner
786	Jeremiah O'Leary	Lake County Commissioner
787	John Buckhouse	Dept. Rangeland Resources, Oregon State Univ.
788	Bob Utley	
789	Delbert Caswell	
790	Pat Sabin, on behalf of:	Lake County Chamber of Commerce
791	Pat Sabin	
792	Buck Windom	
793	Buck Windom, on behalf of:	Lake County Chamber of Commerce's Hart Mountain Liaison Committee
794	John O'Keeffe	
795	Mike Getty	
796	Susie Hammond	
797	Willie Riggs	Oregon State University, Extension Service
798	Becky Hatfield	
799	Doc Hatfield	
800	John Kiely	
801	Bill Millsap	
802	Len Shrewsberry	
803	Marianne Osborne	
804	Archie Osborne	
805	Bill Cox	
806	Don Simms	

Other Letters Submitted as Official Responses and Public Comments

807	E. William Anderson	Certified Range Management Consultant
808	Robert Pardue, Jeremiah O'Leary, and James Gipson	Lake County Board of Commissioners
809	Jack Hodnett	U.S. Department of Agriculture, Animal Damage Control
810	Thomas J. O'Leary	Lake County Farm Bureau
811	John O'Keefe	
812	Micheal Getty	
813	Marianne Gonzales Osborne	Lake County Chamber of Commerce, Tourism Committee
814	R.C. Utley, Terry Utley, Randy Utley, Gloria Utley, and an unlegible signature	Favell-Utley Corporation
815	Sue Hammond	
816	Hugh Cahill	
817	Tim Cross	Oregon State University
818	Hugh Cahill	First Interstate Bank

OTHER PERSONS THAT ATTENDED THE U.S. FISH AND WILDLIFE SERVICE OPEN HOUSE MEETINGS

819	A. Y. Powell	
820	Charlie Sottosanti	
821	Glenn Van Cise	
822	Lance Masterson	Lake County Examiner
823	Tom Hoyt	
824	Bob Miller	
825	Lorrie Stinchfield	KQIK
826	Pete Frost	
827	Cathrine Ciarlo	
828	Patrick Wright	U.S. Fish and Wildlife Service
829	Paul Sauer	Catherine Freer Wilderness Therapy Expeditions
830	Linda Craig	
831	Joy Belsky	Oregon Natural Resources Council
832	Bob Amundsa	
833	Bob Poane	

836 Total (note that there were 3 instances of misnumbering -- 29, 772, 780)

REFEGE GOALS AND LONG-RANGE OBJECTIVES

General Comments

1 "I, like many who reside elsewhere, am an active user of the Refuge and appreciate that it offers excellent opportunities for non-intrusive activities such as birding, hiking, backpacking, and wildlife viewing. I wholeheartedly support NAR goals as outlined in the Plan." (45)

2 "The objectives of returning HMNAR into a mosaic of native ecological communities was recognized as an important step toward improving biological diversity and moving toward an ecosystem-oriented management approach." (540)

3 The way the first three NAR goals are stated indicates you are cognizant of the need to manage public lands in ways to offset the devastation of our biosphere we are permitting on private lands. This, of course, is obvious to the scientists but I'm afraid not to the politicians or to most of the public." (555)

4 "OWF [Oregon Wildlife Federation] is especially pleased that the Service's studies confirmed what other multi-disciplined scientists have been saying for years. The study, along with other findings, confirmed (1) that residual grass cover is important habitat to many wildlife species, and (2) that leaf litter increases soil absorbency and protects soil from erosion." (695)

5 The DEIS provides the first clear cut implementation from any agency to restore late 18th Century damage. Don't worry about definite end date for ban on grazing. (773)

6 A key objective is the goal for restoration. This is a wise objective. (773)

Response. Comments noted.

Comment

7 "The stated goals are nebulous and do not recognize the changing nature of area habitat." (66)

Response. The writer of this comment is correct in recognizing that habitats on Hart Mountain NAR are dynamic. This actually is a key component of the goals. Healthy ecosystems are resilient to changing conditions, as are healthy wildlife populations.

Comment

8 "There is so little natural range, and I believe we should foster the "natural" environment at Hart Mountain." (137)

Response. This is consistent with what the Service is proposing in the Proposed Action.

Comment

9 "I think your five goals sound great but I have problems with the words MANAGE, RESTORE and PROVIDE as outlined in these goals. These words all emphasize a human interface with wildlife which in most cases ends up with problems.

It would be nice to isolate the area from human interface and allow it to recover - on its own. I realize this is now impossible, because of ranching and the political implications that are now going on." (239)

Response. The Service is responsible for managing Hart Mountain NAR. "Manage" does not necessarily translate to manipulation of habitats -- one management option is to isolate the Refuge from human interface, as proposed in Alternative E of the EIS. However, totally isolating Hart Mountain NAR from human interface would not be possible because management of surrounding lands (e.g., fire suppression activities) would continue to influence the Refuge. Current policy also would not allow such an option to be implemented. Deteriorated habitat conditions on the Refuge also make this management option unfeasible, given Refuge goals and objectives. An aggressive, and carefully executed, prescribed burning program will be necessary to restore upland habitats. The Proposed Action emphasizes passive restoration of riparian areas, but prescribed burning will be necessary in some habitats (e.g., aspen).

Comment

10 "I am confused about one of your long-range objectives mentioned early on in the DEIS. Upland Habitat #6 for mountain mahogany (page 10) states as an objective to " emphasize manipulating areas colonized by mahogany less than 100 years old..." However on page 99 you point out that 100% of the mountain mahogany is in a very late seral stage (presumably greater than 100 years old). Just where are these young mountain mahogany stands and how much of it exists? It would seem to me that responsible ecosystems management would be to encourage some variability in the age of vegetation types to in order to maintain biodiversity as well as long term viability of the vegetation type. I would not recommend that large areas of old growth mountain mahogany be burned, but rather if some young growth is present, or occurs, that it be left alone and not eradicated or "manipulated". I am not totally opposed to some limited prescribed burning of old mountain mahogany, but would encourage that the bulk of it be left alone." (483)

Response. The long-range objectives for mountain mahogany have been reworded to clarify our intensions. Objectives 6(a) and 6(b) refer to the mountain mahogany vegetation type, and Objective 6(c) refers to other vegetation types into which mountain mahogany has expanded. The objective for the mountain mahogany vegetation type will be to maintain old-growth stands of mahogany. For other vegetation types (e.g., quaking aspen, mountain big sagebrush) into which mahogany has expanded (recognizable by existence of trees less than 100 years of age), the objective will be to periodically burn the areas, as outlined under the appropriate vegetation type. Historically, periodic fires discouraged the establishment of mountain mahogany in areas unprotected from fire (e.g., vegetation types other than mountain mahogany and western juniper). Because the Service will strive for patchy burns and because not all areas that have newly established mahogany will be reached, many stands of newly establised mahogany will be maintained by default.

Comment

11 "The DEIS should express management's intention to manage with a light hand. Among the goals stated in the DEIS was to provide undisturbed ecosystems for natural biological and evolutionary processes to occur. Since this is open to different interpretations, the FEIS should clearly convey the intent of the Refuge to manage at a level necessary for healthy ecosystems and wildlife populations and not to intrude on these processes. For example, wildlife should not be managed to produce a "surplus" of certain preferred species, but managed as components of the entire ecosystem. And rock-check dams should be built only after discovering whether they work. I saw several where the stream simply cut around the dams with no visible improvement. The NAR should be managed so that it mimics as closely as possible a natural Great Basin ecosystem." (519)

Response. The last sentence in the above comment is consistent with the intentions of the Proposed Action (Alternative D). In fact, it is an underlying principle upon which the alternative was formulated. The emphasis of the Proposed Action is to replicate, to the extent possible, the range of habitat conditions under which native wildlife communities evolved. This would be accomplished by mimicking processes (e.g., disturbances) that historically maintained the desired habitat conditions. Providing "undisturbed ecosystems for natural biological and evolutionary processes to occur" was not included among the Refuge goals in the DEIS. This type of goal would imply that, if left alone, the Refuge would revert back to pre-Euroamerican settlement conditions. We do not believe that this would occur. In Alternative D, the Service proposes to mimic natural fire, through prescribed burning, to produce conditions under which native wildlife communities evolved and to restore habitat conditions. Disturbances are important components of ecosystems. However, this does not mean that all disturbances are desireable. Some disturbances, such as cattle grazing, are not processes (or do not mimic historic processes) under which native ecological communities evolved, and thus may adversely impact those communities. The intent of the goals is discussed in the Basis for Long-range Objectives section of Chapter 1, Section Two. This section has been revised in the FEIS. We agree that producing a surplus of certain wildlife (e.g., game species) would contradict the emphasis on wildlife populations being in balance with each other and their habitat. Rock check dams would only be installed after careful evaluation.

Comment

12 "page 8, "All Habitats", objective (5) Merely "emphasizing" endemic species seems a little weak. It seems to me I notice among biologists increasing concern about introducing outside genes into an area. It almost seems as tho the more we learn the less confident we are of our knowledge. The benefits and risks of such introductions require very careful weighing." (555)

Response. The Service agrees that risks are involved with introducing plants that are not endemic to an area being planted. However, some species of plants may be at such low levels of abundance on the Refuge to make collection unfeasible. Cases in which a seed-source of a native plant species is not available on or near the Refuge, requires that the closest source of seeds of the same species be evaluated. Benefits and risks must certainly be evaluated.

Comment

13 "Vol. 1, Summary - XI, Goal 1 - This goal is probably not achievable. It is not natural for biological systems to be in "balance" for very long. They could be in "populations appropriate for the capability of their habitats". The term "balance" is used, improperly (2), in several other instances in the documents." (657)

Response. The Service disagrees that it is not natural for biological systems to be in balance. The disagreement likely stems from symantics. The writer seems to equate "balance" with "static". We acknowledge that a perfect state of equilibrium is never achieved (or is of short duration), but that the state of healthy ecological systems ossilates around an equilibrium. Ecological systems tend toward equilibrium, but a large variety of forces constantly counter this process, not allowing the system to ever remain in a completely static state. Populations of particular plant and animal species constantly change, even if we cannot measure these changes. We define a balanced wildlife community as one in which (1) populations of individual species fluctuate, but that the trend in population remains constant over time; (2) these populations have the ability to recover from population reductions (i.e., resilient to change); and (3) the population of one species does not threaten the continued existence of another species.

Comment

14 "Vol. 1 Chapter 1-6, Hart Mountain. NAR Goals, - Goals 1 & 2 may be in conflict with Goal 3. If Goal 3 is accomplished, then Goals 1 & 2 will fill in their niche naturally. Hopefully, but not necessarily, in some preconceived "balance"." (657)

Response. The Service agrees fully that if goal 3 is accomplished, goals 1 and 2 would be accomplished. In fact, this is one of the key assumptions upon which the EIS/CMP is based. In other words, by accomplishing goal 3, populations of particular wildlife species would be in balance with other wildlife populations and with changing habitat conditions. Therefore, we do not feel that Goals 1 and 2 are in conflict with Goal 3.

Comment

15 "We do not see "man's roll in his environment" considered in the HMNAR Goals; nor is there historic, cultural or socio-economic consideration or integrated inclusion into the plan for residents, or neighboring lands, and their occupants. THIS IS A MAJOR OVERSIGHT and not in coordination with the Service mission, as stated. When this "goal" is included it will necessarily reflect major changes in the current and long-range objectives." (730)

Response. The Service mission, as stated in the document *Vision for the Future*, completed in 1991, is "to provide leadership to achieve a national net gain of fish and wildlife and the natural systems that support them." It does not mention man's role in his environment. The mission of the National Wildlife Refuge System is "to provide, preserve, restore, and manage a national network of lands and waters sufficient in size, diversity and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available." Refuge goals are based on these missions. One of the goals of the NWRS is "to provide an understanding and appreciation of man's role in his environment..." (emphasis added). Refuge Goal 4 addresses this. It calls for the Refuge to "provide opportunites for wildlife/wildlands-dependent recreation and education oriented to the Great Basin ecosystem..." Section Two of Chapter 1 of the FEIS explains in more detail the basis of Refuge goals and objectives. A socio-economic analysis was completed as required by NEPA.

Comment

16 "Specific habitat objectives (prescriptions) are missing from the Draft Plan for the following major vegetation and aquatic types, and should be included in the Final Plan and EIS:

a. Upland
   1. Other Desert Shrub
   2. Wheatgrass
   3. Basin Big Sagebrush
   4. Mountain Shrub

b. 1. Deciduous forest (Quaking aspen)
   2. Submergent aquatic
   3. Aquatic non-vegetated

Consider listing habitat objectives in a Table format for easier access and comparative purposes, as was done to compare alternatives." (745)

Response. Thank you for pointing out this short-coming. The FEIS has been revised to reflect this concern (Chapter 1, Section Two, Long-range Objectives).

Comment

17 Why passive restoration? If passiveness is due to cost, there are many groups that would help. (766)

Response. The proposed strategy for passive restoration of riparian habitat was based on the premise that it would be the best available technique for restoring these habitats.

Comment

18 "FWS doesn't have to go by the letter of the law...(re: strictly following mandate to manage for wildlife)." (768)

Response. We disagree.

Comment

19 "Another thing that we have come up with is a strategy. If renewable resources in Lake County is timber, grasses, brush or wildlife, leaving or dead, are allowed to accumulate in such a manner so as to promote disease, fire hazard, or imbalance to wise multiple use and sustained yield, and/or fail to promote long term customs, cultures and economies of Lake County, Lake County should condemn such conditions. Take control of the violation to regain proper operation of those resources. No renewable resource will be allowed to deteriorate or remain unsalvaged because of inability to negotiate a law or unreasonable procedures. We have millions of board feet of lumber rotting in the woods. We've got accumulations of brush on Hart Mountain and more and more all of the time." (784)

Response. Dead grass (standing and accumulation on the ground) is an important component of the ecological system on Hart Mountain NAR. Excessive accumulations of dead grass have not been determined to be an ecological problem on the Refuge. We agree that excessive shrub cover is a problem on the Refuge -- as such, prescribed burning is a necessary management action to curb this problem.

Comment

20 "Now, the missions and goals of the United States Fish and Wildlife Service. To think that missions and goals are absolute is morally wrong. Traditional and historical uses of the land should and must be considered in all decisions regarding the land and wildlife management. The community is as much a part of the element as the wildlife that live there as well. Missions and goals are often determined by itinerant managers often devoid of community ties and oblivious of the consequences of their decisions and actions. Now one of their goals, goal 1, has something to do with the endangered species act. It doesn't apply on Hart Mountain. I'm not aware of any endangered species and if there is; I'm sure you can bring them back with no problem at all. Goal 2 does not apply to Hart Mountain. Nor is it necessary to continue management of the Shirk Ranch for migratory birds. Its location and contribution to the overall bird population is minimal. Goal 3, which addresses diversity of fauna and flora. That can easily be accomplished with grazing without complications or adverse effects and there are thousands and thousands of examples out there. Goal 4 of the National Wildlife Refuge System has six key words, that being for "which the Refuge was established." The Hart Mountain National Antelope Refuge was established to protect antelope. The purpose is no longer applicable. Antelope are now thriving throughout the western United States. Protection, other than by controlled hunting and predator control, is no longer required." (795)

Response. The traditional and historical use of livestock grazing on the Refuge was considered, in alternatives A, B, and C, for managing land and wildlife management on the Refuge. The historic (c. 1971-1990) level of livestock grazing was considered in Alternative A. Goal 1 of the NWRS (not Refuge Goal 1), dealing with threatened and endangered species, does apply to Hart Mountain NAR. Several species inhabiting the Refuge could be added to the endangered species list in the future, and the EIS covers a 15-year period. Shirk Ranch was purchased by the Service for the migratory bird resource. Not only does Goal 3 of the NWRS "address[]

diversity of fauna and flora," it addresses the preservation of "a natural diversity... of fauna and flora..." Because grazing by large herbivores was not a major process under which native wildlife communities evolved, it is not necessary to simulate this process to preserve the full array (diversity) of native wildlife. It could hamper this effort. Hart Mountain NAR, according to Executive Order 7523, was established as a "range and breeding ground for antelope and other wildlife."

Comment

21 "The U.S. Fish and Wildlife Service... Connie and I just spent the last two days on the Trout Creek Mountains where there's endangered species and wilderness studies and the U.S. Fish and Wildlife Service were there and they were excited with the grazing program that was going on in that area which is in much less desirable shape than the Refuge and much more difficult to manage. The Fisheries biologist was excited. That's with the endangered Lahonton cutthroat trout, in an area that is very hard to manage. Pat Wright, one of the top U.S. Fish and Wildlife Service people in the state office talked enthusiastically about making private partnerships with private landowners to enhance wildlife habitat....How can one agency be promoting private partnerships in part of their agency and building a wall that will take four generations to dissolve." (799)

Response. The reason that the Service is working with permittees in the Trout Creek Mountains while at the same time is proposing the non-use of livestock on Hart Mountain NAR for 15 years primarily rests on the statutory requirements that direct management of the lands in question. Grazing allotments in the Trout Creek Mountains are managed by BLM, which has a multiple-use mandate, and Hart Mountain NAR is managed by the Service, which has a dominant-use mandate. Pat Wright and Ron Rhew (Service), working in the Trout Creek Mountains, relayed their enthusiasm to Hart Mountain NAR staff regarding the progress being made in the Trout Creek Mountains.

Comment

22 "We're not representing those people back east. We are not even representing those people in Bend, Oregon." (801)

Response. Hart Mountain NAR is a National Wildlife Refuge.

PURPOSE OF REFUGE

General Comment

23 It is essential that Hart Mountain be managed for wildlife. After all, most of the rest of eastern Oregon is managed for cattle grazing, so we don't need more of that." (19)

Response. Comment noted.

Comments

24 "Originally Hart Mountain was to be an antelope refuge and is so named. Where is the authority to manage it as a total wildlife refuge?" (17)

25 "Your identification of the real purpose of the refuge, as a place first for the antelope, seems sound and reasonable." (142)

26 "Hart Mountain incorporates less than 2% riparian areas in it's approximately 275,000 acres, according to information in the above mentioned document. The 183,000 acre Malheur Wildlife Refuge is predominately riparian areas. Hart Mountains' mandate is the protection of Antelope; Malheur's is migratory waterfowl." (730)

Response. Executive Order 7523, signed by President Franklin D. Roosevelt in 1936 established Hart Mountain Antelope Refuge (subsequently renamed Hart Mountain National Antelope Refuge) "...as a range and breeding ground for antelope and other species of wildlife..."

Comment

27 "I understand the ranchers' perspective, coming as I do from an old Wyoming family, yet I see it as essential that the particular needs of the plants and wildlife at Hart Mountain be honored. After all, it is primarily a refuge, and all of the allowed uses of the site must be commensurate with that primary function." (83)

Response. The writer of this comment brings up the directive that is at the crux of the issue on Hart Mountain NAR. The Refuge, as all NWRs, is to be managed first and foremost for wildlife -- all other uses are secondary to this, and can only be permitted if they are compatible with the purpose for which the Refuge was established (National Wildlife Refuge Administration Act).

ESTABLISHMENT OF REFUGE

Comments

28 "The refuge was established at the behest of Lake County citizens in 1936. It has, since its inception, recognized grazing as a part of refuge management. In 1950 a proposed addition of public lands to the refuge recognized grazing as a part of refuge management." (66)

29 "Lake County created the Hart Mountain Refuge with the intent that traditional and historical uses continue in perpetuity." (795)

30 "..contrary to popular belief, Hart Mountain Antelope Refuge was not put together by the Oregon Natural Desert Association, Rest the West, or the Oregon Natural Resources Council. It was established with pride as a grass roots effort, by individuals in Lake County, Oregon in 1936. The Refuge was intended for wildlife, with any surplus forage going to livestock." (798)

Response. We apologize for this oversight. The FEIS was revised to recognize the help and support provided by local residents during the establishment of the Refuge (please refer to page 1 of Chapter 1, Section One). The Order of the Antelope, the name that local supporters gave themselves, helped in many ways to establish the Refuge (Gabrielson 1943:93). Supporters of Refuge establishment identified by Gabrielson were "local residents and livestock men as well as by conservationists from all parts of the state." Livestock grazing has been recognized as part of Refuge management since its establishment. Many records, such as the 1969 Resource Management Plan (USFWS 1970) and Anderson, et al. (1990a), attest to this. The Service now realizes, through a greater understanding of wildlife-habitat relationships and degraded habitat conditions on the Refuge, that continued cattle grazing on the Refuge would hamper the potential for accomplishing Refuge goals. We are unaware of any records that indicate that Lake County residents supported the creation of the Refuge with the contingency that traditional and historic uses continue in perpetuity. The executive order that established Hart Mountain NAR does not mandate the Service to provide surplus forage to livestock.

Comments

31 De-commission refuge. In interest of saving money, turn administration over to BLM. (770)

32 "Bighorn sheep from Hart Mountain have been transplanted to numerous sites throughout Eastern Oregon and the successful management of those herds by the Oregon Department of Fish and Wildlife, Bureau of Land Management and private landowners clearly show us that future management of the herd on Hart Mountain does not justify the continuance of Hart Mountain as a refuge." (795)

33 "After reviewing the document and considering the antelope and bighorn sheep are doing quite well, the community has only two choices: The alternative best suitable for the community is a combination of both Alternative B and D which will allow a minimum of 4,000 AUMs and an increase in AUMs as conditions improve. A local board consisting of local citizens, the Commissioners, and the Fish and Wildlife Service and a third impartial party, the BLM, would determine any decreases or increases in AUMs on a periodic basis. Or, we should disband the Refuge with ownership of the land reverting back to the County and the Bureau of Land Management. The BLM would receive back all lands the government laid claim to prior to the establishment of the Refuge and the County would receive ownership of all private and state lands acquired since the establishment of that Refuge." (795)

Response. These comments are beyond the scope of this EIS.

ORDER OF THE ANTELOPE

Comments

34 "I do not support... favoritism granted to the Order of the Antelope to conduct their celebrations within the Refuge..." (45)

35 "The huge annual party by the Order of the Antelope at Blue Sky and the subsequent habitat damage was an outrage." (72)

<u>Response</u>. Issues concerning the Order of the Antelope are beyond the scope of this EIS.

QUALITY OF DOCUMENT & WORK GOING INTO IT

General Comments

36 "You are demonstrating the kind of leadership needed to restore damaged federal land for the use and enjoyment of all of us, the public, rightful owners of the land." (5)

37 "First let me say that the DEIS seems to be very well done and it is fairly easy to understand what you are trying to do with each alternative that is presented." (25)

38 "The Hart Mountain NAR draft EIS is an excellent document, containing the kinds of scientific data and analytic thought that the EPA strongly supports. We must stress that we believe the writers of the draft EIS did a remarkably thorough job on this project." (32)

39 "Overall, good work. This is the first EIS I have seen that I felt genuinely addressed ecological concerns." (49)

40 "I appreciate the integrity of your decision in light of the intense pressure you must be under from local ranchers." (53)

41 "Because of the lack of objectivity, none of these considerations [those addressed in letter] can be addressed under the present project leader. He has been unable to work with our elected public officials and landowners adjacent to Hart Mountain." (66)

42 "I realize this is not the politically "easy" plan, but it is a courageous example of the kinds of approaches that will be needed in the coming years to repair decades of abusing nature." (70)

43 "Obviously this recommendation was made with great courage because it goes against the mythic sanctity of cattle ranching long held in the West. There is no doubt that this proposed alternative will generate a great deal of flack... I am writing to endorse your bold stand. Please do not back down and appease a minuscule special interest, namely welfare ranchers. This decision represents a victory of common sense over entrenched habitat destruction. Not only was the proposed alternative the proper one, but more like-minded decisions should be made on this country's public lands." (71)

44 "I am particularly disturbed to read in the Capital Press that Rep. Bob Smith is trying to get Mr. Reiswig transferred as a result of his attempts to finally improve Hart Mountain for wildlife. I will do all I can to stop these efforts to remove good management when in conflict with the interests of a few Oregon ranchers." (72)

45 "Let me extend congratulations and thanks for being so bold as to actually utilize sound science in making a policy choice. For too long the cattle industry has roamed unchallenged across the eastern part of our state." (82)

46 "I would first of all like to compliment you for having produced a quality document which is logical, allows easy comparison of the alternatives, and leads to conclusions which are scientific rather than political... While I understand that you are located in the midst of "cattle country", and that your local citizens are probably going to lobby hard for Alternative B, I also recognize that all over this country people are being forced to make adjustments stemming from the excessive strains on our natural resources which have resulted in fewer logs, fewer fish, less water, and yes, less good quality public grazing land. You must strongly resist any economic impact arguments which deny reality, make the situation worse, and only postpone the inevitable need for change." (86)

47 "While this alternative is certain to be unpopular with ranchers, and may even inconvenience hunters and possibly even people like me, who visit the refuge to observe and photograph the wildlife, it is obvious that bold steps must be taken to not just preserve but restore valuable natural ecosystems." (92)

48 "It is refreshing to see a plan proposed that has the best interest of the native species, and the land itself, not special interests at heart." (93)

49 "I recognize there will be opposition. I do not want to destroy the small cattle rancher. But when cattle destroy the land, everybody - including the cattle rancher - loses. Due to poor past practices a few will be hurt for the good of all. The other alternatives - more will be hurt for the short-term good of a few." (128)

50 "The O'Keefe Ranch has grazed on Hart Mountain since the early 1940's, my dad couldn't recall the exact year he first took cattle there.

I intend to comment on the DEIS that has been issued for Hart Mountain's 15 year management plan. Please realize that these comments come from someone who has worked closely with the EIS team from the start of the process. With the exception of one evening workshop on camping, I participated in every part of the EIS Process that was open to the public. These included Scoping sessions, on-site workshops and refuge open house review of the DEIS. I served on a liaison committee that the Chamber of Commerce appointed to increase community involvement in the EIS process. The committee spent many hours working with refuge staff and reviewing information about the DEIS. Now that a DEIS has been published it is obvious to me that the grazing issue did not receive fair treatment." (206)

51 "From what I've read of this plan, it is very forward thinking and a refreshing honest look at the needs of the refuge." (230)

52 "In all of the draft management plans that we have reviewed in recent memory we have never been more favorably impressed than as with the plan for Hart Mountain NAR. It is commendable that the Refuge staff has chosen to emphasize the basic goals and tenets of the Refuge, namely the management of natural habitats in an integrated ecosystem management fashion. It is also commendable that the Refuge proposes accommodating public use requests to the extent possible and when it is consistent with these basic Refuge goals." (359)

53 "This also is the only draft environmental statement that I've seen (and I've seen many) that utilizes a scientific basis rather than "smoke and mirrors" to reach the preferred alternative." (483)

54 "Oregon Trout found the DEIS well organized and readable. The goals and objectives for the DEIS were clearly articulated. Further, the DEIS complies with the myriad of procedural requirements detailed in the National Environmental Policy Act (NEPA) and its implementing regulations found in the Code of Federal Regulations (CFR). This is not a typical accomplishment for federal managers. The DEIS is well developed procedurally and substantively." (516)

55 "This is the technical continuation of my comments on the Hart Mt. Draft Environmental Impact Statement (DEIS). It should not be taken in any way as criticism of an excellent and comprehensive scientific effort and production of a very satisfactory NEPA document by Refuge staff... Alternative D is, on balance, an environmentally sound proposal based on thorough scientific research that may very well help habitat conditions on Hart Mt. Refuge reach their potential. However, like Refuge habitat, the DEIS itself is not up to potential. The Hart Mt. National Antelope Refuge is on the cutting edge of rangeland management in the Great Basin." (521)

56 "This plan seems rather asinine and ill-planned." (533)

57 "While much of the material is certainly scholarly and comprehensive (perhaps too comprehensive for the purpose, losing the reader in the process), it also introduced concepts that are questionable if not highly outrageous." (603)

58 "OWF, by these comments, formally requests that Bruce Babbitt or his appropriate agent reward the Refuge staff for its superb work on this DEIS. OWF suggests grade level increases, step increases, or one time incentive awards for all staff. The size of each employee's award should depend on the amount of time s/he devoted to the DEIS." (695)

59 "It is a joy to read the Hart DEIS. This is the first government public land/resource planning document I have read (of the dozens I've seen since 1987) which begins and builds from the proper (the truly reasonable and responsible) aspect--the issues surrounding and integral to healthy landscapes and native species existing as

interrelated and interdependent communities influenced by climate, soil, topography, etc.! Thank you for the opportunity to review such a refreshingly hopeful planning document." (732)

60 "I commend the DEIS planning team for considering and presenting the most "reasonable range" of alternatives I have ever read in a government planning document. I commend the team also for the actual discussion of environmental impacts associated with the alternatives presented. I had become accustomed to reading plans which focused more on the forage and water needs of cattle, then on the environmental effects of domestic livestock grazing upon native species and their habitat and life cycle needs. Thank you." (732)

61 "I also found the table and charts very helpful. And was impressed with not only the scope, but the quality of the literature cited. The glossary appears adequate--I did not spend as much time with that section as I could have." (732)

Response. Comments noted.

Comment

62 "I think, that while the EIS is couched in scientific terms, it is written by human beings and these people are subject to many pressures and biases. It is my feeling that the preferred alternative was not chosen because it had the best scientific support or because it represents the best management, but that it was the most legally defensible option. It must be realized that the environmental groups that profess high ideals and lofty causes must threaten or file law suits to generate publicity. This keeps the donations (income) coming in. So, for the Fish and Wildlife Service to arbitrarily discard one admittedly special interest group, the ranchers, who have shown high regard for Hart Mountain over generations and who have years of experience and an ever expanding knowledge with the ability to implement livestock grazing as a tool for forage management and yes, riparian improvement, in favor of any other special interest group whose financial interests are being furthered by this controversy, is bad refuge management and shows a lack of organizational courage." (601)

Response. Alternative D was selected by the Service as the Proposed Action because it would make the most progress toward resolving core problems, and reaching long-range objectives, and ultimately, Refuge goals. The Proposed Action is the most ecologically defensible alternative outlined in the EIS. Because the Proposed Action would best comply with authorities that direct management of NWRs, Hart Mountain NAR in particular, it also would be the most legally defensible option.

Comments

63 "It is quite evident to this writer that the DEIS in design and format is more of a radical environmentalist "wish list" than a fair coverage of a highly charged issue. It does speak well for the lack of intelligence and uncompromising dictation of terms by the hired hands the tax payers have employed to present an "unbiased" observation. Further, it demeans the abilities and dedication of those who have spent generations and lifetimes in establishing a workable solution in a cooperative manner for a sustainable multi-use in, at best, a difficult climate and terrain." (603)

Response. We in no way wish to demean the families and individuals who have worked to produce food in the harsh terrain and climate of southeastern Oregon. The proposal outlined in Alternative D should not be taken as a condemnation of ranchers. The EIS does not evaluate whether livestock grazing is a viable use of the land in southeastern Oregon. It does, however, present what the Service believes to be the best possible way to manage wildlife on a National Wildlife Refuge in the northern Great Basin. The Service is a dominant use agency, and at this time we do not feel that there is a workable solution to maintaining a livestock program on Hart Mountain NAR, given Refuge goals, legal mandates, and condition of the Refuge. We are in agreement that livestock grazing systems can be designed and implemented such that watershed conditions can improve. However, we also maintain that watershed health would improve most rapidly on the Refuge without cattle. Additionally, cattle grazing would not be an effective way to manage for native wildlife communities on the Refuge, and conditions created by cattle grazing can adversely affect some species of wildlife that inhabit the Refuge. Again, we fully recognize that livestock grazing systems can be adjusted to minimize impacts to wildlife.

Comment

64 "There is vague reference to changing, lots of charts, but no interpretation of data." (605)

Response. We disagree. A tremendous amount of data was summarized and interpreted in Chapter 3 and Appendices B, D, F, H, I, and J of the DEIS.

Comments

65 "This Proposed Management Plan is no more than a, one place in time, "fairy tale editorial" and collection of select information about a select subject. Hopefully someone somewhere will realize this and instill some common sense and actual Natural Resource Management, for the good of the ecosystem and the species, including Man." (730)

66 "Our ranch is particularly concerned with the CMP-1993. From the original scoping process, this plan has not been well thought out, and is certainly not an integrated document for the best interest of the ecosystem. We are neighbors, and permittees on the refuge and do not feel this historic interaction has been considered. Cattle and antelope are compatible and the management for each, in cooperation with the other is beneficial. Our ranch is the home of many antelope year round; and many of the antelope graze and water and LIVE on both sides of the fence." (731)

Response. Many animals of the Refuge spend time off the Refuge on other lands including private property and BLM lands. A number of migratory birds spend winters in other countries. As such, Refuge wildlife depend on the integrity of the people managing these other lands. The Service especially appreciates the efforts of private landowners that manage their land in an ecologically sensitive manner and efforts of those that go out of their way to ensure quality habitat for wildlife.

Contrary to the opinion of the writer, the Proposed Action was designed specifically to provide the most benefits possible to the ecological system within the Refuge's borders as a means of managing all wildlife native to the area. We recognize that cattle can be incorporated into a plan that has as its basis an ecosystems approach to management. However, whether cattle are included in such a plan depends on goals and objectives. Based on Hart Mountain Refuge goals and objectives, there is not a need for cattle during the next 15 years of management. Inclusion of cattle into Hart Mountain NAR's plan would work against habitat restoration efforts and negatively affect some wildlife.

Comment

67 "The cursory review I have given this EIS revealed a convincing display of verbosity and appendices. Also there are inaccurate and obviously biased ecological concepts and citations from related published papers. My evaluation suggests that the credibility of the team preparing this EIS is highly questionable. Some of the theses presented by the Team are not consistent with the contemporary rangeland research nor realistic in respect to what actually occurs out on the land. I suspect this Team consisted of a group of very inexperienced academics." (807)

Response. Examples of concepts and citations to which the above comment refers, and the Service's response, are forthcoming (please refer to comments 194, 201, 321, 460, and 481).

CONCEPTUAL FRAMEWORK

General Comment

68 "Since the proposed action is a fifteen-year management plan, the Final Environmental Impact Statement (FEIS) should be an exemplary multipurpose document, serving as both an educational and research model that informs the public and as a source of fact and scientific analysis that inspires other refuges (and agencies) addressing similar habitat concerns. There is currently too much material crucial to habitat management left to gather dust as unpublished Refuge files or as inaccessible, short-lived oral traditions. If ten years from now present management has moved on, how shall we know the intended specifics of the plan if it is not spelled out now? Other Great Basin land manager trying to follow the Refuge's lead may lack the knowledge and experience of your staff. The FEIS is the place to pull together all relevant information supporting the preferred alternative and put it down it coherently This is certainly necessary in any event to satisfy the NEPA process. There is an urgent need to begin the habitat restoration program, and therefore a need for an FEIS that is not only immune from substantive appeals but is also destined to succeed as a comprehensive management plan (CMP)." (521)

Response. Comment noted.

Comment
69 "Alternative D the Proposed Action is based on four premises. In brief they are:
1) Fire is the dominant historical influence on habitat.
2) Herbivores played a minor role historically.
3) Livestock would slow habitat recovery.
4) For wildlife to benefit from grazing, habitat must be in good condition.
One of these is arguably true. One is no longer as valid as it was in pre-settlement times and two are totally unsupportable.

The first premise, that fire was the dominant disturbing factor is true, however, fuel loads have built up from 100 years of fire suppression, this along with the presence of invading exotics such as cheat grass, means that fire doesn't always yield the results it did in pre-settlement times. Yet this change in fire regime is not adequately dealt with in the DEIS.

The second premise, that herbivores played a minor role is probably true for the last 8,000 years. Before that there were dog sized horses running around, along with elephants and bison. They must have been eating something. But still, 4,300 AUMs annually on a 275,000 acre refuge is also a minor influence. Yet, it would allow habitat manipulation on a site by site basis in ways unachievable through fire.

The third premises, any livestock use would slow habitat recovery. Nowhere was any evidence cited that a low intensity, well prescribed grazing program would inhibit habitat recovery, only evidence involving intensive grazing was cited.

The fourth premise, possible benefits to wildlife from the use of livestock grazing depend on habitats being in healthy condition. In spite of what has been reported in The Oregonian habitat conditions on Hart Mountain are largely in very good shape. But even if that was not true, practices like removing coarse, old growth from meadows to allow Sage grouse access to tender high protein forage benefits wildlife regardless of the condition of the habitat." (206)

Response. We agree that fuel loads are likely quite different than what they were prior to fire suppression, and that cheatgrass adds a difficult hurdle in burning some areas of the Refuge. These factors makes it necessary to control fires through prescription, as opposed to allowing all wildfires to burn without restraint. A Fire Management Plan is currently being developed for the Refuge; it will provide additional details on the prescribed burning program.

Herbivores that existed prior to 8,000 years ago are not of concern to Refuge management. Of concern to Refuge staff are processes that influenced wildlife communities up to Euroamerican settlement and introduction of domestic livestock. We agree that removal of 4,300 AUMs spread evenly over 275,000 acres would exert a minor influence on the Refuge, assuming that no other effects would take place other than the light clipping of plants. However, most of the use would be concentrated within about 5-15% of the Refuge, primarily in riparian areas and other wetlands (e.g., Big Flat). During the next 15 years, there will not be any need for habitat conditions created by cattle grazing.

Regarding the third premise, the writer stated that "nowhere was any evidence cited that a low intensity, well prescribed grazing program would inhibit habitat recovery..." Prior to allowing cattle on the Refuge for commodity purposes, the Service would, among other requirements, have to determine that the practice would not hamper the recovery of native habitat conditions. We are unaware of any low intensity, well prescribed grazing programs that would allow habitat to recover to the degree called for in the Refuge goals and long-range objectives. The preponderant evidence suggests that any amount of cattle grazing will have impacts. Without evidence to the contrary, the Service has no other alternative other than what has been proposed in the Proposed Action.

Comment
70 "Vol. 11, Appendix I-5, second paragraph - "in good ecological condition..", what is it? It, "..good..", could mean any one of a variety of ecological conditions depending on the value one places on the benefiting species. We suggest you define "...good ecological condition..." " (657)

Response
Response. The reference to "good" ecological condition in Appendix I was in reference to pronghorn habitat. Appendix I of the FEIS has been revised.

Comment
71 "The "Plan" may be better termed "Long Range Goals" as it is now written. A plan would contain more site specific accomplishment objectives etc. Such as specific acres to be burned; specific miles of road to be obliterated; specific water holes to be improved etc. by 5 year increments. A plan would also contain budget

requirements for the specific accomplishment objectives. We urge you to give us at least a 2 or 3 page outline of a management plan in the final document. Such a plan makes it much easier for citizens to support your struggles to obtain adequate funding. It also gives us performance criteria against which to judge future refuge administrations." (736)

Response. A comprehensive management plan, as described in USFWS (1992c), identifies Refuge goals and objectives, and management strategies to reach these goals and objectives. Shorter term (3-5 year), operation plans will describe specific management activities, tasks, and other actions and schedules for implementation of management strategies outlined in a comprehensive management plan. This level of detail, however, is beyond the scope of this EIS. These plans will be available from the Refuge manager upon request. Cost estimates for implementing each of the alterantives has been added to Chapter 2 of the FEIS.

Comment

72 "Management for the listed preferred species should provide suitable habitats for maintaining biological diversity." (540b)

Response. A key species approach is one option for managing biological diversity. Although the Service is not proposing such an approach, monitoring of key species would be part of the strategy. On a limited basis, some components of the habitat (e.g., waterholes) would be managed primarily for particular species (e.g., pronghorn. Therefore, the approach proposed by the Service incorporates some of the concepts of a key species approach. The Service is proposing an approach aimed at producing and maintaining the range of habitat conditions under which native wildlife commuities evolved. Our understanding of pre-settlement habitat conditions on the Refuge is greater than our understanding of the specific needs of key wildlife species, how to produce and maintain these conditions, and how it will affect the remaining 299 vertebrate wildlife species on the Refuge. An ecosystems approach, we believe, provides the best chance of maintaining healthy populations of all wildlife native to the area. The focal point of such an approach is to resolve the root causes of problems that interfere with achievement of Refuge goals.

Comment

73 In regard to Alternative D, "restoration in drier habitats will likely take longer than 15 years" " (540d)

Response. We fully agree with this assessment. This is one of the reasons why long-term objectives (50-200+ years) were developed instead of 15-year objectives.

NEPA COMPLIANCE

General Comments

74 "I got mad four years ago. Some of you just got mad tonight. But four years ago when this nonsense started, they called scoping meetings. Well-documented meetings. Very sterile. They divided these people up into little groups, but you couldn't discuss a damn things, but we could put em on stupid lists on blackboards. What we ought to have had was this kind of discussion then. We ought to have had a big open forum. What do people want to do and why do we want to do these things." (802)

75 "On the bright side, the Alternatives Chapter is fairly good." (746)

Response. Comments noted. Please also refer to comments 90, 91, and 92.

Comment

76 "The fairness of the process used by the Federal Agency involved at Hart Mountain is being seriously questioned by those who have sought to seriously participate in the development of the plan for the future use of the mountain. The arguments in support of the preferred alternative, which seriously restricts or eliminates all uses on this 275,000 acre refuge except the nurture of antelope, ring false and hollow in the face of the arguments presented by the participants in the hearing process utilized by the Commissioners, as well as the considerable body of scientific evidence brought forth in the attached record." (808)

Response. Alternative D (Proposed Action) is the alternative that the Service believes would best fulfill its statutory mission.

Comment

77 "The comment period allowed is gravely deficient for if a person wants to disprove the contents of the DEIS, or to provide new or additional information, that person would have to be a professional in land or wildlife management with years of experience, reference materials, and data available at his or her fingertips and spend the majority of their waking hours assimilating a credible response. A common person has absolutely no chance of providing comment since it would take months of research and dozens, if not hundreds, of requests for specific information from agencies and individuals. Responses from them would be a slow and tedious process. Those with the knowledge to give work, on the most part, for state and federal agencies; their responses would be tailored to their established biases or to mitigate reprisals from their superiors. It is obvious that the DEIS "system" is specifically designed to eliminate the common man, and the community from comment. Simply put, the DEIS is a battle of degrees, whether in biology or law, and are simply nothing more than graphite exercises specifically designed to appease the radical environmental groupies." (795)

Response. The amount of time for public comment on the DEIS was consistent with the NEPA process regulations contained in 40 CFR § 1506.10(c), which requires a minimum of 45 days for public comment on a DEIS (Department of Interior policy requires a minimum of 60 days). Public comment was invited as provided in 40 CFR § 1503.1(a)(4). The Service has made diligent efforts, as outlined in 40 CFR § 1506.6, to involve the public.

Comment

78 "On page 22, in the Alternative Development section, the draft EIS states, "...some of the adverse effects that could result from implementation of the management plan have been minimized by including mitigation measures into the alternatives themselves." Although this type of organization is acceptable under NEPA, the draft EIS lacks a sound, definitive mitigation discussion. Mitigation measures associated with burning and other vegetation treatments, in particular, are not made clear in the Alternatives section.

A comprehensive discussion of proposed mitigation for direct, indirect and cumulative impacts is required by the CEQ Regulations for Implementing the Procedural Provisions of NEPA. The CEQ regulations state that an EIS should include the means to mitigate adverse environmental effects (40 CFR 1508.7). Judicial review of NEPA cases have supported not only the need for identifying mitigation measures, but for discussing mitigation effectiveness as well. Mitigation effectiveness is determined by using a monitoring procedure designed to compare baseline data with existing conditions.

As an example, in Appendix J, page 3, there is a detailed and informative discussion on the methods of vegetation treatment and their effects on soils. In this section, it would be helpful to include an explanation of mitigation measures associated with the various types of vegetation treatment (i.e., mowing and chopping, chaining and railing, and disking and plowing). With this additional information, EPA can get a better picture of how soil disturbances will be avoided, minimized or mitigated." (32)

Response. A more comprehensive discussion of proposed mitigation has been incorporated into chapters 2 and 4.

Comment

79 "By law, Environmental Impact Statements are required to consider the most current and credible information available at the time of EIS preparation. I submit the following sources of information which I believe was ignored in the preparation of the DEIS...

Information Sources:

Holistic Resource Management; Allan Savory; Island Press; 1988

Vision Statement: Toiyabe Watershed and Wetlands Management Team; Toiyabe National Forest, Austin Ranger District, Austin, Nevada." (600)

Response. Thank you for providing these references. We applaud Savory (1988) for his recognition that land management equates to process management; and that successful management depends on clear articulation of goals, identification of weak links, and a holistic view of the land and organisms being managed. Alternative D of the FEIS fits well with the general principles of the holistic resource management model developed by Savory (1988); many similar procedures were followed. However, because the EIS was not developed using Savory's planning process, a complete overlap of the components outlined in his model (Savory 1988:5) cannot be expected.

The only major deviations from Savory's (1988) holistic resource management approach seem to be the non-use of livestock in an semi-arid environment and the use of fire. Grazing by large mammals played a limited role in shaping habitat in the northern Great Basin before the introduction of domestic livestock (Mack and Thompson 1982, Young et al. 1976). As such, grasses in this region are less resistant to grazing than grasses that evolved under heavier grazing pressure (Mack and Thompson 1982). On the other hand, periodic fire historically had a major influence on northern Great Basin habitats (Kaufman 1990). Wildlife are a product of the habitat which is a product of processes (e.g., fire, grazing). As such, native wildlife communities depend on native processes (e.g., fire) and may be adversely impacted by non-native processes (e.g., type of cattle grazing promoted by Savory). This should not be taken as a statement against the use of Savory's methods in managing other lands with objectives that include cattle production.

Dayle Flanigan of the Austin Ranger District, Toiyabe National Forest sent, upon request, a 5-page copy of the Goal Statements and Five Year Plan of Action of the Toiyabe Watershed and Wetlands Management Team. This material has been reviewed.

Comment

80 "Finally, before an alternative is selected, all resource data needs to be collected, analyzed and interpreted. The bias needs to be removed from the report." (605)

Response. Data collection for the EIS was completed in 1992. This data has been analyzed and interpretted. Information from previous data collection efforts, including soil surveys, has been evaluated and was incorporated into the planning process. Although soils information was used extensively during development of the DEIS, the sources of which were appropriately cited in the DEIS, we regretfully provided inadequate information on Refuge soils in the DEIS.

Comment

81 "There is no evidence of a multi-disciplined resource committee having collected the data and reported on it; Range Conservationists, Foresters, Soil Scientists, Soil Conservationists, Botanists, Economists should have been involved. The socio-economic, cultural factors and quality of life must be studied and impacts mitigated along with the effects on the wildlife.

The Lakeview SWCD [Soil Water Conservation District] Board of Directors strongly recommend the current EIS and Management Plan be revised by a Multi-disciplined Team. The new EIS and Management Plan should then go through the review process again." (605)

Response. The DEIS was developed by a Interdisciplinary Team (IDT) as required by NEPA. The IDT was comprised of Refuge staff in the disciplines of wildlife and habitat, public use, livestock grazing management, and fire management. These were identified in the List of Preparers section of the DEIS. We mistakenly did not identify the economist that did the socio-economic impact analysis (Appendix L, DEIS) as part of the IDT. This has been corrected in the FEIS. The official title of the person that was in charge of the livestock grazing program for the Sheldon-Hart Mountain Refuge Complex during the development of the alternatives is 'Fish and Wildlife Biologist'. His background, however, is Range Conservation; he was a Range Conservationist for BLM prior to working for the Service, and now is employed with the BLM as a Range Conservationist. The Complex Biologist has a minor degree in Range Management. Additionally, Jim Yoakum, who provided substantial input during the planning processes, has had extensive experience in the area of livestock grazing/wildlife relationships. Information also was received from Oregon State University's (OSU) Department of Rangeland Resources, and this information has been reviewed. Several faculty from OSU's Range Department attended a number of meetings on the Refuge (please refer to Chapter 5 of the FEIS), and the information that they presented has subsequently been evaluated. Because of the controversy that the DEIS generated in regard to the livestock grazing issue, the Service solicited comments, from two professionals experienced in livestock grazing management regarding the treatment of livestock grazing in the DEIS. Please also refer to comment 99.

Comment

82 "A management plan with the proposed alternative in the HMNARCMP could be considered a change of land use. Under the LCDC rules and regulations of the state of Oregon, should adjoining land owners be considered or notified?" (703)

Response. Changes in zoning are currently not being considered for Hart Mountain NAR.

Comment

83 "...the proposed action is poorly identified - it's called the preferred alternative and the reader has to search through the document to find it since its not obvious from any heading or subheading." (746)

Response. The FEIS was revised to reflect that Alternative D is the proposed action. Alternative D is identified as the proposed action in various locations of the document, including the Table of Contents.

Comment
84 "...the No Action alternative is poorly identified. Its called the "Baseline Management" alternative in the document and again the reader must search for it." (746)

Response. The FEIS was revised to reflect that Alternative A (Baseline Management) is the no action alternative. Alternative A is identified as the action alternative in various locations of the document, including the Table of Contents.

Comment
85 "...there is no Cumulative Analysis." (746)

Response. A Cumulative Impact Analysis was added (please refer to Chapter 4 of the FEIS).

Comment
86 "...there is no comparative Summary of Impacts in the Alternatives Chapter. There is a discussion of comparative impacts (but not a matrix) in the Environmental Consequences Chapter." (746)

Response. The Summary of Impacts of Alternatives section was moved from Chapter 4 of the DEIS to Chapter 3 of the FEIS.

Comment
87 "...quantification is poor. There is some quantification but not as much as the Alternatives Chapter facilitates." (746)

Response. Because habitat management strategies proposed in each alternative are not site specific (they are specific to vegetation types), a more detailed quantification would not be possible.

Comment
88 "...issues are generalized. We find such issues as 'wildlife', 'habitat', 'recreation opportunities', 'local economy'." (746)

Response. Issues are described in more detail in Section Three of Chapter 1.

Comment
89 "...the analytical development is poorly done. Analysis tends to be conclusionary and lacks specification." (746)

Response. The comprehensiveness of the EIS and vast expanse of land did not facilitate site-specific evaluation of impacts.

Comment
90 "The Draft Environmental Impact Process and the Final Environmental Impact statement which will ultimately result from it are both mandated and controlled by the National Environmental Policy Act of 1969, 42 USCA §4321-61, (NEPA). The Act specifically provides in §4331 that

> "it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans". (emphasis added)

This statement of policy, which must guide the Fish and Wildlife Service in these proceedings is nearly identical to the policies which Congress has enacted to guide other federal agencies in their land use and management activities. Thus the Federal Land Policy and Management Act, 43 USCA §§1701-84 at §1712(9) requires the BLM when developing land use plans applicable to the lands under its jurisdiction to

> "coordinate the land use inventory, planning, and management activities of or for such lands with the land use planning and management programs of other Federal departments and agencies and of the

States and local governments within which the lands are located"..."and shall provide for meaningful public involvement of State and local government officials, both elected and appointed, in the development of land use programs, land use regulations, and land use decisions for public lands, including early public notice of proposed decisions which may have significant impact on non-Federal lands".

Similarly, The National Forest Management Act, 16 USCA CC 1600-14 at C 1604, requires the Forest Service, in the management of the lands under its jurisdiction to:

"develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System, coordinated with the land and resource management planning process of State and local governments and other Federal Agencies".

Two things are clear from the record compiled by the Commissioners of Lake County in this case. First, the Commissioners provided a forum for local citizens to comment and discuss the DEIS which has been prepared by the Federal Fish and Wildlife Agency, since the citizens felt that the comment process provided by the agency was inadequate and unfair. Second, the Commissioners feel that the clear intent of Congress is that local government officials be consulted and efforts be made to coordinate the plans, processes and interests of local governments in all federal land management decisions, including those impacted by the NEPA process." (808)

Response. As directed by CEQ Regulations, the Service has interpreted the provisions of NEPA "as a supplement to its [the Service's] existing authority and as a mandate [has viewed] traditional policies and missions in the light of the Act's national environmental objectives..." (40 CFR §1500.6). In addition to section 101(a) of NEPA (first quote above, §4331), NEPA also directs that "[t]he policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies" (section 105). The Service, to our knowledge, has complied with Service policy, legislation, and other authorities that direct planning and management of NWRs. Within this framework, the Service also has complied with NEPA and associated CEQ Regulations. The Federal Land Policy and Management Act and the National Forest Management Act do not direct management of NWRs.

The Service thanks the Lake County Board of Commissioners for providing a forum for public comment in addition to the seven open house meetings provided by the Service. The Commissioner's Special Meetings were attended by 62 people, 33 of which commented. The Service meetings were attended by 47 people. Comments received during the Commissioner's Special Meeting have been addressed (this Appendix).

In regard to the second point raised in the above comment, we agree that the intent of Congress, as interpretted by the Council on Environmental Quality (40 CFR §§1500-1508), is for Federal agencies to solicite participation of local agencies (40 CFR §1501.7(a)(1)). The Service has adhered to this regulation. CEQ Regulations also direct that an EIS "shall include discussions of... [p]ossible conflicts between the proposed action and the objectives of... local... land use plans, policies, and controls for the area concerned..." (40 CFR § 1502.16(c)). Additionally, CEQ Regulations direct that EISs "shall discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned). Where an inconsistency exists, the statement should describe the extent to which the agency would reconcile its proposed action with the plan or law." (40 CFR §1506.2(d)). This was not done for the DEIS, but has been included in the FEIS (Chapter 4, Section Two). CEQ and NEPA do not direct Federal agencies to comply with local land-use plans if such actions would conflict with statutory requirements of the particular Federal agency.

Comment

91 "One area of major concern is the procedure which has been followed in development of the Draft Environmental Impact Statement.

The scoping meetings and the open houses did not provide adequate, meaningful opportunity for local comment. There has never been a public hearing or public meeting at which time a room full of people could discuss the issues of Hart Mountain. And upon review, it appears most local and scientific input from outside the agency, or contrary to pre-conceived plans of the Agency, was ignored." (808)

Response. We regret that the Board of Lake County Commissioners perceive the meetings provided by the Service to have been insufficient. The two scoping meetings at the outset of the planning process and seven open house meetings following the release of the DEIS were held in accordance with procedures outlined in CEQ Regulations (40 CFR §§1501.7(b)(4) and 1506.6(c)) and Service policy (30 AM §§3.9B(4)(b), 3.9B(4)(h), and 3.9E). Additionally, the Lake County Board of Commissioners held two meetings during the public comment period to solicit comments from Lake County residents. These comments were compiled and submitted to the Service, and are included in this Appendix. All input from local residents and professionals were reviewed and evaluated by the Service.

Comment

92 "The Lake County Commissioners know the U.S. Fish and Wildlife Service is active on most fronts building bridges and developing partnerships with private landowners and local governments to deal with Threatened & Endangered Species issues. But in Lake County the Refuge is doing more to destroy any credibility the U.S. Fish and Wildlife Service has built than you can hope to repair for generations.

In Lake County at this time there are at least two (2) areas where a cooperative effort is under way with the Service. One is the Goose Lake Basin and effort to aid recovery of certain fishes found there. The other is Warner Valley and the Warner Valley sucker.

If you continue on the course you are following it is only evident the Service is managing the Refuge at the direction of outside interests. You need the support and involvement of Lake County and its citizens to be successful." (808)

Response. We applaud the efforts of Service personnel, other agency personnel, and Lake County residents that are working in cooperation on recovery projects. However, the Service personnel to which the comment refers are in the Ecological Services division of the Service, and are working on private lands and lands administered by other agencies with different legal statutes (e.g., multiple-use mandates) than those directing the management of NWRs. The NWRS is under a different branch and division of the Service than the Ecological Services Division. Refuge managers (in the Refuges and Wildlife division of the Service) manage lands that are administered by the Service, which are administered under a dominant-use principle . Hart Mountain NAR is to be managed first and foremost for wildlife, and thus options for management are much more restrictive as compared to other lands.

PUBLIC INVOLVEMENT

General Comments

93 "Since Hart Mountain was created by the Order of the Antelope and individuals in Lake County that did have vision for the future, I firmly believe the majority of the citizens of Lake County should have a stronger voice in what goes on our beloved Hart Mountain." (44)

94 "The land that makes up most of the High Desert around Hart Mountain is public land. That means everyone in the United States has a say in what goes on." (562)

95 "Several of the critical sites on the Refuge referred to in the study is on Lake County land. The Fish and Wildlife should use some common sense and ask for help from the County instead of calling our County Commissioners and Lake County residents names." (788)

Response. Comments noted.

DOCUMENTATION/USE OF SUBMITTED INFO.

General Comments

96 I'm beginning to think that we have too many people that are listening to the 'Animal Activists' and interpreting the research differently than the rest of us." (44)

97 "I had a fellow that worked for the Fish and Wildlife Department. He's now around I'd say 85 years old. I had him in here a couple days ago. He was the maintenance man, worked on Hart and Sheldon for his whole life. Retired as the maintenance man from the Sheldon. I had him in the other day and I think he put things pretty appropriate. He said, "You know". He said, "When I worked for the Fish and Wildlife, I used to think I was employed by the people." And he said, "It's not that way anymore." I guess that can mean quite a few things, but I don't feel that there's been an impact statement put together that is really the wish of the people. I haven't seen in writing or any other view that the input that has been taken so far really supports what is being brought forth in that environmental impact statement. As a democratic society, I think that is kind of a sad state of affairs. I would like to think that the people really have some say so and I don't think that is really happening here." (791)

Response. Comments noted.

Comment

98 "This response is directed to you [Bruce Babbit, Secretary of the Interior] because the scoping process and input from the citizens of Lake County has, to this point, been disregarded by those formulating the management plan for Hart Mountain.

The management plan lacks these considerations: 1) Historical data has not been utilized; 2) The existing Lake County plan is completely ignored and some of the management considerations are in violation, i.e. wilderness study areas." (66)

Response. Input from Lake County residents was not disregarded. In particular, the Service did not ignore input from Lake County residents that promote the continuation of cattle grazing (primary issue at hand) on the Refuge. The Service simply does not agree that cattle grazing should continue on the Refuge during the next 15 years. The wilderness area issue is discussed below.

Historical data was used extensively in the evaluation of current habitat conditions and how they relate to past conditions on the Refuge (recent and pre-settlement history). Please refer to comment 266 for further discussion.

The Final EIS has been revised to identify areas where the Proposed Action conflicts with Lake County's Interim Public Land Management Plan (LCBC 1992), and to provide a discussion on the extent to which the Proposed Action would conflict with the Plan (refer to Section Two of Chapter 4). CEQ (Council on Environmental Quality) regulations dictate that NEPA documents shall include discussions of possible conflicts between the proposed action and local land use plans (CEQ § 1502.16(c)). "Where an inconsistency exists, the statement should describe the extent to which the agency would reconcile its proposed action with the plan or law" (CEQ § 1506.2(d)). NWRS Policy (FWM 602 and 610 FW 2.1) directs that all NWR lands and waters be reviewed for their wilderness potential during the comprehensive management planning process.

Comment

99 "The plan as presented does not utilize the expertise of credentialed range and wildlife managers from the U.S. Fish and Wildlife Service, Oregon State University and Oregon Department of Fish and Wildlife." (66)

Response. We disagree. The Interdisciplinary Team (IDT) includes six wildlife professionals (Service employees). Additionally, Tim Cummings of the Lower Columbia Fishery Resource Office (Service) reviewed and discussed alternative strategies being considered, prior to completion of the DEIS. Dr. John Crawford of Oregon State University's Department of Fish and Wildlife Science provided valuable input. Larry Conn, Gary Anderson, and Pam Dupee of Oregon Department of Fish and Wildlife (ODFW) reviewed and discussed alternative strategies being considered, prior to completion of the DEIS. They also provided technical assistence. Pam Dupee and Kim Jones (ODFW) evaluated current stream habitat conditions on Rock and Guano Creeks. In addition to representatives from organizations listed by the commenter, Jim Yoakum (retired BLM biologist) has worked very closely with the IDT in the planning process as a consultant. Also under contract is Dr. David Dobkin (ecologist) of the High Desert Ecological Research Institute. He headed-up a riparian bird/habitat study for the Refuge, and provided assistance to the IDT during planning. Additionally, Chris Maser (co-author of *Wildlife Habitat of Managed Rangelands - Great Basin of Southeastern Oregon*, under contract to the Service, reviewed and commented on portions of the DEIS (Refuge files).

In terms of the range profession, the Interdisciplinary Team (IDT) included two Service professionals that have range management backgrounds (former BLM Range Conservationists) and two IDT members that have minor degrees in range management. Jim Yoakum, who has been heavily involved in the planning process under contract to the Service, has extensive experience in livestock grazing-wildlife relationships. He is a retired BLM biologist. Several faculty members of OSU's Department of Rangeland Resources were involved in the NEPA process (e.g., Dr. William Krueger, Dr. John Buckhouse, and Dr. Thomas Bedell -- refer to Chapter 5 of the FEIS). Their input has been reviewed. Dr. John Crawford of Oregon State University's Department of Fish and Wildlife (refer to Chapter 5 of the FEIS) has a PhD in Range and Wildlife Management and has worked extensively in rangeland habitats. Based on comments received during the public comment period for the DEIS, the Service had two professionals with experience in livestock grazing review the portions of the document dealing with livestock grazing management. Additionally, two range conservationists of the Lakeview BLM District Office also reviewed and made recommendations on Alternative B's grazing program as outlined in the DEIS. Their input was considered during the development of the FEIS.

Comment

100 "A concern I had as I read the Draft EIS, and this concern was shared by Dr. Krueger as well, is that while there are a number of maps, a huge number of tables and pictures in the Draft EIS, some of the existing work

that was done by William Anderson and David Franzen over a period of time out here on the Refuge has not been incorporated to the degree that I would like to see it in the Draft EIS. I know that Anderson and Franzen have a complete set of range sites which are ecological configurations that they have mapped the entire Refuge with. In addition, there are soils maps that are very detailed as opposed to a sort of one paragraph comment about soils being important. Then there are ecosystem maps that Franzen and Anderson did as well. What I'm suggesting is some of this old data, and I recognize that Franzen and Anderson's work goes back over a period of about 20 years, some of this old work is very, very well done. It makes good sense to me that as one as [___?___] future should take us, that we don't throw the baby out with the bath water as we look at our resources and our evaluations of those resources over a period of time. It makes a lot of sense that one would look at the old data and the ecological maps. Ecological maps are not going to change radically, at least not rapidly. They are probably still very valid and would be very, very useful." (787)

Response. Soils maps (USSCS 1993) were used extensively in the development of the EIS. The Service agrees that a more detailed discussion of soils (information used in developing the EIS) should have been included the DEIS. The FEIS has been revised accordingly (Chapter 3, section I, C).

Comment
101 "A strong argument could be made that the use of herbivory in habitat management works. The citations we have noted in this DEIS response are well researched and documented. These concepts were also clearly spelled out to Mr. Reiswig and Mr. Yoakum in letters and a report from the senior faculty of the Department of Rangeland Resources, Oregon State University, in 1991 (Appendix A). We see no evidence of those thoughts being incorporated in the DEIS." (205)

Response. We agree that a strong argument can be made for the use of herbivory in habitat management. However, the decision of whether to use it or to what degree depends on management objectives of the particular area being managed.

We disagree that thoughts from the senior staff of OSU's Department of Rangeland Resources were not included in the DEIS. Although the reports and letters may not have provided the sole basis for inclusion of concepts or strategies into the DEIS, many of the concepts they described are part of the document. For instance, Krueger et al. (1991) highlighted the importance of defining habitat objectives. Habitat objectives were outlined in Chapter 1, Section Two of the DEIS. Krueger et al. (1991) and Krueger (1992a) pointed out that the tendency is for plant communities to move toward dominance by shrubs. They also recognized that different succession stages are important to different species of wildlife. In light of this, Krueger (1992a) suggested that the fundamental basis of Refuge planning should be to maintain a mixture of succession stages by periodically reducing shrub cover. This principle forms the basis of long-range objectives. Chapter 1, Section Two of the FEIS has been revised to better explain the basis of long-range objectives for upland vegetation types. Krueger et al. (1991) assessed that pristine conditions would not be an automatic result of prescribed burning and that cheatgrass and other weeds are potential threats to Refuge habitats. These points were discussed in more detail in the FEIS.

Krueger et al. (1991) recommended the use of livestock grazing as a management option when it can be used to accomplish defined objectives. Krueger (1991, 1992a, 1992b), in corresponding with Yoakum (1991, 1992a, 1992b), provided evidence that cattle grazing can be used under some circumstances to delay the phenology of grasses and forbs. This information was incorporated into Alternative B's cattle grazing program; the description of the alternative was revised to more accurately depict specific recommendations. Chapter 4 and Appendix I of the FEIS provide assessments of the recommended applications of using livestock based on the extent to which they could be used to accomplish defined objectives.

Krueger (1991, 1992a) concurred with Yoakum (1991, 1992a) that cattle would not be practical for reducing shrub cover on the Refuge. They also agreed that excessive shrub cover was a major problem on the Refuge that limits wildlife diversity. Krueger (1992a) recommended the use of fire, and possibly herbicides to address the problem. The problem of excessive shrub cover is discussed in Chapter 3, Section One of the FEIS, and the importance of periodically reducing shrub cover is discussed in the Basis of Long-range Objectives section, Chapter 1, Section Two. Please also refer to Appendix I and J for further discussion.

Comment
102 "Large amounts of evidence supporting livestock grazing as a tool to manage wildlife habitat were submitted.

Some of the best of this evidence was submitted by the Range Department of OSU. This input was ignored by the EIS team. Since this issuance of the DEIS Dr. John Buckhouse and Dr. William Krueger have commented on the DEIS for the OSU Range Department.

Buckhouse and Krueger raise several points:
First, the DEIS dismisses the use of livestock as a tool, they go on to give four specific examples of how grazing could be used to manage habitat on Hart Mountain NAR. Scientific literature is cited supporting their assertions.

Secondly, they comment on the lack of an integrated approach to management of the refuge. Essentially, why eliminate tools that could prove useful?

Third, Buckhouse and Krueger point out that the botanical manual used in drafting this EIS was not written to pertain to this region.

Also they point out that just because some of the habitat problems on the refuge can be linked to past overgrazing it does not mean that future elimination of all grazing is the best way to deal with the problems.

Evidence supporting grazing that the EIS team didn't ignore they attacked, although rather ineffectually.

On one study actually done on the refuge, the EIS team disregarded it because the sample size was too small, no comment was made concerning the content or methodology of the study.

Another study was disregarded simply because it was "not substantiated" again no comment on the content or methodology.

At one point the DEIS states that a study was not substantiated in the Great Basin, of 388 pieces of literature being cited 53% were not done in the Great Basin. Yet the single time a work was faulted for not being done in the Great Basin it had to do with livestock grazing as a wildlife habitat management tool." (206)

Response. Again, we agree that cattle grazing, as any other process that results in changes to habitat, have potential applications in habitat management. Whether a particular procedure is used depends on the objectives at hand. Evidence submitted by OSU's Department of Rangeland Resources are discussed elsewhere (471, 471, 482, 484, 489, 491, and 497). The study that was conducted on the Refuge (Anderson et al. 1990a) was found to provide little information on the effects of livestock grazing on vegetation and pronghorn primarily because the "methodology" used in the study was innappropriate for the questions that were examined (refer to comment 460 for further detail). We are unclear as to which other study the writer of the comment referred.

The decision to use information contained in a particular study depends on many criteria, including (1) the region where the study took place, (2) similarity of habitat to those found on Hart Mountain NAR, and (3) wildlife species that were investigated, and (4) amount of information on the subject (if information is limited or non-existent for the Great Basin, information from other areas must be sought). Similarity of habitats depend on such factors as vegetative structure, dominant vegetation, composition of vegetation, and general climatic features. The only references to a "study" not being "substantiated in the Great Basin" that we were able to locate were in the Featured Species section of Chapter 4 for alternatives B and C. In each case, we stated that the application of preconditioning forage for [pronghorn and mule deer] has not been substantiated for the Great Basin. We are unaware of any studies that have examined the viabiliy and practicality of preconditioning herbaceous vegetation in upland habitats in the Great Basin. Support for the use of livestock for preconditioning herbaceous forage has been assertained in higher precipitation zones (Pitt 1986, Rhodes and Sharrow 1990; 40 inches and 100 inches per year, respectively), but Pitt (1986) warned that the extent of regrowth after grazing depends on the availability of moisture. Laycock and Price (1970) similarly reported that clipping may not increase total protein content in arid rangelands if soil moisture is low. Holechek et al. (1989) surmised that benefits from livestock grazing are questionable in the more arid and desert ranges. In addition, regrowth was found to occur after grazing by cattle in only two of five years at a study site near Fort Rock, Lake County which received 10 inches of precipitation per year on average (Hedrick et al. 1969). Nutritional quality of regrowth was not compared to ungrazed plants in this study.

Comment

103 "I don't feel the public interest is best served when only experts who say what you want to hear and listened to and the others are given no credence. I don't feel it is best served when the old-timers in the area are not listened to." (9)

104 "Although it was not unanimous the large portion of local input called for the refuge to continue with a well designed grazing program. The EIS team has disregarded local public input, turned it's back on 50 years of adding to the economic base of the county in a manner compatible with wildlife, to cater to the views of a small group of environmental radicals." (206)

105 "I attended the scoping meetings and I felt like the comments that I made there did not mean anything. I did not see any results from anything a lot of people said. They showed us some slides there, which seemed programmed. One slide they showed a guy on a horse and another slide was cattle. The guy on the horse

was in an area that there had not been cattle for about 10 or 11 years, until a year before and that is where they put me. It was programmed. I'm probably the only one there that knew the spot. They tried burning up there and that's where they pumped all their water. They had 25 pumper trucks turned around there and the film indicated that was damage done by the cows." (781)

Response. The Service, in accordance with NEPA and CEQ Regulations, has invited public comment, provided opportunities for the public to comment, and has evaluated all comments received.

Three cattle grazing programs were evaluated in the EIS. Because of the concern that the Service did not regard local input, we added more details to the livestock grazing section of Alternative B in Chapter 2 and we added more details of our evaluation of this program in Chapter 4. A technical evaluation of potential uses of livestock grazing on the Refuge is provided in Appendix I (see also Appendix J). The Service found that cattle grazing, under any prescription, would not contribute to the resolution of core problems facing the Refuge. In other words, it would not contribute to achieving long-range objectives. Additionally, continuation of a livestock grazing program would hamper efforts to resolve core problems. As stated earlier, the Service did not disregard local public input. In terms of the cattle grazing issue, we simply do not agree that cattle grazing should be part of the management of the Refuge for the next 15 years; nor could we support such an action. If any benefits to wildlife resulted from the last 50 years of livestock grazing (the process of herbivory) on Hart Mountain NAR, they remain unknown. Based on current information, the past 50 years of livestock grazing has limited habitat recovery on the Refuge.

Comment

106 "Can key documents be supplied in Appendices? Certain key documents need reprinting or adequate summaries. This includes Executive Order 7523 (only one sentence is quoted from this historic document), the Shirk 1992 EA (which proposes a major unscrutinized action)." (521)

Response. The description of Executive Order 7523 was expanded (Appendix A, Volume II of the FEIS). Agreeably, the description in the DEIS was short. The Environmental Assessment for the Shirk Lake Wetland Development (USFWS 1991) is available in Refuge files.

Comment

107 "a 12 point font size is excessive; reduce to 10 point and put more beef into the same-sized FEIS document." (521)

Response. We do not feel that a 12 point font size is excessive. We have made every attempt to make the document as easy to read as possible to a variety of interest groups.

Comment

108 "Is it a coincidence that there is not one literary reference under the "Livestock Grazing Program"? Where is the information gathered at the original scoping meetings. Where is the actual "public comment" made by the people who are knowledgeable and have first-hand information about the aesthetics and historical management of the mountain?" (730)

Response. The degree to which a livestock program would be affected by vegetation treatment would primarily depend on the effects of treatments on vegetation, and indirectly on soils. The Livestock Grazing Program section (Part Six of Appendix J) refers to technical discussions in section C (Vegetation) of Part's One and Two of Appendix J so that this information would not have to be repeated. Additional technical information was not warrented for this section.

Comment

109 Whenever livestock are brought up, it's always in negative connotation...can't FWS give some credit to livestock? (768)

Response. The Service agrees fully that livestock can be used to manage habitat for selected wildlife species or communities under some circumstances. However, whether livestock should be used to manage habitat depends on the area under consideration, and the goals and objectives for that particular area. Based on the goals and long-range objectives of Hart Mountain NAR, and given the underlying reasons why goals are not being reached, livestock would be a hinderence to accomplishing these goals.

Comments

110 "My first concern is that information provided to your department by Oregon State University Department of Rangeland Resources was not considered in the DEIS document. The personnel in this department have expertise in rangeland management in relation to the Great Basin and Eastern Oregon which should have been considered when this draft was being developed. The exclusion of the information provided by this leading Agricultural institution is unacceptable. The personnel in this department are recognize West wide as leading researchers, educator's, and cooperators by agriculturalist as well as environmental interest groups. I cite the Oregon Watershed Improvement Coalition as a resource where this department has wide and positive acceptance. I believe that it is imperative that the FEIS incorporate the information that they have provided." (505)

111 "Finally, there is one other point, Don, that Dr. Krueger and I have made in this written document and that is that from the period of time in 1991, when the Refuge went into their scoping process, we wrote a series of reports and letters to Mr. Reiswig and Mr. Yoakum dealing with most of the issues that I have mentioned here tonight. They are well-cited and well-documented in our reports and it appears that, that particular block of information was overlooked as the Draft EIS was completed. This worries us not because we are egomaniacs but rather because it seems to me when one is dealing with something as crucial as this particular document that all aspects and all pieces of information should be incorporated." (787)

Response. The information provided in the Krueger et al. (1991) report and the subsequent correspondence between Yoakum and Krueger was not overlooked during the development of the DEIS. Information on management strategies is reflected in various alternatives that we felt most appropriate for the information. Much of the information pertaining to the use of livestock as a means to manage wildlife habitat was incorporated into Alternative B. We unfortunately did not specifically refer to the report and correspondence. This oversight has been corrected. However, we have made better reference to this material in Chapter 1 and Chapter 2 of the FEIS. The information dealing with the use of livestock to enhance forage for particular species of wildlife and other uses of livestock did not fit within the framework of Alternative D, and thus was not incorporated into the Alternative. Information also is presented and reviewed in Appendix I. See also comment 101.

Comment

112 "Folks, I read this (ODFW letter) and I am concerned that the information that has been gathered to substantiate the proposal that has been put before us has been brought together to satisfy a fordrawn conclusion. I don't believe that all of the information that's available out there by folks such as Mr. Buckhouse is being taken advantage of. It's actually being ignored on purpose." (792)

Response. Again, information submitted by Dr. Buckhouse and others was carefully evaluated. It was not ignored. After evaluating information submitted by Dr. Buckhouse regarding the potential uses of cattle on the Refuge, we found that (1) application of some of the uses (e.g., to enhance forage quality) would not contribute to achievement of Refuge goals and objectives; (2) the potential for obtaining consistent and successful results of some of the applications (e.g., cheatgrass/weed control, seed dissemination in Wyoming big sagebrush), based on available information, would be limited; (3) research on some applications (e.g., dissemination of seeds, cheatgrass control) is still in its infancy; and (4) some identified applications (e.g., willow enhancement, fostering of shade for cover and thermal protection of waterways) as yet seem to be unsubstantiated (please refer to comments 471, 472, 482, 484, 489, 491, and 497 and Appenix I for further detail). Because of the concern that ODFW's letter generated, Refuge staff met with two of the authors of the letter and the ODFW Regional Supervisor (Southeast Region) on Hart Mountain NAR to discuss concerns that they expressed in their letter of August 20, 1993. During discussions, ODFW expressed overall support for the action proposed by the Service (Refuge files). As pointed out in the letter, however, they have several concerns regarding the proposed action. These concerns were discussed during the Refuge visit (refer to comments 225, 226, 344, 345, and 346).

Comment

113 "The DEIS states that their research began in 1989, and by 1992, the research alleges that cattle grazing has no place on the mountain. Amazingly, four years of intensive research has refuted 60 years of the same. Considering that the research was conducted during a long and extensive drought period, I am profoundly unimpressed with the end result. "Silk purse out of a sow's ear." " (795)

Response. The core problems (Chapter 1, Section Two) primarily are a consequence of livestock grazing pressure during the late 1800s and early 1900s, and fire suppression. We recognize that historic droughts likely interacted with other more prevalent factors (e.g., livestock grazing and fire suppression), to exaggerate habitat deterioration. However, the most recent drought has had little to do with the status of the core problems on the Refuge. For instance, we have no reason to believe that shrub cover in late succession stands on the Refuge is substantially different than what it was in 1968 (Table 3-5, FEIS).

Comment

114 "This is a comparison of Alternative B and D. I think it's important that I show you some errors, because it might get some of you people that have a lot more knowledge about this system than I and you can probably address it better. It should only take about five minutes, so if you will bear with me I will show you where I feel the document is lacking. There are some pages in the summary which is in the front of volume one. There are two tables: Table S2 and S3. If you can imagine, they have all of the alternatives stretched across, then vertically they have the issues like pronghorn predator control, mule deer. In other words, the list of issues that were brought up. Now, in this chart, the Fish and Wildlife Service assigned signs: a 0, +, + +, -, and --. What I did, I assigned those signs values. I gave an 0 and 0, a + a 1, + + a 2 and - a -1 and etc. For the first fifteen years, Table S2, Alternative B, which includes grazing, scores a nine, while Alternative D only scores only an 8. So in the first fifteen years, obviously for the community as well as wildlife, Alternative B is the better plan. The prediction for fifty years, which is Table S3, scores Alternative B at 11 and D at 17. However, the DEIS and other materials that I read contradicts the values arbitrarily assigned by the Fish and Wildlife. The values should be corrected as follows: On the first Table S2, under Alternative B, which allows grazing. The issue is pronghorn. The Fish and Wildlife assigned a zero. Now ODF&W and other sources say that moderate grazing has no negative impact. Alternative B proposes a 66% reduction in current AUMs. How can you have such a drastic decrease in AUMs and result in a zero which is defined as no significant change? It can't be. You can't have a 66% cut in cattle grazing and not have some, in their eyes, positive change. So this issue should have been assigned a plus. Now mule deer. They again assigned a zero. It is a prudent fact that cattle grazing has improved and expanded the range of mule deer and elk in the western United States. This issue should have been assigned a plus. Again, because in their eyes no grazing is good. So, I'm using their terms when I say that the reduction in AUMs is supposed to have a positive effect. Trout, again zero. But how can you do that when you are going to eliminate cattle from riparian zones and have a 66% reduction in AUMs on the uplands. So again, this should have a plus. Diversity! They again assigned a zero. For the same reason, how can you possibly not have more diversity if you are going to eliminate the cows? On wetlands, the same thing, zero. Now under Alternative D, which is no grazing, they take the issue bighorn sheep and they assign themselves a plus. But the Oregon Department of Fish and Wildlife has officially stated the bighorn on Hart Mountain have reached their capacity and have approved hunting to be used to control over-population. Since no change is going to occur, this issue should have been assigned a zero instead of a plus, because there will be no change. We've met the capacity. We are going to start shooting ewes now to get rid of them. Now, when you apply the correct values to Alternative B and D, you will note that Alternative B scored a 15 and D, now is down to 6. What plan is better? 15 or 6? Obviously, Alternative B is the better of the two. But, however, their grading system does reveal the political agenda and bias in the decision making process. The accuracy of such charts is imperative, because the average reader will not attempt to digest the contents of this statement. The average reader prefers to read summaries and look at charts and thus can be misled if those are not accurate. Now Table S3 is the 50 year prediction. Under Alternative B the grazing, mule deer again a zero and this should have been a plus. Sage grouse, they assign a zero and this should have been a plus. Trout, again a zero and wildlife viewing, again a zero. Those should each be a plus. Under Alternative D, the no grazing concept. Pronghorn are given a double plus. ODF&W and other documentation available shows that predator control is a vital factor in improving and maintaining populations. Alternative D does not consider predator control. This issue should only be a plus. Not a double plus. On bighorn sheep, again they give themselves a double plus. I just told you that the ODF&W says no, we're going to start shooting the ewes. So that should be a zero. Mule deer, again they have assigned themselves a zero. I have ready many, many studies from Colorado and Montana and Idaho and other places, right here in Oregon, that cattle grazing is good for mule deer. And of course under Alternative D we're not going to have cattle grazing, so we are going to see a decrease. There's a lot of experts out there that will tell you that we are going to see a decrease in deer population if we don't have cattle grazing the land. Yet, they give them a zero which is no significant change. I say it's a minus. Then sage grouse, they give themselves a double plus. That's burning 30,000 acres when the ODF&W says don't burn. So that should be at least a zero. Now when you apply the correct values to Alternative B and D for the 50 year prediction. Alternative B scores 15 and D scores only 11. That's a 15 year and a 50 year prediction and Alternative B is by far the better plan. Not only for wildlife but

for the community as well. It is quite obvious which of the alternatives best suits the wildlife and the community. In fact, the combination of the best of each alternatives could be a serious consideration. Professional land and wildlife managers should use every possible tool available to them which includes grazing and predator control. We cannot afford not to. I might add here that under the 15 year plan for Alternative B, the Fish and Wildlife gave predator control a double plus. Which means that it would benefit the other issues very highly. In their Alternative D, they propose absolutely no predator control at all." (795)

Response. A footnote has been added to Tables S-2, S-3, 4-7, and 4-8 in the FEIS to inform readers that +'s and -'s cannot meaningfully be assigned values and added within columns to determine which is the "better plan". The tables were designed for in-row comparisons only (e.g., which alternative would likely be the best for pronghorn?). This is because each row (issue) has an unknown weighting factor. For instance, what happens to wildlife diversity (which accounts for 302 vertebrate wildlife species) might be 50x more important than what happens to the feral horse population. Although assigning specific weights to the different issues can be done, we feel that it would be purely speculative. Additionally, not all -'s are undesirable and +'s desirable (e.g., feral horse population, predator control). The table has been modified in the FEIS in hopes of clarifying any misunderstandings. This consideration aside, the following discussion pertains to specific points brought up in the comment. Because the writer did not provide any documentation upon which his claims are based, we could not evaluate the validity of the underlying assumptions, etc. relative to the technical review of information provided in Appendices I and J.

Comment

115 "An example of selective use of the scientific evidence available can be seen by examining the comments of Mike Getty (written comments in tab A, and video tape) when he examined and destroyed the value of the EIS by exposing the inaccuracy of charts found in the summary, Vol. I page XX and XXI tables S-2 and S-3. Mr. Getty substituted realistic numerical values for +'s and -'s which resulted in showing alternative B to be the one the body of scientific evidence supports." (808)

Response. Please refer to the response of the above comment.

LITERATURE

Comment:

116 "The following are reports I suggest you review or obtain for your reference library.

Forre, T.G. and R. Kindschy. 1990. Spring meadow restoration: Fifteenmile Unit, Jordan Resource Area. U.S.D.I. Bureau of Land Management, Vale District. 12 p.
Project proposal documenting severity of spring meadow degradation in the Trout Creek Mountains/Oregon Canyon Mountains of Southeastern Oregon, attributing/connecting livestock grazing with erosion, stream channel cutting, grass/sedge sod "weakening" and decrease in water "production" or absence of perennial flow. Five springs discussed. Color photographs (7 p.) Final project expanded to involve 18 springs.

Furnish, J. 1989. An analysis of macroinvertebrate, trout and stream survey data from the Trout Creek Mountains of Southeastern Oregon. U.S.D.I. Bureau of Land Management, Vale District.
Stream survey data from 1981-1985 analyzed "to identify water quality indicator species, classify sites on the basis of the aquatic macroinvertebrates present and develop a rapid bioassessment protocol for monitoring water quality. ... Taxa chosen as indicators of good water quality were associated with fast current velocities, well oxygenated water and clean, coarse substrates. ... Total macroinvertebrate taxa occurring at a site was the best predictor of trout density and biomass. ... This study demonstrates that an understanding of aquatic macroinvertebrate diversity and distribution is a key element in explaining the connection between habitat quality and trout abundance."

Kauffman, J.B., R.L. Beschta, and W.S. Platts. 1991. Field review of fish habitat improvement projects in the Grande Ronde and John Day River Basins of eastern Oregon. Prepared for the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. P.O. Box 3621, Portland, OR 97208-3621.
Recommends re-evaluating use of structures in streams where management practices/activities continue. Suggests first change practices, see if physical intervention needed at all.

________ 1992. Fish habitat improvement projects in the Fifteenmile Creek and Trout Creek Basins of Central Oregon: Field review and management recommendations. Prepared for the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. P.O. Box 3621, Portland, OR 97208-3621. 52 p.

Focus: Steelhead trout--anadromous fish recovery and habitat restoration focus. Activities affecting fish populations and habitat considered in a variety of stream reaches: farming, irrigation withdrawal, livestock grazing, and timber harvesting. More strongly--plainly--worded than John Day/Grande Ronde report, but more of same conclusions. Cautions regarding use of structures in streams. Questions need. Emphasizes need to halt/change harmful activities before implementing physical projects.

Li, H.W., G.A. Lamberti, T.N. Pearsons, C.K. Tait, J.L. Li, J.C. Buckhouse. 1993. In Review. Cumulative impact of riparian disturbances on high desert trout streams of the John Day Basin, Oregon. Oregon Cooperative Fisheries Research Unit, Dept. of Fisheries and Wildlife, 104 Nash Hall, OSU, Corvallis, OR 97331-3803.

Five watersheds reviewed. "Watersheds with greater riparian canopy had higher standing crops of rainbow trout (Oncorhynchus mykiss), lower daily maximum temperatures (range: 16-23 (degrees) C) and perennial flow. ...Maximum temperature reflects cumulative upstream influences of riparian shading and spring inputs, whereas solar insolation is a site-specific measurement. Algal biomass was positively correlated with solar insolation (0.91), total invertebrate biomass (0.77), and herbivorous invertebrate biomass (0.79). Invertebrate biomass was not significantly correlated with rainbow trout standing crop. High irradiance apparently resulted in increased algal biomass and invertebrate abundance. However, increased temperature to sublethal levels may impose high metabolic costs on rainbow trout, which may offset higher food availability. We speculate that high metabolic demand may increase competition for food among trout."

Liverman, Marc. 1993. 2nd DRAFT. Western Juniper Woodland Management Policy. Oregon Dept. of Fish and Wildlife, Habitat Conservation Division, Portland, OR.

Clearly sets forth the present day conflict between those who see the native juniper as a threat to certain specific resources and/or a limiting factor for domestic livestock grazing and those who perceive the native juniper as both providing valuable wildlife habitat and responding to other changes by "increasing" its range (or reforesting those areas where previously juniper had once predominated the landscape--on a geologic, not a human time scale).

Describes the need for a policy on this native species; provides valuable background information and discusses the richness and abundance of species which use juniper habitats. Lists the number of species found in specific juniper habitat types and whether they would be favorably or adversely impacted by changes in juniper habitat. Of the 539 species found in four described juniper habitats, 351 would be adversely affected, 97 favorably affected.

Miller, R.F. 1990. Oregon Trout comment letter IN Proposed Three Rivers Management Plan and Final Environmental Impact Statement, Vol. II - Appendices, September 1991. U.S.D.I. Bureau of Land Management, Burns District, Hines, Oregon.

"Grazing by domestic herbivores has been identified as one of the primary activities causing the decrease in ecological condition in riparian areas. ... Riparian zones are unlikely to respond to livestock reductions unless the pastures are truly overstocked. Riparian areas are frequently overgrazed even in understocked pastures.....if livestock have access to riparian zones these areas are frequently the focal point of use, leading to overgrazing even in an understocked pasture. Fencing these areas as separate pastures will be one of the most effective tools in returning these systems back towards maximizing their potential benefits."

Northwest Coalition for Alternatives to Pesticides. See "Pesticides - Chemical Concerns."

Pearsons, T.N., H.W. Li, and G.A. Lamberti. 1993. In Press. Influence of habitat complexity on resistance and resilience of stream fish assemblages to flooding. Oregon Cooperative Fisheries Research Unit, Dept. of Fisheries and Wildlife, 104 Nash HAll, OSU, Corvallis, OR 97331-3803.

Stream fish assemblages determined by snorkeling before and after a summer flash flood and two spring floods. "Following the floods, hydraulically complex stream reaches lost proportionately fewer fish, had generally higher fish diversities, and had higher fish assemblage similarity than in hydraulically simple stream reaches. ... Young-of-the-year of fishes that spawn in early spring (e.g., rainbow trout, (Oncorhynchus mykiss) were more negatively affected by early spring floods than summer floods. ...

Higher fish diversities in hydraulically complex reaches...suggests (sic) that fish assemblage resistance may be related to overall habitat complexity in these small streams."

Platts, W.S. 1993. DRAFT. Managing riparian zone grazing: A guidance and reference document for ranchers and range managers. For the Bonneville Power Administration. 66 p.

Final due out soon. Discussion and assessment of impacts of various livestock grazing systems. Charts and tables. Plain language.

Roberts, B.C. and R.G. White. 1992. Effects of angler wading on survival of trout eggs and pre-emergent fry. (Journal name indistinct, ends in "Management 12:450-459 1992." The cooperators are the U.S. Fish and Wildlife Service, the Montana Department of Fish, Wildlife and Parks, and Montana State University, Bozeman.

My question: If anglers negatively affect egg and p-e fry survival (and it seems they do), how much more negatively affected are trout eggs and p-e fry by herds of cattle "wading" these spawning and nursery gravels?

Tiedemann, A.R., D.A. Higgins, T.M. Quigley, H.R. Sanderson, and D.B. Marx. 1987. Responses of fecal coliform in streamwater to four grazing strategies. Journal of Range Management 40(4), July 1987. 322-329.

"Concentrations and loadings...of fecal coliform (FC) indicator bacteria were measured from 1979 through 1984 in streamflow from 13 forested watersheds under...range management strategies... Both FC concentrations (number/100 ml) and instantaneous loadings differed significantly among strategies, seasons, and water years. ... A definite relationship was established between the presence of cattle on the pastures and FC concentrations. Elevated FC counts in strategy D watersheds and loadings...in the winter season provide evidence that organisms live into and through the winter period in animal feces, sediment, and soil. Results provide evidence that livestock removal may not provide an immediate solution to elevated levels of FC in streamwater. ...Sediments also serve as a reservoir of FC and Salmonella organisms..." ("Populations in sediments may be 100 to 1,000 times grater than in surface waters...")

"The Oregon Range Evaluation Project (EVAL) was established in 1976 to implement known range management techniques and to evaluate their impacts on range and associated resources. Water quality was one of the major associated resources studied..."

"Strategy D. Management of intensive grazing to maximize livestock production with multiple-use considerations. Includes practices to attain uniform livestock distribution..."

"Levels of FC organisms in streamflow appear to be more closely related to watershed characteristics that determine where livestock are likely to c concentrate than to stocking rates. ...(strategy C) had FC counts similar to ...D watersheds despite actual use that was 67% less." C and D had similar meadows which presented "the greatest opportunity for animal contact with the stream ecosystem." " (732)

Response. References listed and technical information cited were noted. Some of the technical information provided in these reports and studies was incorporated in the FEIS where deemed appropriate.

LAWSUIT

General Comment

117 "Having just finished a law suit with National Wildlife Federation against BLM I can assure you that you will see one on the exclusion of cattle from the refuge. Each exclusion is viewed as a bad precedent by the cattle industry and they are determined to prevent as many as their money and attorneys can stop." (6)

Response. Comment noted.

Comment

118 "That the Sierra Club Legal Defense Fund had filed legal action against the USFWS in the early Spring of 1991, is not mentioned in this Plan. The political repercussions from this filing should be addressed, or at least discussed in the plan. The information that: from June through October, 1992, and for at least 2 years, all cattle had been or were removed by the permittees, due to the lack of forage and water sources caused by drought, is missing. To our knowledge, this was a one-time only precedent, since the establishment of the refuge." (730)

Response. The 1991 lawsuit involving Hart Mountain NAR is beyond the scope of this EIS. It is correct that the permittees voluntarily elected to forego their livestock grazing permits; however, this took place in the early 1991. It was the first time, since the Refuge was established, that cattle were not grazed on Hart Mountain NAR lands.

SUPPORT OF ALTERNATIVE D (PROPOSED ACTION)

General Comments

119 "We want to congratulate you and your staff for seeking and preferring Alternative D as a means for restoring Hart Mountain Refuge habitat for wildlife." (5)

120 "I support alternative D - the no grazing - controlled fire option to managing the refuge. I encourage your support of this alternative, thank you." (12)

121 "Please know, though, that this refuge does have a following and a mission well beyond the local interests." (15)

122 "We are very concerned that the Fish and Wildlife Service would consider adopting any of the other alternatives presented in this draft document. Our analysis of the draft leads us to believe that Alternatives A,B,C and E would lead to an increase in grazing by domestic livestock and would fail to provide needed protection for refuge dependent wildlife." (127)

123 "OWF [Oregon Wildlife Federation] applauds the US Fish and Wildlife Service (Service) for doing such a superb job in studying the Hart Mountain National Antelope Refuge (Refuge) and for suggesting an alternative that will considerably improve the Refuge's ecological condition." (695)

124 "The Hart Mountain National Antelope Refuge Draft EIS (HMNAR DEIS) preferred Alternative D (Ecosystem Management) is the management Alternative recommended by the Oregon Chapter of The Wildlife Society (TWS). Alternative D (Ecosystem Management) is most consistent with the position of the Oregon Chapter of TWS in terms of the current emphasis on conservation at the ecosystem level and the maintenance of biological diversity in native habitats. It is also consistent with the current Oregon Chapter of TWS position on using fire and livestock grazing as a management tool on wildlife refuges. The Oregon Chapter of TWS supports the option to use fire and grazing when specific, identified management objectives may be achieved through these practices.... The HMNAR DEIS preferred Alternative D (Ecosystem Management) is most consistent with the current emphasis by both TWS and NWRS on conservation at the ecosystem level and the maintenance of biological diversity... Therefore, in terms of consistency with the position of the Oregon Chapter of TWS, Alternative D (Ecosystem Management) appears most appropriate, with Alternatives B (Featured Species Management) and C (Habitat Restoration) being roughly equivalent albeit for different reasons... Alternative D (Ecosystem Management) was viewed as the most favorable option by the majority of the Review Committee [Oregon Chapter of The Wildlife Society] and was not opposed by any member, with the caveat that the total exclusion of all livestock grazing for 15 years was deemed excessive by 2 members of the Review Committee. Overall, this alternative was viewed very favorably and few comments were provided by the Review Committee that would alter the proposed approach to restoring habitat. In fact, the objectives of returning the Refuge into a mosaic of habitat types more representative of the native ecological communities historically occurring in the northern Great Basin was recognized as an important step toward improving species diversity and moving toward an ecosystem-oriented management approach. There was also consent regarding the reintroduction of fire as a management tool, although there were some questions as to whether the amount of proposed shrub removal might be excessive during a 15 year period and result in a large portion of the refuge being in an ecologically similar state of recovery. This alternative also appears to provide the greatest opportunity for sensitive riparian areas to recover. The several paragraphs that follow include some comments regarding specific aspects of Alternative D." (540)

Response. Comments noted.

Comment

125 "We would view the preferred alternative as an experiment and would support such an experiment if it proceeded slowly and were adequately monitored." (7)

Response. The Service, contingent upon approval of Alternative D, intends to proceed with caution. The monitoring program is a critical part of Alternative D; monitoring results used in conjunction with long-range objectives provides a much needed feed-back loop.

SUPPORT FOR ANOTHER ALTERNATIVE OR COMBINATION OF ALTERNATIVES

General Comments

126 "...I do feel that alternative C is a better balance and should be the preferred alternative. It does allow some livestock grazing which will return some money to the Federal treasury." (25)

127 "I was intrigued with Alternative E. I liked the additional wilderness and the closing of more roads. However, I don't believe that abandoning the refuge, as E does, is wise. Perhaps a combination of D & E that closed roads and designated wilderness as in E but worked to restore the refuge (prescribed burns, etc.) as in D." (49)

128 "I'm writing in support of a combination of alternative D and E for restoring the Hart Mountain Refuge to a more natural state." (51)

129 "I believe there is a very large gap between Alternative D and Alternative E. I would like to have seen an alternative that takes some of the elements from both Alternatives. In particular, Alternative E provides for substantial (26%) Primitive classification whereas Alternative D has none. There should be an area that would qualify for a primitive classification in the South Hart Mountain segment. In addition Alternative D provides for more than 3 times as many miles of roads (162 vs 50) as Alternative E. I would like to see more roads closed to motorized vehicle travel, particularly Black Canyon and most of the roads in the south portion of the refuge." (483)

130 "Preferred Alternative: B (Featured Species Management)... 1) Alternative D (Ecosystem Management) represents the next most preferred choice among proposed alternatives. 2) Strictly controlled livestock grazing represents a management tool that should remain an option at HMNAR. 3) Management for the listed preferred species should provide suitable habitats for maintaining biological diversity." (responses to individual points are discussed under appropriate sections in this Appendix)" (540b)

131 "Preferred Alternative: C (Habitat Restoration)... 1) The proposed level of shrub removal under Alternative D may be excessive in a 15 year period. 2) Strictly controlled livestock grazing represents a management tool that should remain an option at HMNAR. 3) Predator control may be appropriate if habitat conditions are improving but predators are limiting recruitment." (responses to individual points are discussed under appropriate sections in this Appendix)" (540c)

132 "We have no hope that the Baseline Management (Alternative A) will pass muster primarily because it would be perceived as a "sell-out" to the non-resident, non-professional out-of-county "environmental" observers. Alternative B, in our mind, is the least disruptive of the remainder but would require some alteration. I would suggest that more AUM's can be supported, less roads be utilized and herbicide treatment reduced (the jury is still out on possible deleterious affects) and limited quality hunts offered. Alternatives C through E, we reject totally.

Our vote, then must be for Alternative A or a modified Alternative B as mentioned. Alternative C is a simple prelude to reverting the Refuge into a National Park. The preferred Alternative D must be rejected out of hand as should Alternative E. Both of these Alternatives are simple enhancements to Alternative C and would simply lock up the area permitting only the young and hardy to visit this remarkable area." (603)

133 "After reviewing the alternatives, I believe that a combination of features from Alternatives B, C, and D would provide a more balanced and a more realistic alternative." (723)

134 "...we do not feel any alternative presented is acceptable." (730)

135 "We are representative of our family and employees, Harney County School District #16 (Frenchglen, Or.), Crane, High School, Save Our Industries and Lands (a Harney County group affiliated with Oregon Lands Coalition, which represents aprox. 81,000 families in Oregon), Ranchers for Conservation (representative of all of the cattle permittees on the Malheur National Wildlife Refuge), Oregon Cattlemen's Association, Oregon Cattle Women, Harney County Cattlewomen, Harney County Stockgrowers Assn., Oregon Farm Bureau, and

the Harney County Chamber of Commerce. Nearly 100% of the membership of all of these organizations should go on record as being in favor of cattle being aestheticly desirable on Hart Mountain, and being in favor of cattle being used as a management tool for the benefit of the range and breeding ground for antelope and other species of wildlife." (730)

136 "I favor a combination of B and C. I feel that there is room for limited grazing, moderate numbers. Cattle can be controlled with water and fencing. The Refuge should not limit themselves to "no new waterholes." The Refuge should continue heavy biological monitoring, and should use moderate to heavy predator control. I favor limited, quality hunts, and a 3-point limit." (755)

Response. Comments noted.

RANGE OF ALTERNATIVES

General Comments

137 "**Alternative A, Baseline Management.** This is the status-quo alternative which continues the degraded condition of the Refuge. It does little in restorative efforts. It should not be the selected alternative.

Alternative B, Featured Species Management. This is a start in the right direction but the emphasis is on selected species not on the whole ecosystem and grazing at a reduced level is still allowed. There is too much emphasis on roaded recreation. We also object to the extensive use of herbicides to reduce shrub cover, as other plants besides the targeted shrubs will be affected. This also should not be the selected alternative.

Alternative C, Habitat Restoration. This alternative is definitely in the right direction but we feel the token grazing retained will be more of a problem than it is worth. As mentioned above, we are concerned about the amount of herbicide use. We like the reduced amount of road open to travel. This alternative would be our second choice.

Alternative E, Custodial Management. The only good thing that can be said about this alternative is that it keeps the cows out with the hope that the Refuge will recover on its own. It provides no recreation and limited wildlife viewing for the public, a stated use of refuges. No attempts are made to speed up habitat restoration and feral horse numbers are allowed to increase. It is not a good alternative." (254)

138 "Alternatives B (Featured Species Management) and C (Habitat Restoration) were roughly equivalent in terms of consistency with Oregon Chapter of TWS positions albeit for different reasons. Alternative B represents less of an ecosystem-oriented management approach and emphasizes managing for those featured species identified in the DEIS, relying heavily on livestock grazing to achieve management objectives. Alternative C represents an ecosystem approach through restoration of native habitats, but deviates from the position of the Oregon Chapter of TWS by proposing to allow limited cattle grazing without identifying specific management objectives." (540)

139 "Alternative B (Featured Species Management) proposes livestock grazing as a management tool to condition vegetative structure for native ungulates and sage grouse. This approach is consistent with TWS [The Wildlife Society] policies in respect to using livestock as a management tool to fulfill specific wildlife management objectives, but is less consistent in terms of the current emphasis on promoting biological diversity, and would be less effective in reaching habitat restoration goals than alternatives C or D." (540)

140 "Alternative B (Featured Species Management), although devised to manage for featured species is, according to HMNAR calculations, anticipated to be less effective in promoting these populations than either Alternative C or D in either the short term (Table S-2) or over the next 50 years (Table S-3). Additionally, this alternative is not expected to benefit native trout and would likely impede riparian recovery in areas where cattle have access. This alternative would require intensive monitoring and temporary or permanent fencing to reduce adverse effects of livestock grazing on sensitive riparian communities. While these approaches are often used on public lands with a wise-use mandate, NWRS goals are not required to operate under a multiple-use mission designed to provide economic opportunity. Although livestock grazing remains highly controversial as a management tool, one of the possible advantages of limited grazing would be the removal of rank herbaceous vegetation with a resultant increase in late season use of meadows and grasslands by sage grouse and pronghorn, and to a lesser extent mule deer. Grazing regimes have been designed to minimize disturbance during pronghorn fawning and sage grouse nesting periods, but grazing periods are scheduled for upland big sagebrush-bitterbrush habitats during the peak mule deer fawning and immediate post-partum

periods (15 May - 15 July). One of the proposed advantages of cattle grazing would be to enhance bitterbrush productivity for deer. However, the advantages of this strategy are controversial and may be negated by direct competition for bitterbrush as well as reducing use of these areas during fawning, and disturbance or displacement of fawns during the immediate post-partum period when fawns are highly susceptible to predators. This alternative also proposes a moderate to intensive predator control program directed at coyotes and ravens, the objectives of which are to increase fawn production of pronghorn and mule deer, and nesting success of sage grouse. Although predator control programs have often been used, evidence has not been demonstrated that such practices provide long-term, sustainable increases in recruitment for either mule deer or pronghorn. From the perspective of ecosystem management, removal of predators to enhance the production of species not listed as sensitive, threatened, or endangered seems inappropriate and may even result in negative effects on plant communities as has been demonstrated by ungulate populations existing at levels near carrying capacity. Therefore, Alternative B (Featured Species Management) appears to fall short of either Alternative C (Habitat Restoration) or D (Ecosystem Management) in terms of the ecological benefits it will provide to featured species (except perhaps pronghorn and sage grouse) because it does not emphasize habitat improvement to the extent these other options do and may have negative effects on sensitive riparian areas as has been documented from livestock grazing at HMNAR in the past. Additionally, because this alternative emphasizes livestock grazing as the primary management tool for habitat modification, it will primarily favor those species that benefit from the effects of livestock grazing, and would be expected to do little to improve wildlife diversity above previous levels." (540)

141 "Alternative C (Habitat Restoration) emphasizes prescribed burning to restore a natural mosaic of native vegetation communities consistent with what may have been encountered under historic fire regimes. This alternative also incorporates livestock grazing at greatly reduced levels (approximately 95% reduction) with minimum 2-year rest rotations and approximately 80% of the refuge being excluded from any grazing. Although this level of grazing could be used to manipulate vegetative structure in select areas, the primary focus would be to "provide a limited amount of forage for cattle when it would not have significant ecological impacts." The use of livestock grazing in this manner is not consistent with the position that grazing on national wildlife refuges should fulfill specific wildlife management objectives. However, the objectives of restoring habitat and the anticipated associated effects on biological diversity are consistent with TWS (The Wildlife Society) positions." (540)

142 "Alternative C (Habitat Restoration) is very similar to Alternative D (Ecosystem Management), in terms of management objectives (Table S-1) and predicted benefits to wildlife and habitat (Tables S-2 and S-3). The major differences between these alternatives in terms of wildlife management and habitat restoration are the inclusion of limited grazing in Alternative C, and a higher level of shrub cover reduction in Alternative D. As proposed, livestock grazing would be allowed under Alternative C at levels that would minimize or eliminate adverse environmental impacts. Livestock grazing would not necessarily be used for any specific wildlife management objectives under this alternative, an approach that would be inconsistent with the TWS-Oregon Chapter position regarding livestock grazing wildlife refuges. However, while all members of the Review Committee felt that the restoration of habitats and movement toward an ecosystem management approach were appropriate objectives, the suggestion was made that limited livestock grazing in areas that had been sufficiently rested should not be completely omitted as a management tool at HMNAR, particularly for sage grouse management. It was suggested that rangeland converted from shrub cover to grassland may result in large areas dominated by residual grasses, and that periodic grazing of some of these areas represents a management option that could contribute to habitat diversity while reducing the potential for fast-moving range fires. However, the use of livestock under controlled grazing regimes such as proposed in alternative C would require increased expenditures for monitoring livestock distribution and for fence construction around sensitive areas, raising the question of whether other options such as burning might not provide a more economical manner in which to allocate limited funds that must also be used for wildlife monitoring and habitat restoration. Additionally, while the negative effects of fencing on wildlife are poorly documented, they do occur." (540)

143 "**1. Alternative A, Baseline.** This is the status-quo and is not a good alternative in that it does little to restore the Refuge to ecological health. The cows are still chomping away, leaving little herbaceous vegetation to propagate prescribed burning to control excessive shrub growth. The riparian areas would continue to be degraded. It is a bad alternative.
2. Alternative B, Featured Species. This too is a poor alternative, only selected species are provided for, the whole ecosystem is not helped. Cattle grazing is reduced, ameliorating their impact. There will be some improvement in the riparian, but cows are still going to be impacting these areas. Given the cost of managing

grazing, it hardly seems worth the effort. The high use rate of herbicides has me concerned, other plants such as herbs and forbs would be adversely affected while the targeted shrubs are controlled. This alternative only controls the feral horse population, it does not eliminate them. This alternative will not get the job done.
3. Alternative C, Habitat Restoration. This alternative is getting a lot closer to what needs to be done. It makes positive efforts to get the Refuge back to health. It almost eliminates cattle grazing and I would expect the expense and effort to accommodate this small amount of grazing will far exceed any return from grazing fees. Herbicide use is reduced compared to Alternative B and the wild horses are eliminated, both good steps. I can almost accept this alternative especially if the cattle grazing is completely dropped.
4. Alternative D, Ecosystem, the Preferred Alternative. I really like this alternative, it eliminates the cattle, the wild horses and makes a good effort to bring the Refuge back to ecological health. I also like the road program, enough roads remain open for the public to enjoy and experience the Refuge yet the road network is reduced giving the animals a little more solitude. Herbicide use is greatly reduced, limited to areas where other methods will not work.

The last three years of no grazing on the Refuge as a result of drought give a glimpse of what can happen when the cows are removed. In particular, the riparian areas are showing great improvement. Prescribed burning is also having a positive affect and is an important part of this alternative. This needs to be the finally selected alternative.
5. Alternative E. Custodial. This too is a bad alternative. The cows are gone, but no efforts are to be made in restoring the land and streams from over a century of grazing impacts. The recreational and wildlife viewing aspects of the alternative are poor. And feral horses will be allowed to increase which is not good. Beside removing the cows, about the only other good thing about this alternative is the allowing of wildfires to burn." (718)

144 "I don't agree with Alternative C's limiting horseback use to roads." (765)

Response. Comments noted.

Comment
145 "During the many hours I spent discussing grazing with the refuge staff one of the things I tried to do was to describe the type of grazing system that would be totally unworkable for a rancher. As near as I can tell the EIS team took this information and used it to construct Alternative C, that is the alternative between the preferred alternative and the alternative that contains a grazing system that would be workable for the permittees.

Alternative B contains a grazing plan that was developed with some help from the Chamber Committee. Alternative B also contains some pretty cumbersome baggage, such as: high levels of pesticide use, undesirable hunting changes, and a slow schedule of upland recovery. These things have nothing to do with grazing but they greatly reduce the desirability of the grazing alternative.

Grazing was placed in an alternative that did not have the aggressive burning plan needed to address sagebrush densities in the uplands, apparently the DEIS writers believe that 4,300 AUMs annually is incompatible with a burn plan. Yet since 1970 over 18,000 acres have burned on the refuge when great efforts were being made to stop the fires. These fires occurred when grazing levels were around 12,000 AUMs annually. To imply that 4,300 AUMs annually would interfere with burning 40,000 acres in a 15 year period defies common sense." (206)

Response. Of primary considerations for not selecting Alternative B as the Preferred Alternative were factors related to the livestock grazing program of the Alternative. The Service would not be able to support the implimentation of the livestock grazing program outlined in Alternative B, regardless of the other components of the alternative.

Comment
146 "My vote of confidence for the preferred alternative is a decided vote against Alternatives B and C. I actually don't see much difference between these two alternatives. I object to the title given to Alternative C in that habitat restoration and livestock grazing are mentioned in the same breath. Although the DEIS concedes that cattle grazing has been the primary reason for habitat deterioration, it implies that habitat restoration can occur with continued (albeit decreased) grazing. Improvement, maybe. Restoration, no way! It is akin to saying that a patient who is ill from smoking 3 packs a day can get well if he cuts down to 1 pack. Perhaps he might not feel or look as bad, but to really recover, he needs to quit completely. I don't think Alternative C did anything to broaden the scope of alternatives. I agree with the DEIS that both B and C are incompatible

with the mandate of the National Wildlife Refuge System and NAR goals to provide protection to the wildlife and ecosystems of the Refuge." (483)

Response. We would like to point out once again that habitat recovery can occur under well designed livestock grazing programs that are carefully controlled. The rate of recovery may be reduced compared to rest from livestock grazing, but recovery (improvement) can take place.

Comment

147 "There should be another Alternative for all benefits -- hunting, sightseeing, camping, livestock grazing. We should get as much use and benefits from the Refuge as possible, but make it feasible." (765)

Response. We feel that Alternative B adequately reflects an option described by the above comment (please see also Chapter 2, Section Three of the FEIS).

Comment

148 "I'm concerned about livestock grazing levels -- none had an increase, there is only one with current levels." (765)

Response. The Service had no basis for considering an alternative that proposes an increase in livestock use of the Refuge (please refer to Chapter 2, Section Three of the FEIS).

PLANNING PERIOD

Comment

149 "The 15 year timeline is empirical and should be changed to periodic assessment (maximum of three years)." (66)

Response. The comment points out a critical component of successful land management. Periodic assessments, that evaluate the degree to which objectives are being reached, are important. This demonstrates the importance of monitoring. The 15-year time frame of the FEIS serves as a strategy, and shorter-term (3-5 year) operation plans will be developed to outline in more detail on-the-ground management. Success of operation plans will be evaluated.

Comments

150 "The DEIS does not clarify whether habitat will receive longterm protection beyond the 15-year planning period. While some areas of the refuge may recover relatively quickly, many others will not. The EIS should address the criteria that will be used to determine whether (or when) livestock grazing may resume on the areas where livestock grazing is not ruled out for the "foreseeable future." DEIS, p. 69." (74)

151 "A long range plan, though it may not be implementable now, needs to be in place to take maximum advantage of changing land ownership patterns that will be occurring." (90)

152 "We do have two minor suggestions. The first concerns the elimination of grazing for fifteen years. We consulted with a conservation biologist who specializes in range management. He fully supported your proposal, but suggested that fifteen years may not be enough. At the end of that period, the situation can be reevaluated." (484)

153 "The Service intends to re-evaluate the proposed Comprehensive Management Plan in 15 years. Oregon Wildlife Federation believes 25 years is a more realistic period. The Refuge, until 1994, will be operating under a management plan which the Service developed 25 years prior, in 1969. There is no reason to believe the situation will be any different in the future. If the Service chose a 25 year planning period, the far sighted plan would apply to the Service's actions throughout the entire interval between management plans. If the Service adopts a 15 year plan, that plan may not anticipate actions which the Service will need to take after the 15 years expire.

A 25 year planning period will allow the Service, at its discretion, to implement "Phase II" of the plan in appropriate areas of the Refuge at appropriate times. Phase II recognizes the Refuge is managed to heal its ecosystems to the point where the Refuge no longer requires human intervention to restore or maintain ecosystem health. OWF's comments on Phase II's components follow, at various points, infra." (695)

154 "If the best scientific evidence shows it will take fifty or one hundred years, or more, to reverse the damage caused by livestock grazing, a fifteen year moratorium is obviously only a beginning. While a longer moratorium may be impractical in day-to-day plans, there is no reason to take a weak stance in favor of a longer term. The grazing ban should automatically renew for successive fifteen year periods unless it can be shown the land is adequately recovered - there is no reason to have to prove the damage still exists every fifteen years. And even if the land does recover, a permanent ban on grazing should be an option for the entire refuge." (729)

Response. We appreciate your concern that the planning period of 15 years is too short. We agree that 15 years is a short period of time and that relatively few areas would recover during this period. However, re-valuation of Alternative D after 15 years of implementation, contingent on its approval, would be critical. At this point, the Service can evaluate progress made toward reaching long-range objectives. Then, in accordance with NEPA, the Service can decide whether to readjust management or long-range objectives, based on new information and results of monitoring efforts. Long-range objectives are provided in this FEIS to make it clear what direction the Service is going (i.e., what the Service is shooting for). Future planning efforts, based on 15 additional years of accumulated information, hopefully will make adjustments to the long-range objectives where needed, and continue short-term planning based on long-range objectives. If deemed appropriate, and after complying with NEPA requirements, Alternative D could be extended for an additional period of time. Otherwise, the plan could be revised where needed, or a new plan could be developed. We agree that implementation of Alternative D for 15 years would provide only a starting point for reaching these objectives. However, because the FEIS only covers management of the Refuge during the 15 years following implimentation, management beyond this 15-year period is beyond the scope of the FEIS. Criteria to be used to determine whether livestock grazing should resume would be addressed in the next planning period.

Comment

155 "The preferred alternative calls for no grazing for the duration of the plan. My suggestion calls for a short period of no grazing (2-5 years), followed by a review of progress, or lack of it, on the refuge. If possible, open the refuge to very limited grazing--reviewed each year for the remainder of the plan. If not possible, set aside another short period (2-5 years) until the next review. It's a shot in the dark, but maybe it will help to avoid some of the court battles." (549)

Response. The Service agrees with the writer of this comment that progress of the plan should be evaluated every 2-5 years. This would provide opportunities for strategies to be readjusted based on the results of monitoring information. However, to effectively manage an area, management strategies must be based on long-term goals and objectives (please refer to the above response for further detail).

Comments

156 "I also think you should focus on the short term, 15 year, effects when selecting the Alternative to be implemented. The long term is a goal at best, but I don't believe it should affect this decision. Even in 15 years a lot of things can change such as funding, public expectations, political direction and on-the-ground resources such as happened in these last few years of drought." (723)

157 "It appears that if we must think in terms of centuries, that maybe the sites have changed to the point that return to the original vegetation is not possible. At the back of the symposium proceedings are some references. If you want to look at any of these, let me know. The climate has shifted from the past and will continue to change into the future. Thus, my suggestion would be to focus on changes that we can realistically monitor and influence within the planning horizon (in this case, 15 years)." (730)

Response. The time that it will take habitats to recover (e.g., decades, centuries), and the time-scale at which processes of the area operate (e.g., decades, centuries) are the two primary reasons why long-range objectives were developed, and why these were used as a primary criteria for selecting Alternative D as the Preferred Alternative. Short-term planning based on long-range objectives is critical. Though not explicitely stated, this concept is a basic founding principle of "sustained yeild" in forest management (USFS 1989). Although short-term planning (15 years) would be based on long-range objectives, the focus will be on what can realistically be accomplished within 15 years toward reaching the long-term objectives.

Introduction of exotic plant species (namely cheatgrass), and possibly reduced soil productivity, certainly complicates the re-establishment of native plant communities in some areas of the Refuge. However, we do not believe that conditions have changed to the point where native plant communities cannot be re-established, given enough time. Laycock (1991, 1992) does not conclude that converting dense stands of sagebrush with depleted understories to open stands of sagebrush with productive understories is impossible; he surmises that it is a difficult threshold to cross.

Comment

158 "There are no clauses regarding what will happen at the end of 15 years in terms of livestock grazing. Maybe state that "livestock grazing would be re-evaluated at the end of 15 years"." (766)

Response. The statement, "livestock grazing would be re-evaluated following the 15-year planning horizon" was added. (Chapter 2, Alternative D).

MULTIPLE USE/COMPATIBILITY

General Comments

159 "Without question, our use of some special-use lands in a multiple-use way has resulted in severe damage to the land, sometimes almost past the point of any likely recovery. Your preferred alternative seems to recognize that reality as you call for a moratorium on grazing, a reduction in roads, careful use of fire to reduce the sage and juniper cover, and a removal of campsites from sensitive areas." (142)

160 "We should be able to keep antelope, livestock and tourists if people will work together." (762)

161 "The DEIS should address possible effects of livestock program on BLM lands. Reduced AUMs on Refuge increases pressure for BLM to find room for more use." (764)

Response. Comments noted.

Comments

162 "There needs to be give and take on both sides. One side cannot be completely disregarded." (9)

163 "The USFWS may permit a variety of uses in the National Wildlife Refuge System, but those uses must be compatible with the major purposes for which the refuge was established. 16 U.S.C. § 668dd(d)(1) (1985). The executive order that designated the present boundaries of the Hart Mountain refuge reserved the land "as a range and breeding ground for antelope and other species of wildlife." Exec. Order No. 7523, 1 Fed. Reg. 2184 (1936). The regulations guiding refuge management echo the statute. The USFWS must manage refuges to restore and protect wildlife and wildlands habitat. 50 C.F.R. § 25.11(b) (1992)." (74)

164 "A National Wildlife Refuge is not to be managed for multiple use (Executive Order 7523). The purpose of the refuge - in letter AND spirit - should be honored." (316)

Response. The second and third comments provides a good start for answering the first. The National Wildlife Refuge System Administration Act mandates that NWRs be managed for wildlife resources above all other uses. Where secondary uses (e.g., livestock grazing) can take place without significant impacts to the purpose for which a refuge was established, then the use may be permitted. Whether a secondary use is permitted on a refuge (assuming it is determined to be compatible) is left up to the discretion of the Refuge Manager. So, there can be room for give and take, BUT only within the constraints of what is compatible. If a use is not compatible, the Service does not have the flexibility to permit its use.

Comments

165 "The Refuge Manager has continually stated that Hart Mountain NAR is not managed for Multiple-Use. This is well understood, but it does not change the fact that refuges have long standing traditions as well as a continuing commitment to issue special use permits for compatible uses. Past refuge managers found grazing at a level of 12,000 AUMs annually to be compatible with the refuge goals, after three years of work on a DEIS the only grazing criticism to surface is generic criticism of intensive grazing, clearly a well designed program of 4,300 AUMs would be compatible with current refuge goals....

In my dealings with the EIS team it was presented to me that the team felt there was not enough known about the effects of grazing on some of the species found on the refuge. Therefore, removing the livestock is the proper way to manage for these species. Yet, consider this, Hart Mountain was severely overgrazed in the early 1900s since the refuges establishment, until 1990 it was grazed at a level of over 12,000 AUMs annually, and today there is not a threatened or endangered species on the refuge. Yet, still when faced with an option to graze at a level of 4,300 AUMs annually the writers of the DEIS felt they should remove cattle because of possible unknown effects of grazing." (206)

Response. Although issuance of special use permits for livestock grazing has occurred since the establishment of the Refuge, the Service does not, or has never, had a commitment to issue special use permits for compatible uses on Hart Mountain NAR.

Our understanding of livestock-wildlife relationships has increased substantially in recent years and compatibility standards are becoming more rigorous. In the past, livestock grazing was assumed to be harmless unless it was proven to have adverse effects. Past management of the Refuge also focused primarily on big game species, and management objectives were based on upland habitat standards (USFWS 1970). Focus has shifted to account for all native wildlife species on the Refuge, while still continuing to highlight species of special interest (e.g., pronghorn), based on Executive Order 7523 (Appendix A). Management of riparian habitats, under the Alternative D, would be recognized for their importance to native wildlife communities. Cattle grazing, even at low levels, can hamper restoration of riparian habitats (Platts 1989). Impacts to each of the 302 vertebrate wildlife species and numerous invertebrate wildlife species are poorly understood. Continued cattle grazing, given current conditions, would conflict with Refuge goals and objectives.

The Service has not identified any threatened or endangered plant or animal species on the Refuge, aside from bald eagles and peregrine falcons that occassionally pass through the area. However, there are 9 species that occur on the Refuge that are being considered for threatened or endangered status (Appendix H, Part 2). These species are to be managed as if they are threatened or endangered. If a species currently residing on the Refuge has its status changed to threatened or endangered, conditions exclusive to the Refuge would likely not have weighed heavily in the decision, aside from the Catlow redband trout and Catlow tui chub. The Service does not know of any plant or animal species that have their range limited primarily to Hart Mountain NAR.

Comment

166 "Vol. 1, Chapter 2-67, - Premises 3 & 4 only further the argument of domestic livestock grazing and you may be hard pressed to support these premises. It is suggested that the "compatibility" issue be used instead." (657)

Response. The Service maintains that livestock grazing would slow the process of habitat recovery on Hart Mountain NAR, but that it would not necessarily curtail recovery completely. Premise 4 of the DEIS was taken out.

ECOSYSTEM MANAGEMENT

Note: The Service, based on public input received during the public comment period, changed the name of Alternative D (Proposed Action) from "Ecosystem Management" to "Native Community Restoration". This name should lessen the confusion regarding what the Service proposes in the Proposed Action.

General Comments

167 "In adopting this policy, the Hart Mountain Refuge Complex has the potential for demonstrating to the nation an enlightened effort to recover a badly damaged ecosystem. Further, the adoption of this policy can set an example for the adoption of similar policies for other ecologically damaged areas of Oregon." (18)

168 "Ecosystem management [in reference to Alternative D] is based on scientific principles rather than on rhetoric." (23)

169 "In my professional opinion, Alternative D would help restore these ecosystems to a more natural (stable) condition." (60)

170 "I think it is important to minimize livestock and human impact on the sensitive and damaged ecosystems in the refuge." (69)

171 "To some extent, it appears that Hart Mountain Refuge may be a test case where various ideas and thoughts about rangelands management and desert ecosystems will be proven, disproved, or substantially modified." (94)

172 "The Oregon Natural Resources Council, a state-wide conservation organization with more than 6,000 members, urges you to adopt Alternative D (the Ecosystem Management Plan) for managing Hart Mountain National Antelope Refuge (NAR). We applaud you for choosing Alternative D as the Preferred Plan in that it recognizes that (1) domesticated livestock are exotic species incompatible with normal ecosystem function in south-central Oregon and (2) intervention in terms of fire, road closures, and ecosystem restoration is now required.

The native vegetation and fauna of the Great Basin evolved under conditions of low grazing and browsing pressure from large ungulates. Intensive and extensive livestock grazing and trampling over the last hundred years has dramatically altered ecosystems throughout the Great Basin, including at Hart Mountain, by destroying the soil-crust of nitrogen-fixing lower plants (cryptograms), reducing the density and diversity of native species, reducing or eliminating grass fires, and altering the landscape from one of a mosaic of shrubland, grasslands, and wet meadows to the present condition of monotonous shrublands locally dominated by exotic weeds. Your analysis that both protection from livestock grazing and ecosystem restoration are now required is accurate." (519)

173 "I'm not happy with the way this has been done. The surrounding ranches are protection for refuge animals.....I'm concerned about commercial development and longterm changes. We need to keep the ranches around Hart Mountain as a green belt. Look at Yellowstone and Yosemite. We need to worry about what happens outside the refuge boundaries. We need compromises." (763)

Response. Comments noted.

Comment

174 "We agree totally with the concept of resource management on an ecosystem basis. The interconnectedness of plant and animal life, water and soil in Oregon's high desert precludes the single species approach to management." (5)

Response. The Service agrees with this interpretation of the Proposed Action.

Comments

175 "USFWS should push for an MOU with BLM for management of the lower Guano Creek and the Beaty Butte Allotment as an ecological unit connecting Hart Mtn NWR with the Sheldon NWR." (33)

176 "Finally, in the interest of real ecosystem management, the U.S. Fish and Wildlife Service would do well to analyze the biological range of the pronghorn surrounding and between the Hart Mountain and Sheldon Refuges with an eye toward expanding and joining them. A start might be the analysis of connecting the Shirk Ranch portion with the rest of the Refuge by annexing the Guano Creek watershed." (47)

177 "I think the Alternative D plan needs more emphasis on connecting Hart Mountain ecosystems with Warner Valley ecosystems. An MOU w/ BLM may be in order." (48)

178 "Think about enlarging the plan to include regional considerations, consulting with the Native Plant Society, The Nature Conservancy, the Oregon High Desert Protection Act, and others interested in linking Sheldon, Hart and the important Warner Wetlands." (90)

179 "Although NAR encompasses a quarter of a million acres, it is a small and artificially circumscribed part of the larger landscape. It's interconnections with other parts of the region need to be considered and planned for in the FEIS. For example, local herds of pronghorn do not rely exclusively on NAR, but migrate out of the Refuge for forage and to Sheldon National Wildlife Refuge for the winter. Similarly, rivers, streams, and riparian zones provide corridors for movement of fish, plants and wildlife between the NAR and Sheldon, between NAR and Shirk Ranch, and between NAR and adjacent ecosystems. The USFWS should consider the alternative of expansion of the Hart Mt. NAR and Sheldon NAR to include the entire biological range of the pronghorn herd that the Refuge initially sought to protect." (519)

180 "We are concerned about the lack of continuity between lands managed by the FWS and the BLM. As we all know, the biological needs of the Refuge extend beyond the Refuge boundaries. We would like FWS to adopt a goal of completing a study within one year from this Plan being adopted to evaluate alternatives to address this issue. Options include a land management agreement with the BLM, designation of adjacent lands as a Pronghorn National Conservation Area or adjustment of the Refuge boundaries." (702)

181 "Individuals who honestly have a love for bighorn sheep grazing on mountain peaks; redband trout spawning in cool streams, sage rats poking their heads out of dusty holes and the awesome sight of the sun going down over the desert should be concerned over the gross disservice political gains and short range thinking are doing to our land and wildlife. The preferred alternative, which is part of the Draft Environmental Impact Statement being pedaled by the United States Fish and Wildlife, claims to be supporting and striving for ecosystem management on Hart Mountain.

What Don DeLong, a person I consider a friend, Barry Reiswig and others that put together the EIS have failed to realize is that Hart Mountain Antelope Refuge is a tiny speck of land in the Great Basin of Southeastern Oregon. It is merely part of a much larger ecosystem. This includes adjoining property that belongs to the Bureau of Land Management and private ranches. Obviously, the only boundaries put up between these land masses are human boundaries. When the antelope and the mule deer migrate onto adjoining private ranches and Bureau of Land Management lands, they are unaware of human political boundaries. Unfortunately, the Refuge is in more ways than one, doing everything it can to remove its piece of the pie from the greater ecosystem. It may satisfy some narrow thinking activists for the short term, but the long term picture is bleak." (798)

182 "A quote from page 2 of Planning Update, August 1993, in regard to ecosystem management "we often don't fully understand how natural systems really work." It seems we don't even recognize the boundaries of natural systems. The boundary of the ecosystem of which Hart Mountain is a part is not the survey lines on a map or fence lines on the ground. To manage Hart Mountain under this plan and call it ecosystem management should be an insult to the scientific community." (808)

Response. Because of the many interpretations of the term "ecosystem management" and to lessen the concerns regarding the label given to Alternative D, the Service changed the name of the Alternative to "Native Community Restoration". The intention of the Service's naming Alternative D as "Ecosystem Management" was to indicate that an ecosystems approach to management would be taken under this alternative. The IDT defines an ecosystems approach to management as an approach that takes into account all components and processes of ecological systems, and interrelationships among them within a defined area (e.g., Hart Mountain NAR). It also takes into account components and processes of ecological systems outside the defined area that affect or are affected by management within the defined area. None of these intentions have changed in the alternative due to the name change; an ecosystems approach (i.e., holistic approach) to management is still proposed.

The Service will continue to cooperate with BLM on issues that involve boundary areas of the Refuge. Additionally, the Service intends to meet with the BLM to reevaluate the current MOUs (Memorandums of Understanding) between the Service and the BLM, and to explore additional options. In particular, the MOU that covers the Shirk Ranch and BLM land to the northwest, Jacob's Reservoir, and other nearby Service lands will be revisited in the near future (USFWS 1994).

Comment

183 "Hart Mountain Refuge should be permitted to evolve back into its natural state, before cattle and other human uses took their toll." (50)

Response. Service policy would not allow all naturally occuring fires to run their course on the Refuge. Additionally, given the degraded conditions and small size, the Refuge would not "evolve back into its original state" if left completely alone. Management off of the Refuge would continue to influence ecological fire frequency and other ecological processes on the Refuge. An evaluation of this type of a scenario is provided in Chapter 4 of the FEIS for Alternative E (Custodial Maintenance).

Comment

184 "Because we have altered the landscape so severely, it seems necessary that human intervention be used to help bring back the native animal's vegetation. However, I feel it would be equally important to leave part of the refuge completely untouched (with cows and roads off) so that we could observe how these systems may affect their own equilibrium." (51)

Response. We agree. Control areas are critical for evaluating the success of management actions and the progress being made toward achieving long-range objectives. The vast majority of riparian areas would be left "completely untouched", and at least 85 percent of the Refuge uplands would be left untreated during the 15-year planning horizon. An examination of the ROS map for Alternative D (Map 2-13) illustrates the vast amount of area that is roadless. No additional roads, aside from proposed reroutes, are being proposed by the Service at this time.

Comment

185 "Investigate the possibility of coordinating your planning for Hart Mountain with Sheldon." (53)

Response. Management of Hart Mountain NAR and Sheldon NWR would continue to be coordinated.

Comments

186 "The effect of the proposed plan on surrounding private and federal lands has not been adequately addressed." (66)

187 "The DEIS fails to address secondary or indirect impacts to adjacent land management activities. Operators on adjacent lands will need to adjust their use on other permits or leases because when one portion of a rancher's operation changes, other aspects have to adjust to compensate for the change. As an examples, the BLM has already revised an existing Allotment Management Plan (AMP) for allotment #0216 on the south border of the refuge in response to the 1991-92 closure. Similar adjustments in other allotments and permits are very likely as the Service plan is implemented." (541)

Response. These concerns have been addressed in section VII of each alternative in Chapter 4 of the FEIS.

Comment

188 "By ecosystem management you should mean employing natural processes to achieve preservation of native biota in a state of diversity equal to that of pre-settlement time. Ultimately, the techniques will prove inexpensive because you will be working with natural forces, not against them. And the high diversity will ensure preservation of native species, recreation, and hunting within the constraints of carrying capacity and sustainability. Management will be directed at the whole system and all native species, including antelope and game mammals and birds as well as non-game species, plants, invertebrates and so forth. Natural processes will be allowed to proceed; fires will contribute to a mosaic of communities at various stages of succession; streams will agrade and degrade and meander in accordance with the intricate interaction of climate, topography, vegetation, soils, animals and so forth. In short, the system will be dynamic and diverse." (504)

Response. We agree with the above scenario, and feel that it falls in line with what is being proposed under Alternative D, except possibly in regard to fires, depending on the intentions of the writer of the comment. Where naturally ignited fires fall under pre-determined prescriptions, they would be managed as prescribed natural fires. Otherwise, Service policy mandates that they be treated as wildfires.

Comment

189 "What regional planning was considered? Regional planning seems minimal in the DEIS, even though the antelope in particular spend crucial seasons off-refuge. Modern preserve design stresses planning at the landscape level, with emphasis on connecting corridors. The DEIS needs a regional map showing corridors to the BLM's Warner Potholes, public land linking Hart Mt. Refuge to Sheldon, and the Sheldon Refuge as well. A bio-regional preserve proposal that encompasses the biological range of the antelope was published in 1992 in the Native Plant Society Bulletin but not cited in the DEIS (map enclosed). The Sheldon tui chub (Gila bicolor eurysoma), which is thought to move in wet years from its main refugia in creeks on Sheldon north through Guano Valley to Shirk Lake and Guano Creek, is a federal C2 species that will need regional planning to recover. Better coordination with the Oregon High Desert Protection Act legislative proposals is in order, especially with their Pronghorn and Oregon Grasslands WSAs (map enclosed). Refuge WSA recommendations are not currently coordinated with smaller BLM WSA recommendations on nearly adjacent areas (e.g., Guano Creek WSA). DEIS planning needs to accommodate the fact that BLM lands around refuge to the north, east, and south are in poor condition with an erratic trend, placing a special burden on Refuge to sustain species that historically had marginal habitat on the refuge, relatively speaking. For example: the sage grouse has leks in Guano WSA, yet this area may not provide adequate habitat today because of continued BLM grazing and the birds need to move onto the Refuge." (521)

Response. Regional planning is beyond the scope of this EIS. However, the effects of management actions on lands surrounding the Refuge, wildlife that moves on and off the Refuge, and effects on the local economy were evaluated (Parts VI and VIII of each alternative in Chapter 4 of the FEIS). Coordination with BLM would take place during the wilderness study process. The MOU between the BLM and the Service covering management of the Shirk Ranch and BLM land to the northwest, Jacob's Reservoir, and other nearby Service lands will be revisited in the near future (USFWS 1994). The Oregon High Desert Protection Act has not been passed as of yet.

Comment
190 "The BLM is moving towards an Ecosystem Based Management approach in managing public lands. We believe it is critical to coordinate future project planning and watershed restoration efforts in order to benefit the whole ecosystem. Guano Creek, Guano Slough, Jack's Creek, bighorn sheep, wild horses, antelope, sage grouse, and livestock grazing are all examples of issues that should be addressed at the landscape or watershed level, rather than as a patchwork of management strategies of different agencies separated by an artificial boundary." (541)

Response. We agree that future restoration efforts should be coordinated. To begin addressing the recommendation in this comment, Refuge personnel met with several staff members of the BLM Lakeview District Office (Refuge files). It was decided that prescribed burning, control of noxious weeds, management of feral horses, and management of Guano Creek south of the main border of the Refuge should be coordinated. It also was decided that the MOU covering the Shirk Ranch, Jacob's Reservoir, and other scattered Refuge lands should be revisited.

Comment
191 "The DEIS should discuss how the proposed management plan fits with the existing Memorandum of Understanding (MOU) between the Service and the BLM regarding management of the southeast corner of the refuge and the area west of Shirk Ranch." (541)

Response. Implementation of Alternative D would not affect management of lands that currently are administered by the BLM under the existing MOU. This clarification has been added to page 4 of the FEIS.

Comment
192 "OWF [Oregon Wildlife Federation] strongly urges the Service to discuss in its FEIS the impact of adding a wildlife corridor which would allow pronghorn to travel unimpeded between their summer range of the Refuge to their winter range on Sheldon National Wildlife Refuge. OWF suggests that the Service consider beginning an aggressive program to acquire land which would constitute this wildlife corridor." (695)

Response The Service is not considering a cooperative program with BLM to create a corridor between Hart Mountain NAR and Sheldon NWR at this time.

Comment
193 "The Final Plan and EIS should evaluate whether isolation of the Refuge from other similar or functionally related habitats is a factor limiting achievement of Refuge goals and objectives. If this is the case, strategies (such as interagency cooperative agreements, coordinated resource management planning, or land acquisition) should be discussed to address this issue." (745)

Response. Although isolation of the Refuge from other similar habitats may be a factor limiting achievement of Refuge goals, such a factor has not been identified.

Comment
194 "In order to manage an ecosystem, it is imperative to understand the ecological components of the system to be managed. The EIS Team has demonstrated an unacceptable consideration of the ecological (range) sites and their specific soils on Hart Mt NAR, both of which are described in a handbook (1977) that is, or was in the USF&W files in Lakeview, OR.

The Team ignored or more likely did not understand the concept of ecological sites which has been a basic, contemporary concept in resource management for many years. An ecological site is an area of land having a distinctive combination of soil, climatic, topographic and natural biotic (chiefly vegetation) factors which has management implications. The 1969 site survey mapped and described 26 ecological (range) sites on Hart Mt NAR. Apparently, none of these ecological data were used in formulating the rationale of statements in the EIS.

The Team used vegetation types as a classification of the NAR ecosystem. This is an acceptable generalization for some purposes in resource planning and management. However, vegetation types alone do not adequately characterize the basic natural units of the ecosystem. For example, the Low Sagebrush vegetation type on Hart Mt NAR includes three significantly different ecological sites, resources, including wildlife. Furthermore, three other distinctly different ecological sites on Hart Mt NAR naturally grow Low Sagebrush mixed with one or more other sagebrush species." (807)

Response. The Service agrees that an understanding of the components of ecological systems is critical to successful land management using an ecosystems approach. Soils information from USSCS (1993) and range site information from Anderson (1978) and USSCS (1969) were used in delineating vegetation types (Maps 1-3 and 1-4), as described on page B-1 of Appendix B. USSCS (1969) and Anderson (1978) were used in initial assessments of Refuge habitat conditions, until more recently collected data were analyzed. Because of the concerns expressed in several comments, we reevaluated USSCS (1969) and Anderson (1978), and added this information to Chapter 3 of the FEIS (section I, C of Chapter 3, Section One) and Appendix C. Specifically, the information was used to supplement assessments of conditions in late succession stands of upland habitats; note, however, that range condition does not characterize the status of wildlife habitat. The extensive amount of information on ecological sites contained in Anderson (1978) and USSCS will be of great importance when developing site-specific plans. Information contained in these documents will be of value when predicting vegetation response to burning or other treatments for specific areas. They provide valuable information on potential composition of plant communities in a late stage of succession.

We chose to use vegetation types as a basis for managing habitat on Hart Mountain NAR partly based on the scale at which information is available for wildlife species that inhabit the Refuge. Habitat needs of most wildlife species are not readily available below the vegetation type level (i.e., range site level) for the major vegetation types found on the Refuge (e.g., low sagebrush, mountain big sagebrush, Wyoming big sagebrush). Range sites are of a finer resolution than vegetation types in areas of low inherent habitat diversity on the Refuge. For instance, there are two low sagebrush range sites (stony terrace and claypan terrace) included in the low sagebrush vegetation type in the tableland areas of the Refuge; another low sagebrush ecological site (gravelly ridgetop) comprises the higher elevation low sagebrush vegetation type. The opposite is true for areas of high inherent habitat diversity. For instance, the high rolling hills range site (Anderson 1978) encompasses the mountain big sagebrush, low sagebrush, mountain shrub, aspen, mixed-deciduous shrub, willow, sedge-rush-bluegrass, and bluegrass-ryegrass vegetation types. Because riparian areas and small patches of other distinct habitats are of at least equal importance to wildlife as compared to larger blocks of upland habitat, a finer resolution is needed in mapping areas that encompass high inherent habitat diversity.

Comment

195 "They don't want the public to know what ecosystem management really means. The public is deliberately being held ignorant of what the end results will be. Ecosystem management translates into non-management. Since there are no monitoring requirements, success can be failure and failure can be success. Who will know the difference? The hunting public is going to find out too late what it is going to mean to them. The above journal excerpts [refer to comment 266] exemplify the true meaning of the ecosystem management. And as you can see, those period of times; there was five years, ten years, eight years and from the time that Ogden was here in 1826, there was nothing. Then there was one time where Work did find some game. There were periods and ecosystem management is going to be an up and down and up and down of wildlife populations. We can't afford to do that right now. We are here now. There are 250 million people in this country. We've got towns. We've got roads. We've got natural barriers built to prohibit wildlife from being managed naturally. We have to get out there and physically manage the land and use every possible tool that we have to do it. Otherwise, we are going to lose it. When those wildlife populations swing down as a result of draught, disease, or whatever; there is going to be a day when they are down there and they are not going to come back up. Because somebody ignored the use of management tools or believed in a system that has yet to be proven and a lot of us here know it won't work." (795)

Response. Projected end results of the Alternative D are clearly outlined in Chapter 4 of the DEIS. Alternative E (Custodial Maintenance) is the "non-management" alternative. Wildlife populations fluctuate, whether managed or not.

Comment

196 "There is concern that the ecology of Hart Mountain will tend to return to its pre-settlement conditions if all available tools are not used. We doubt once that condition is reached, or the trend of wildlife populations

begin to move toward less abundance, visitors to the mountain will be satisfied with ecosystem management on a micro system scale." (808)

Response. All necessary tools for managing Hart Mountain NAR, based on Refuge goals and objectives, would be available to the Service if Alternative D is implemented.

PLANT/ANIMAL LISTS

Comment

197 "Botanical resources of Hart Mountain NAR are listed in the DEIS in Appendix E. Hitchcock and Cronquist (1973) are quoted as the authority for this effort. Hitchcock and Cronquist are poor choices for this documentation since the manual was created for botanical elements north of the Great Basin. They state in their introduction: "For the purposes of this manual, as in the earlier work, the Pacific northwest is considered to include all of the state of Washington, the northern half of Oregon (north of approximately the 44th parallel), Idaho north of the Snake River Plains, the mountainous part of Montana, and an indefinite fringe of southern British Columbia. The southern boundary is drawn with the intent of excluding as much as possible of the Klamath and Great Basin elements that become so important to the south of our range" (Hitchcock and Cronquist 1973, pg. vii).

Using a botanical manual designed for a different geographic location is problematic since it suggests that plants detailed in Appendix E may be threatened, rare, or endangered, when in fact they are simply at the edge of--or out of-- their range. More appropriate manuals have been:

Peck, M. E. 1961. 2nd Ed. A Manual of the Higher Plants of Oregon. Binfords and Mort. Portland. 932 pp.

Hickman, J. C. 1993. The Jepson Manual. Univ. Calif. Press. Berkeley, CA. 1400 pp.

Cronquist, A., A. Holmgren, N. Holmgren, J. Reveal, and P. Holmgren. 1989. The Intermountain Flora. New York Botanical Garden. New York. 4 volumes." (205)

Response. Hitchcock and Cronquist (1973) was used as a source of common names of plants. It was not used to develop the list of plant species described in Appendix E. The list of plants in Appendix E was compiled from observations of plants on the Refuge. Apparently, Hitchcock and Cronquist (1973) has served as primary manual used by professional botanists and refuge staff to identify plants of the Refuge for the past 20 years. It continues to be used as a primary reference used by plant taxonomy classes taught on the Refuge (K. Holte, Idaho St. Univ., pers. commun.). More than 99% of the species listed in Appendix E are described by Hitchcock and Cronquist (1973). The Service is aware that other manuals exist for the region and uses them where appropriate. Because a few specimens were identified using Cronquist et al. (1984, 1989) and Hickman (1993), these references were added to Appendix E and are cited in the literature list.

Comment

198 "Can plant names be presented more conventionally? The plant inventory, Table E-1, should be alphabetized sensibly by life form-family-genus-species, not by life form, family, common name, which separates closely related species. Nomenclature should be modernized, i.e., use Jepson or the Intermountain Flora, not Hitchcock, which does not purport to cover Oregon south of the 44th parallel. Note that Hitchcock does not recognize the three subspecies of sagebrush featured so prominently in the text, although Jepson does (pg. 205). How about an illustration summarizing the differences between sages? The 1993 Klamath Marsh list of 550 spp. could be used as a source for current taxonomy. Table E-1 and E-2 need updating to reflect current field season results (e.g., Cypripideum montanum). The nearby Sheldon Refuge has such an excellent list: why not tabulate plants found on Sheldon but not yet found on Hart Mt. (as a means to complete Table E-1)? How about a star(*) for FWS hydric species and the full code (including explanation) for featured wetland species (e.g., aspen are Fac+). A table of botanical names for taxa comprising Map 1-3 and 1-4 community types is very much needed. Wheatgrass, bluegrass, rush -- which of the Refuge's five Agropyron, ten Poa, or thirteen Carexes is meant? The genus Arnica, as represented at Hart Mt., ranges from upland species (A. fulgens), to FAC- (A. latifolia), to FACW riparian species (A. amplexicaulis), to FACW palustrine species such as A. chamissonis -- the species intended in "rush-spikerush-arnica." Lumping arnicas is like lumping artiodactyls: if the DEIS distinguishes cows and mule deer, it should distinguish the arnicas, sedges, rushes, and bluegrasses. Many typos in Table E-3 (e.g., Chenepodiaceae, Arnica ludiviciana, Arnica dracunculus, etc.) need correction. Defamatory and/or sexist language directed at Native Americans has no place in any federal forum: surely another common name can be found for Ribes cereum.)

Povertyweed is seriously ambiguous as a common name. The Onagraceae are thoroughly confused in Table E-1 and certainly not out of Hitchcock. Camisissonia is misspelled." (521)

Response. As pointed out, there are many potential approaches for organizing plant lists. We feel that the organization chosen for placement of plant names in the species list for plants (Appendix E) (life form-family-species) is sufficient. A database is maintained in the Lakeview office that contains a table that cross-references names of plant species subject to recent change in taxonomic nomenclature. Note that the plant list of Appendix E was modified. The FEIS includes current taxonomic nomenclature of plant species, as described in Hickman (1993).

The use of Hitchcock and Cronquist (1973) as a source for common names is justified by the fact that this book describes 99% of the plant species listed in the Appendix E. Hitchcock and Cronquist (1973) continues to be used as the standard reference used by field botany classes taught at Hart Mountain NAR (K. Holte, Idaho St. Univ., pers. commun.). Other references used for identification of listed plants have been added. Identification of sagebrush subspecies was based on Winward (1980), considered an authoritative source. The plant list was updated to include plants identified in 1992 and 1993 field seasons (e.g., *Cypripidium montanum*).

The Refuge Complex office in Lakeview is in the process of developing databases for plant materials collected and identified at Sheldon NWR and Hart Mountain NAR. The database is incomplete and information that cross-references data from both Refuges is not available. The database will include information on functional relationships of species (e.g., wetland status). Scientific names of species that form dominant vegetation cover used to classify vegetation types can be found in the plant list of Appendix E. The arnica of the rush-spikerush-arnica vegetation type is *Arnica chamissonis*. Other species' names used as names for vegetation types indicate generic dominance of these taxa (e.g,. rush-spikerush-arnica = *Juncus-Eleocharis-Arnica*). Other comments were noted.

Comment

199 "Is the list of extirpated species exhaustive? For rare or unusual species said to be on the Refuge in Appendix H, there is a need to state the date of last record or whether the occurrence is speculative. Thus wolverines are most unlikely given their known dietary and habitat preferences. The last sharp-tailed grouse and gray wolf sightings should be stated. Appendix H would benefit from some population estimates. Historical sources don't seem to have been consulted in determining extirpated species. e.g., George Crook's 1866-67 field season and notes and specimens of early botanists such as Cusick. Elk petroglyphs are found at the base of Hart Mt. The Paiute word for elk is padu-hute. Elk were found in Willow Creek in 1992, yet aren't in Appendix nor discussed in the text. Bison petroglyphs are found at Jack Lake and bones were reported from New Camp Warner. [Feral horse petroglyphs are also found at south Long Lake.] Marmots were once extremely abundant and a staple of one group of Paiutes (Gidu-tikada: marmot-eaters)." (521)

Response. Although we conducted an exhaustive review of technical and refuge records, we do not presume to have reviewed all records of occurrence of species thought to have once occurred at Hart Mountain. We would appreciate being informed of specific historic records of species that may have been overlooked.

All species that were presumed to have occurred historically on the Refuge (e.g., wolverine,) were excluded from analysis of species richness and placed in a separate table. To the best of our knowledge, there are no sharp-tailed grouse records for Hart Mountain NAR. However, the species historically occurred in the surrounding region (Bendire 1877, Grinnell et al. 1918, Kelly 1932, Cushing 1941) and apparently made primary use of habitats that occurred historically on the Refuge. There are no records that indicate gray wolf regularly occupied sagebrush-dominated habitats of the northern Great Basin, including Hart Mountain NAR (Kelly 1932, Grayson 1988). Consequently, they were not evaluated in the analysis of sensitive species or the analysis of species richness.

Modifications to Appendix H in the FEIS includes a listing of sensitive species and development of a table that describes status. Since the 1980s, small numbers of Rocky Mountain elk apparently have emigrated from surrounding areas, such as the Warner Mountains, and colonized Hart Mountain. The Refuge population is currently estimated at 5 animals. Consequently, elk are considered permanent residents and are addressed in the analysis of species richness found in Appendix H. Other comments were noted that described historic occurrence of bison and yellow-bellied marmot near the Refuge.

Comment

200 "Provide for a thorough sensitive, rare and endangered plant survey." (542)

Response. Under contract, The Nature Conservancy (Oregon Natural Heritage Program) conducted a survey of sensitive, rare, and endangered plants in 1991. Results of the survey suggest that no federally threatened and endangered species occurred on the Refuge. The report describes the status of prostrate buckwheat, the only candidate threatened and endangered species known to occur on the Refuge. A rock barricade was erected to protect the population of prostrate buckwheat in 1992. The report also describes the status of broad-stemmed onion, nodding melic, and long-flowered snowberry, which are considered species of concern by the state of Oregon. Recommendations made for management of these rare plants were noted. The Service has and will continue to solicit expertise to inventory and monitor botanical resources. For example, Karl Holte, Idaho State University, held a field-class on the Refuge in 1992 and 1993. The secondary purpose of the class was to assist the Service with inventory of plant species and monitoring of areas scheduled for prescribed burning.

Comment

201 "The potential for trouble with the Endangered Species Act, which Dr. Buckhouse cited is supported on Page 10 Appendix H: "Sensitive species are defined as species which occur or are thought to occur on the Refuge and are listed as rare, threatened, or endangered at the federal, state, or Refuge level. Also in the second paragraph, "Fifty seven of the 334 wildlife species that occur or probably have occurred on the Refuge were classified as rare, threatened, or endangered at the federal, state, or refuge level (underlining is mine).

I suspect the lists of plant species Table E-1 and wildlife species Table H-13 are assemblages of species not necessarily identified on Hart Mt NAR but represent the entire Great Basin region. However, titles to these two tables imply that all these species have been identified on Hart Mt NAR." (807)

Response. Wildlife species of hypothetical occurrence were deleted from the analysis of species richness in Volume I and II (including Appendix H) of the FEIS. The new treatment deals entirely with species of known occurrence on the Refuge based on verifiable records. Species considered hypothetical are now listed separately in a table in Appendix H.

Determination of which wildlife species probably occurred (hypothetical occurrence) was based on review of technical information (e.g., Maser and Thomas 1984a, 1984b) and professional judgement. For example, bats are regularly observed on the Refuge. However, no species have been identified because surveys have not been done and, unlike identification of birds, identification of bats requires specialized skill or equipment. Nonetheless, a dozen bat species probably occur on the Refuge as transients, summer residents, or permanent residents. In the case of bats, determination of probable occurrence was based on review of records of bat distribution (Verts and Carraway 1984), review of habitat requirements (Maser and Thomas 1984b), and review of Refuge records of potential habitat available for feeding, breeding, and roosting. A similar analysis was performed with other species listed as hypothetical.

As for plant species, we added a narrative section to the FEIS that summarizes botanical information found in the tables of Appendix E. In short, plant species listed Appendix E were identified on the Refuge by professional botanists and Refuge personnel.

WILDLIFE SPECIES RICHNESS

Comment

202 "We agree that [wildlife diversity] will probably be enhanced with sagebrush removal up to a point. Again where that optimum point is will be hard to determine." (7)

Response. Wildlife diversity would increase after reduction in sagebrush in some, but not all sites. Diversity would decline after sagebrush removal where stand-replacement disturbances (1) reduce late succession vegetation in sites where late successional stands were small in size and scattered in distribution; and (2) increase the amount of early seral vegetation to a point where few, small stands (e.g., < 100 acres) of late successional vegetation remained on a site (Thomas et al. 1979b).

Principles described by Thomas et al. (1979b) would be used to maintain sufficient area of vegetation types in late succession stages for species that may be associated with the occurrence and amount of late successional habitat. Additionally, sites burned in prescribed fires or wildfires will be mapped, burn maps will be incorporated in the vegetation database, and relative amounts of succession stages will be calculated to track fire management and guide planning on a site-specific and Refuge-wide basis.

Comment

203 "We question the credibility of the report when it lists wolverines, the table H14 Page 85, as an animal existing on Hart Mountain." (605)

Response. Wolverines are considered a rare permanent resident of the basin and range province of Oregon (Marshall and Haight 1986). One was trapped on Steens Mountain in 1974 (Wilson 1983). Because the majority of habitats found at Steens Mountain also occur at Hart Mountain, there is a reasonable chance that wolverines may have occurred at Hart Mountain. However, hypothetical species, including wolverines, have been excluded from table H-14 in the Final EIS, and placed in a table that lists hypothetical species.

FEATURED SPECIES

General Comment

204 "It [Alternative D] provides for high population levels of several candidate species for listing under the Endangered Species Act: bighorn sheep, sage grouse, and redband trout." (358)

Response. Comment noted.

Comments

205 "Can the featured species list be broadened for better biodiversity? The featured species list could be broadened to include distinctive representatives of all life forms, not just so-called game animals. Why not balance current featured species by adding quaking aspen, beaver, biscuitroot, and a butterfly? DEIS featured species are exclusively hook 'n bullet varieties (trout, antelope, mule deer, sage grouse, bighorns). In some ways, the DEIS is just a tussle between beef and venison interests. Native vertebrates are described in demeaning terminology (game), their agonizing deaths from cruel and barbaric technology (muskets, archery) is treated casually (need for sport trophies), and drunken anarchic unbridled bloodlust is celebrated (high quality hunts). Lofty initial prose celebrating native biodiversity develops into trickle-down from commodity game production for the rest of us. Visitor/tag ratios (24,101 to 204: Tables 3-16 and 33-17) suggest that 99.2% of Refuge users are there to enjoy wildlife, not to hunt. Two hundred miles of roads are left open for slob hunters, at total cross purposes to every Refuge objective, to service twenty antelope tags." (521)

206 "Featured species descriptions highlight only game species and neglect to mention other ecologically important or popular species, such as beaver, raptors, or other predators. To the extent that the discussion of featured species in the Final Plan and EIS is intended to provide insight or guidance concerning important, ecological keystone species, or significant management indicator species, the group of featured species should be expanded." (745)

Response. Managing for wildlife species richness and featured species, as described in Chapter 3 of the DEIS, would increase biodiversity given our current understanding of vertebrate wildlife communities of the Refuge. Though not perfect, the current management emphasis on wildlife richness and featured species is consistent with the enabling directive of the Refuge, and is based on a holistically sound conceptual and technical foundation (Maser and Thomas 1983, Maser et al. 1984a, 1984b).

The importance of beaver is acknowledged. Although Alternative D would restore riparian habitat, other factors limit available habitat to beaver, which were re-introduced to Refuge waters in the mid-1960s by ODFW personnel. Limitations on manpower preclude all species from receiving the level of detailed attention specified for featured species. However, beaver and other riparian-dependent wildlife would continue to receive consideration in planning of management actions that may influence the availability of riparian areas for beaver and other wildlife. Please refer to response to comments 288-297 for additional discussion of beaver.

We acknowledge the importance of invertebrates in the maintenance of structure and function of the Refuge ecosystem. However, limitations in funding and knowledge of invertebrates of the Refuge preclude special management attention focused on invertebrates during this planning period (unless threatened and endangered species were known to occur on the Refuge; none are). Because Alternative D would restore diversity in upland habitats and wetland habitats, we assume that native invertebrate species dependent on such diversity would be maintained.

Plant species such as quaking aspen and bitteroot were not specifically addressed in the enabling directive of Hart Mountain NAR and therefore are not specifically addressed in management objectives unless they are considered threatened or endangered by state and federal standards (see Appendix E for description of rare, threatened, and endangered plants). On the other hand, restoration of aspen communities would receive considerable attention under Alternative D because of the dependence of wildlife assemblages on habitat afforded by aspen communities. See also response to comment number 208, below.

Comment
207 "Is there a trade-off between cougar populations and mule deer tags? Cougars are a featured species candidate found on the Refuge that would be most popular with visitor. They were seen on the Refuge in 1993. The FEIS should analyze mule deer tag impacts on this beleaguered cat. Some 200 tags implies the refuge is permanently short about five cougar (assuming a cougar need of about 3 deer AUM). The mule deer hunt is a de facto predator control program. Damaging browsing levels on new willow and regenerating aspen would seemingly be best controlled by cougar. How is Ecosystem Management interpreted in the case of the cougar?" (521)

Response. No, there are no apparent tradeoffs between cougar populations and mule deer tags. Unfortunately, managing wildlife populations is not that simple. Many other factors, other than just food, including space (e.g., home range size), cover (e.g., habitat requirements), and water availability regulate population size and density. Although on average 220 archery and musket tags are issued annually, total harvest averages only 49 deer (5% of populations). Mortality from other factors (e.g., disease) likely exceeds hunter harvest. Therefore, it is very unlikely that the mule deer hunt on the refuge is limiting cougar populations. Fencing is the only practical means of limiting browsing on young willow and aspen, especially where they are found in scattered small stands on deer summer range.

Cougars and other carnivorous mammals contribute to wildlife diversity of the refuge. As such, they are addressed in Chapter 3 and Appendix H in the discussion of species richness.

Comment
208 "Nongame Species: The current emphasis on ecosystem management should be exemplified by incorporating nongame species or guilds (e.g., cavity-nesters) as featured "species" selections. Although Alternative D does this in an indirect way by providing a diversity of habitat communities, the acknowledgement that nongame species represent important ecological components of the natural community would be appropriate." (540)

Response. We recognize that nongame species of wildlife are important components of ecological systems. This is one of the reasons why management for species richness is such a critical component of Alternative D. Important assemblages of wildlife (eg., sensitive species, riparian-dependent birds) would be monitored periodically, contingent upon implementation of Alternative D (see Chapter 2, section two). Such assemblages, which differ in composition between vegetation types and progression stages, will be "featured" in the sense that they would be monitored to assess changes in population and community-level characteristics (e.g., relative abundance of individual species, community composition).

Pronghorn, Bighorn Sheep, Mule Deer

Comment
209 "Likewise for pronghorn, predation has not caused serious population declines on a long term basis. However, a study in 1981 and 1982 (Trainer et al. 1983) and analysis of long term data (Keister 1985, Information Reports 85-1 and 85-2) showed that pronghorn populations were below carrying capacity of the habitat and were limited by low recruitment many years due to coyote predation and overwinter mortality during extreme winters." (7)

Response. Your analysis of pronghorn population dynamics identifying coyote predation and severe winter losses as key mortality factors corresponds with our assessment. The three publications you cited were milestones in documenting these ecological relationships. We add to this one more paramount factor: The quality and quantity of nutritious herbaceous forage during the latter two months of gestation and the first two months following parturition are key periods for pronghorn fawn production and survival (Ellis 1970, 1972, Ellis and Travis 1975, Smith and Beale 1980, O'Gara and Yoakum 1992). This is the period when pronghorn herds are replenished with fawn recruitment and if forage conditions are not favorable, then herd increases are limited. Conversely, if abundant preferred forage is available, the annual fawn crop has higher survival rates and herds increase. It is the needs for high succulent protein grasses and forbs during these crucial spring and early summer seasons (a period when shrubs are low in protein values) that we are striving for a better ecological succession balance of grasses, forbs, and shrubs for big game on Hart Mountain NAR. Then too as wildlife habitat managers, we advocate that rangelands having a better composition of grasses, forbs, and shrubs on crucial winter rangelands will provide higher quality energy forage thereby contributing to higher pronghorn survival during severe winters.

Comment
210 "For mule deer we agree in general with the statement made on page 121 of the DEIS that mule deer numbers are ultimately limited by quality and quality of habitat... However, in those areas that have good mule habitat, such as Steens Mountain, Trainer et al. (1981) found the population was within carrying capacity of the habitat and that coyote predation was the main cause of low fawn crops. In addition, periodic extreme winters also contribute to maintaining populations below carrying capacity for this region." (7)

Response. We concur that predation and severe winters take a major toll of deer during contemporary times. However, as habitat managers, we believe that if deer habitat on Hart Mountain had better quality and quantity of preferred forage--then the carrying capacity would be enhanced resulting in increased deer numbers. Presently, coyote predation and severe winters contribute highly to deer mortality, but as repeatedly reported by Connolly (1978, 1981)---predation continually exists in deer populations, but it is less a limiting factor in habitats with good forage conditions. It is this habitat standard of providing healthy plant communities for wildlife that we are striving for on Hart Mountain NAR.

Comment
211 "The population [of bighorn sheep] continues to expand toward carrying capacity of the habitat. Hunting and trapping and transplanting are viable methods to maintain the population at or below carrying capacity. However, ODFW is rapidly running out of authorized transplant sites for bighorn sheep. In order to maintain the population on Hart Mountain in the future, hunter harvest of ewes may be necessary to maintain the herd at carrying capacity." (7)

Response. The observation that bighorn sheep numbers continue to expand toward carrying capacity is noteworthy. Through monitoring, and in cooperation with ODFW, the Service would assess this population trend and determine when it may reach carrying capacity. A public educational program would be important at an early stage regarding ewe harvests, because public willingness to harvest ewes is much less than rams.

Comments
212 "The draft EIS predicts, in Alternative D (Preferred Alternative), that there will be an increase in populations of pronghorn antelope, and California bighorn sheep. These increases would be due to absence of livestock, maintenance of water supplies, reduced fencing and less competition for forage. The final EIS should include a discussion on the impacts of this population growth on upland vegetation.

According to the Preferred Alternative there will be a significant effort to restore and maintain shrubs, forbs, and grasses in upland habitats in the project area. Will the increases in wildlife populations effect the efforts to re-establish these habitats?" (32)

Response. A review of the literature regarding adverse effects of pronghorn and bighorn sheep on vegetation and on vegetation restoration efforts revealed that they would have little, if any, adverse impacts on vegetation or vegetation restoration efforts (Yoakum 1994b). Should habitat monitoring indicate that increased populations of these species are having adverse impacts, hunting or translocations may provide options for mitigating the impacts.

Comment
213 "When there were cattle on Hart Mountain in the '60s and '70s we archers had a lot of game in the form of deer and antelope. Now, you can't find wildlife. It seems to some of us sportsmen that the Fish and Wildlife Service has a way of managing some game out of existence." (44)

Response. Big game numbers on Hart Mountain are constantly increasing or decreasing depending in large part on quality and quantity of forage and water. Livestock practices have changed since the Refuge was established: domestic sheep no longer graze the mountain, feral horse numbers are controlled, and cattle have been subjected to grazing systems. Refuge records document that pronghorn numbers have increase 400 percent (Chapter 3, Section Two, II, A, 1) during the last 35 years. Deer numbers, however, have decreased some 200-300 percent just as they have throughout most of the Great Basin (Longhurst et al. 1983, Gruell 1986). Then too, bighorn sheep numbers have increased to an estimated 500 (Chapter 3, Section Two, II, A, 2). We have reason to believe that pronghorn, bighorn sheep, and mule deer population increases and decreases are directly related to the availability of preferred forage (other factors include climatic conditions, predator abundance, and disease). Therefore, the FEIS identifies the need to maintain highly productive healthy plant communities which will provide abundant and nutritious forage to sustain optimum numbers of pronghorn and mule deer. Healthy forage production helps produce healthy populations of these species and other species of wildlife.

Comment
214 " "Daddy, why didn't we see any antelope at the Refuge?" This is the most frequent question visitors ask. We see from Table 3-9 (solving a non-linear system of four equations in four unknowns) that 617 buck antelope, over 34% of the herd, are missing. Curiously, antelope were not hunted on the Refuge until 1968 (page G-4). There is no rationale or re-examination in the DEIS for its continuation. Refuge Goals 1-5 cannot be reconciled with the statement on page 115: "management actions would not be carried out that would have significant detrimental impacts to a featured species' population on the Refuge." This statement should not just be dropped in the FEIS, it should be repudiated. The Preferred Alternative is D, not B." (521)

Response. Hart Mountain NAR has different values for different segments of the public: Some want to see wildlife in natural habitat, others wish to photograph wild animals, while still others enjoy recreation days harvesting surplus animals, and many more just want assurance that their wildlife will be protected in perpetuity. The Proposed Action was designed to meet the goals for all these facets of the public. Since pronghorn are polygamous, it was determined over 20 years ago that there was a limited number of surplus bucks that could be harvested without harm to a viable populations (Carter 1970). Two and a half decades later, we see the population has increased some 500 percent, therefore, past conservative harvests have not led to decreased herds.

Comment
215 "The differences I can see are compared to the mid 70s when I used to go there every year. What I have noticed is that there are very few deer now. The antelope seem to be doing fine, as are the other animals." (533)

Response. Yes---deer numbers throughout much of the west have decreased during the past three decades. This appears to be a regional trend throughout the Great Basin ecoregion (Longhurst et al. 1983, Gruell 1986). Likewise pronghorn numbers during this same period are on a continued increase (Yoakum 1986).

Comment
216 "Shrub Removal Effects on Deer Populations: Shrub removal in mountain big sagebrush and bitterbrush habitat types may redistribute and concentrate deer, especially during the late summer and autumn months when bitterbrush becomes an exceptionally important forage item. Redistribution of deer groups will also likely result from burning aspen and snowpocket communities dominated by snowbrush. This could have negative effects on existing bitterbrush stands as well as on the success of bitterbrush planting efforts. Bitterbrush planting efforts should probably be pursued prior to treatment of existing bitterbrush stands as an attempt to minimize losses due to herbivory. Monitoring efforts designed to assess 1) deer condition and 2) bitterbrush utilization, may be advisable in conjunction with the annual fawn counts to determine whether a reduction in deer numbers (specifically females) may be needed to maintain a healthy deer population, limit damage to existing bitterbrush communities and promote bitterbrush planting success." (540)

Response. The key to manipulating shrubs, yet not deleteriously affecting deer movements, is to accomplish treatment projects in small acreages over several year intervals. Habitat manipulations of herbs can also affect deer distribution and be highly beneficial on spring/summer habitats where nutritious grasses and forbs contribute to higher deer production and survival during gestation and lactation. Bitterbrush stands that presently are decadent can be improved through disturbance. These management disturbance areas should remain small (500 to 1,000 ac.) and periodically treated over several years thereby providing a mixed age stand of browse for deer (Yoakum et al. 1980). Such mixed stands are healthier habitats when compared to extensive stands of even-aged communities, especially when the stands become over mature and decadent. The suggestion that monitoring should be accomplished relative to habitat manipulation/deer population numbers is a good suggestion to correlate habitat/animal relationships.

Comment

217 "196, Mule Deer You list numerous habitat improvements, yet you say the numbers would not increase. Is allowing increased hunting the answer? Of course, we do have to make up in some cases for our killing off the other predators, and it's probably a better protein source than fattened beef and pork." (555)

Response. No, increased hunting is not the answer. Habitat restoration for mule deer on Hart Mountain is aimed at trying to maintain or increase numbers slightly. Historically, densities were not high compared to some other deer habitats in the Great Basin. Numbers were greater in the 1950's and 1960's. Deer numbers can be increased, in part, by increasing the amount of nutritious forage that are preferred by mule deer. The Proposed Action would enhance the productivity and health of plant communities. It also would enhance deer fawning habitats and reduce disturbance by vehicular traffic in habitat used by mule deer. Whether these factors would result in increased deer numbers is uncertain.

Comment

218 "There is no baseline biomass productivity or determination of specific vegetation species to manage. How much forage does each animal require at different times of the year? Do wildlife and domestic livestock compete for forage or does each species have a different vegetation requirement?" (605)

Response. Each wild, feral, or domestic ungulate has different requirements for forage and this varies seasonally. When there is an abundance of grasses, forbs, and shrubs for all ungulates for all seasons of the year, there generally are no major forage competition problems. However, when there is insufficient forage during the gestation and lactation periods for big game, or inadequate supplies of high protein producing shrubs during critical winter months, then deer, pronghorn, and bighorn can suffer serious mortality problems. The present condition of limited healthy mixed plant communities of grasses, forbs and shrubs on the Refuge is the basis for the management decision to restore these vegetation communities to ecological potential. Rangelands abundant in mixtures of grasses, forbs, and shrubs provide a wide selection of preferred forage throughout the year for different ungulates--the formula for sustaining wildlife in natural habitats.

Comment

219 "There are no specific numbers of animals (animal units) being managed; there are no goals; The report gives vague estimates as to numbers of various animals that may exist in the future; including animals (wolverines) that probably will never exist on the refuge." (605)

Response. Where estimated numbers of wildlife were on record, they were reported in the FEIS (please refer to Tables 3-9 and 3-10, and Appendix G). Identifying specific populations of wildlife that the habitat can support would be speculative, and given the shear number of species (302 vertebrate wildlife species), would be impractical. Reference to the wolverine has been deleted in the FEIS. The goals of the EIS are to manage the environment for quality ecological conditions instead of estimated wildlife populations. Habitats in good ecological condition will produce healthy numbers of wildlife consistent with the habitat's carrying capacity (which varies year to year).

Comment

220 "One item not mentioned is the control of the wild animal populations. I was on Warner Peak looking into Hart Creek in the fall of 1992 and the wild sheep use in the area look like overgrazing by domestic sheep. It was as bad or worse than most of the cattle grazing I have seen in the bottoms. There must be better control of the use of any of the animals using the refuge, certainly there are ways to move those sheep into an area of lower use." (670)

Response. The control of wildlife populations was reported in the DEIS as follows: Page 71 refers to the possible (albeit limited) use of predator control; the potential use of hunting of pronghorn, bighorn sheep, and mule deer to manage their populations, if the need arises; the continuation of capturing and translocating of bighorn sheep. All of these address the subject of managing big game numbers in relation to carrying capacity of the habitat. Monitoring of big game numbers in relation to habitat conditions has not been an active program in past years. However, it is addressed as a management objective in the FEIS for accomplishment during the next 15 years.

Comment

221 "The compatibility and interaction of cattle and antelope was not thoroughly analyzed." (730)

Response. The compatible and competition relations of pronghorn/cattle was discussed on pages 117 and 156 of the DEIS. Much of the discussion addresses livestock grazing impacts on vegetation condition which, in turn, affects wildlife production and survival. Based upon a literature review of the following technical reports, there is reason to believe that competition for nutritious grasses and forbs on Great Basin rangelands can take place during pronghorn gestation and lactation periods (Ellis 1970, Smith and Beale 1980, Yoakum 1992, O'Gara and Yoakum 1992). Apparently, pronghorn and cattle can have compatible relations (Yoakum and O'Gara 1990), except during the spring when pronghorn does can be displaced by cattle during the fawning season (McNay 1980).

Comment
222 "Also, while this refuge is set aside specifically for antelope, the compatibility and future of the California Bighorn Sheep and the hunting, trapping/transplanting program should be evaluated in the management Plan. To state that "Continuation of the bighorn sheep capture and transplanting program would not impact future population size if herds are maintained at current levels, or are increased" cannot be construed as "planning"." (730)

Response. Research on California bighorn sheep has been conducted on Hart Mountain NAR, and it is from this research, coupled with 40 years of experience, that management goals have been determined. During the last four decades, bighorn sheep have increased from zero to an estimated 500, and they currently continue an upward trend in numbers. The bighorn sheep management program is developed with ODFW, therefore, strategies for managing bighorn sheep is a project of Service/ODFW coordination. Detailed management practices are slated for inclusion in a wildlife management plan to be completed in the future. These plans will be coordinated with both the ODFW and the Service.

Comment
223 "Enclosed please find the Pronghorn Antelope Winter Aerial Census in the Beatys Butte Unit (which is contiguous to the refuge on the Southwest), developed by the Oregon Department of Fish and Wildlife. **Antelope numbers consistently improved from a low of 1,050 in 1955 to a high of 5,463 in 1993.** The antelope from Hart Mountain winter in this area much of the forage coming from private holdings. The effect to these neighboring private lands has not been addressed. Hart Mountain is not an island and the management affects adjoining lands and wildlife that are not confined to the refuge annually." (730)

Response. The Service recognizes that pronghorn come and go freely on Refuge and adjacent lands. For the last three years, monthly counts have been made for pronghorn biological unit (lands occupied by pronghorn in and adjacent to the Refuge as determined by ODFW and the Service). All pronghorn census information has been coordinated with ODFW and BLM--the major land administrator for the area between the Refuge and Beatty's Butte. Both ODFW and Refuge records indicate a constant increase trend in pronghorn numbers for recent years. This continued increase in pronghorn numbers is similar to trend patterns for recent years in California, Oregon, Nevada, and Idaho on private and government administered rangelands.

Comment
224 "I recommend increasing the application of prescribed burning. This includes application used to improve mule deer habitat." (760)

Response. Comment noted; it is consistent with strategies outlined in Alternative D.

Sage Grouse

Comment
225 "Page 122 of the DEIS states that there is no relationship between long-term declines in productivity and abundance of coyotes and ravens. The facts suggest that there indeed is a relationship between the lower productivity of sage grouse and the increase in predator abundance, both of which occurred during the early 1970s. This and other evidence is presented in the ODFW report recently sent to you." (7)

Response. We agree that a relationship between sage grouse productivity and predator abundance probably exists and, therefore, have removed this statement in the EIS. Predation, however, may only be the direct factor regulating sage grouse productivity while quality and quantity of habitat appears to be the ultimate factor limiting productivity (Barnett and Crawford 1994, DeLong 1994, Drut et al. 1994, Gregg et al. 1994). ODFW (1993b) reported that although an increase in predator abundance since the 1970s may have highly influenced the decline in sage grouse productivity, predator control over broad areas is neither cost effective nor practical using presently available methods. ODFW (1993b) continued by stating that "to insure continued self-sustaining populations of sage grouse and improved productivity in Oregon, actions should be taken to maintain and enhance habitat conditions." Please refer to Comment number 538.

Comment
226 "Our greatest concern pertains to the importance of sagebrush cover to sage grouse. Page 170 of the DEIS states that excessive shrub cover is the primary factor limiting sage grouse populations on the refuge. We disagree with this statement and feel it may mislead the public. No research anywhere has made such conclusions. Sage grouse are a bird of sagebrush steppe habitats, not grasslands. Numerous studies documented the importance of sagebrush cover for nesting and wintering sage grouse (it is also extremely important to wintering pronghorn). In addition, numerous studies have documented that nests normally occur under the tallest sagebrush in the area. These findings point out the importance of ample cover of sagebrush. In addition, Mike Gregg's work at Hart Mtn. found that successful nests had high cover of both grasses and sagebrush. According to his data (Gregg *In Press*), successful nests had 56% cover at the nest and 31% surrounding the nest. These values are very high and indicate that sagebrush cover is also very important to nesting sage grouse. Therefore, we disagree with the above statement and the several others made in the text where grass cover is mentioned and sagebrush cover is not." (7)

Response. The statement that "excessive shrub cover is the primary factor limiting sage grouse populations on the Refuge" has been explained in greater detail in the Featured Species section in Chapter 3 of the FEIS. Excessive shrub cover does not directly limit sage grouse populations but it does limit the grass and forb understory which is critical to sage grouse production (Barnett and Crawford 1994, DeLong 1994, Drut et al. 1994, Gregg et al. 1994).

We agree that sagebrush is essential to sage grouse for food and cover throughout their life cycle. The majority of sage grouse nests are located under a sagebrush and the height and canopy cover of the nest shrub appears to influence nesting success. A distinction, however, must be made between shrub cover of sagebrush stands and shrub cover of sage grouse nest sites. Gregg et al. (1994) found no difference in the shrub cover of sagebrush stands surrounding the nest site (75-m^2 area) for depredated and nondepredated nests. This suggests that the shrub cover of the sagebrush stand may not influence nest fate. However, Gregg et al. (1994) reported that increased amounts of medium height shrub cover at nest sites (3-m^2 area) were associated with nests that were not depredated. This suggests that the shrub cover of a relatively small area, predominately the canopy cover of the nest shrub, influences nest fate. We would expect the shrub cover of the nest site to be greater than the shrub cover of the sagebrush stand because the plot used to measure cover at nest sites was relatively small and centered over the nest shrub. Therefore, managers should not interpret the shrub cover for nest sites as recommended shrub cover for sagebrush stands.

Thinning of sagebrush stands may not be detrimental to sage grouse nesting habitat as long as adequate nest shrubs are available. However, conversion of some sagebrush stands from late seral, shrub dominated communities to early seral, herbaceous dominated communities may have negative affects on nesting habitat in the short term (Connelly et al. 1991), and therefore, should only be implemented in areas where other nesting habitat exists nearby. Converting dense sagebrush stands from a late stage of succession to an early stage of succession will be necessary to provide quality nesting habitat in the future.

Comment
227 "The DEIS states that habitat degradation is the reason for the decline in Sage Grouse. But, habitat conditions bottomed out in the 30's and have since improved. The Sage Grouse population continues to decline." (206)

Response. Upland habitats have improved somewhat the past 30 years. However, severe overgrazing in the late 1800's and early 1900's by domestic livestock coupled with the suppression of wildfires resulted in an increase in shrub cover (primarily sagebrush) and a decrease in the herbaceous understory. Several sage grouse studies have demonstrated the importance of herbaceous understory to survival and reproduction of sage grouse (Patterson 1952, DeLong 1993a, Gregg et al. 1994). Habitat quality (i.e., herbaceous understory) will not improve until shrub cover is reduced (Sneva et al. 1984, Laycock 1991, Windward 1991). Furthermore, riparian areas, which are important brood rearing habitats, have not improved much in the past 50 years. In fact extensive field observations in the late 1980's suggest riparian areas throughout much of the west were in the worst condition in history (Chaney 1990). Sage grouse populations will not increase substantially until upland and riparian habitats are improved.

Native Trout

Comment

228 "I am especially pleased to see that the native Catlow redband trout has been included as a key indicator species in the plan. These unique fish species have evolved over thousands of years and occupy a unique niche in the biological diversity of the area. Past land management activities, particularly the grazing of domestic livestock, have adversely affected these species so that they now occupy only a small portion of their range. These fish have been classified as "State Sensitive Species" by the Oregon Department of Fish and Wildlife, and could likely be candidates for listing under the federal Endangered Species Act. The Fish and Wildlife Service has an obligation to see that these fish do not decline to the point where listing under the ESA becomes necessary. Preferred alternative D will provide these unique species with the protection that they need in order to reestablish themselves over their former range." (30)

Response. Comment noted; these observations are consistent with the Proposed Action. An emergency fisheries closure was implemented on Rock and Guano creeks August 14, 1992 due to drought. Under the Proposed Action, it would stay in effect until it is determined that the fish populations have recovered sufficiently to support recreational fishing.

Comment

229 "I believe this alternative (D) will best serve restoration and maintenance of fish habitats on the refuge." (75)

Response Comment noted; this agrees with what we have included in the Proposed Action (Alternative D).

Comment

230 "I do have one comment relative to Oregon Department of Fish and Wildlife's fishery management activities on the Hart Mountain Antelope Refuge. We (ODFW) currently stock rainbow trout fingerlings annually into Warner Pond to provide a recreational fishery. I support your proposal to close the road into Warner Pond three-quarters of a mile below the ponds. I would however, request that administrative approval be granted to allow for access once each spring to stock trout. This would require that the upper 0.75 miles of road not be altered to the point that a 4x4 pickup truck could not negotiate the steep portion of the existing road." (75)

Response. Under the Proposed Action, access would be maintained for fish stocking purposes once each year.

Comment

231 "A sustained elimination of livestock grazing also will ensure conservation of the rare fishes and other aquatic species, some of which may be locally endemic, and many of which largely remain unknown to science." (314)

Response. Comment noted; this observation is consistent with the Service's assessment.

Comment

232 "With respect to the substance of the DEIS, Oregon Trout is particularly concerned with native fish and their habitat. The DEIS did an exceptional job of linking the condition of the riparian vegetation with water quality and quantity, and how that relationship directly affects native fish fauna." (515)

Response. Comment noted; this agrees with what we have included in the Proposed Action (Alternative D).

OTHER WILDLIFE SPECIES

Comment

233 "I am concerned about elk. Have the reasons for mortality been identified? Give elk a chance to establish." (765)

Response. No, reasons for mortality of elk on the Refuge have not been identified. Non-use by cattle for the next 15 years, closing the Barnhardi Road to vehicle traffic, and reducing vehicle traffic on the mountain by Refuge staff should positively affect elk.

Pygmy Rabbits

Comments

234 "Pygmy rabbits normally use very tall sagebrush, in deep soil, surrounded by lower statured sagebrush... This species occurs at low densities and may be isolated from other colonies. Therefore caution should be used in burning large quantities of big sage as colonies may be lost and further isolated. While time consuming, surveys for pygmy rabbits are recommended before burning." (7)

235 "Will pygmy rabbits recover under the proposed CMP? Pygmy rabbits are not described as habitat specialists in Table H-12, page 22. Actually, pygmy rabbit specialist F. Dobler states that "They depend entirely on dense stands of sagebrush for shelter and food. To survive they need dense sagebrush, deep soils suitable for burrowing, and a good cover of grasses and flowering plants. They are the only native North American rabbit who construct their own burrows. Habitat islands can mean doom for pygmy rabbits ... that are unwilling or unable to cross open spaces without cover from hawks....We could lose up to one-third of our population in a thousand acre fire." Pygmy rabbits are known from Allotment 217 just south of the boundary. Has pygmy rabbit habitat been identified on the Refuge and the impacts of prescribed burning considered? Would pro-active management by the Refuge contribute to preventing another Endangered Species Act train wreck?" (521)

Response. The Service agrees that caution should be exercised in burning big sagebrush in areas where Pygmy rabbits may occur. Information on distribution and abundance on pygmy rabbits on the refuge is limited at this time. The Service has acquired recent publications and is aware of their habitat needs. Surveys will be done prior to any planned burns in dense stands of big sagebrush.

Reptiles/Amphibians

Comment

236 "I would be particularly interested to know if you intend to study and monitor reptile and amphibian populations on the Refuge. Also I feel that it is important to pay attention to bat populations and habitat." (35)

Response. Information on reptiles, amphibians, and bats on the Refuge is limited at this time. The service agrees that these animals are an important part of the Refuge ecosystem and need to be considered. The service also believes rehabilitation of riparian areas and uplands will benefit these animals.

Invertebrates

Comments

237 "Should butterflies be accommodated in vegetation management planning? Butterflies, like other invertebrates, are not acknowledged in Appendix H ("Wildlife"). The Refuge has never participated in annual nationwide Fourth of July butterfly counts. There has been no consultation with lepidopteran experts such as Dr. Paul Hammond. Nectar and larval plant resources are not identified nor the impacts or timing of proposed actions on butterflies (major pollinators) analyzed. The Refuge has not been surveyed for a rare skipper (Ochlodes yuma) found nearby at Summer Lake. The larval food, Phragmites communis, a marsh reed (Poaceae) is quite probable in Big Flat. The cryptic satyrid, Neominois ridingsii stretchii (ONHP List 3*) whose larval food is a grass, is found in two high elevation relic populations at Pueblos and Drake Peak. Warner Peak is a high probability site that needs inventory prior to burning, given the rarity of this species. The DEIS does not summarize easily available results from Steens or Klamath Marsh surveys which should be included as Appendix H-17 (see enclosed)." (521)

238 "Has the role of ants been considered in Refuge planning? Ants are probably the dominant Refuge herbivore and may significantly impact biological processes considered by the DEIS. Many Great Basin plants are symbiotically adapted to ants, depending on lyposomal particles for seed dispersal and burial. Sage grouse chicks eat ants at a crucial time and may compete with them later for forbs. Ant mounds are quite noticeable on aerial photos in some habitat types, though the DEIS leaves this unquantified. At two ant per sq. foot and 43,000 sq. feet per acre, 277,000 acres of Refuge implies 24 billion ants. Assuming ten milligrams per ant, we are looking at 240,000 kilograms of ants, compared to merely 80,000 kilograms of antelope. In other words, most of the refuge animal biomass is comprised of ants. Ants have complex social systems, more interesting and highly evolved than those of many Lake County vertebrates. Ants thus "provide opportunities

for wildlife-dependent education oriented to the Great Basin ecosystem "(Goal 4). Clearly, the DEIS should summarize current knowledge and future research plans for Refuge ants." (521)

239 "OWF suggests that the Service consider invertebrates and their niche on the refuge. What role do insects and other invertebrates play as low trophic level prey species and as herbivores? What will be Alternative D's impacts on invertebrates?" (695)

240 "Invertebrate Animal Species - These should be carefully considered since biologists know that they are as crucial to ecosystem health as the larger animals considered in the DEIS." (655)

241 "Research at Hart seems to have included most native animal species except for the world of invertebrates. Given that so many birds, and the fish species present, depend upon insects for food, it would seem advisable to document these species. A reoccurring inventory could provide valuable insight into the effects of rest from domestic livestock grazing, recovery and restoration of natural terrestrial and aquatic plant communities with respect to invertebrate assemblages. The Xerces Society and Lepidopterists Society might even already have data bases upon which to build with respect to resident and migratory butterflies and moths. Aquatic macroinvertebrate inventories could prove important in assessing water quality and as indicators of system recovery stages. Invertebrates also tend to be very susceptible to chemical introductions (poisonings--herbicides, weedicides, pesticides, etc.)." (732)

<u>Response</u>. We agree that invertebrates are important in the Refuge ecosystem, but, we chose not to include invertebrates in this EIS because of time constraints, limited information on invertebrates at the Refuge office at this time, and current budgetary priorities. We agree that more emphasis should be placed on invertebrates in the future. At this time, we do not have plans or funding for studies of Refuge invertebrates. A hypothetical list of Butterflies of Hart Mountain NAR has been prepared but not field checked (Refuge files). The larval food <u>Phragmites communis</u> has not been identified at Big Flat or any other location on the Refuge. Arthropods were identified during a sage grouse research project on Hart Mountain NAR (Pyle 1993a) but no comprehensive list exists for the Refuge (Pyle 1993a). One of the major assumptions of the Proposed Action is that, by resolving core habitat problems, healthy and balanced populations of all native wildlife species of the Refuge would be restored and maintained. This pertains to invertebrate wildlife as well as vertebrate wildlife. The NWRS definition of wildlife includes insects and other invertebrates (USFWS 1982: 7RM 12.3 I). Given projected funding levels, we would continue monitoring vertebrate wildlife (but likely not invertebrate wildlife) to evaluate this assumption. Allowing herbaceous vegetation to remain standing after the growing season into the following year (residual herb cover) and allowing plant material to accumulate as litter should positively affect native invertebrate communities. This should especially hold true in meadows, marshes, in areas where shrub and juniper cover have recently been reduced, and along stream channels (aquatic invertebrates). Restoration of streams, riparian areas, and uplands also should have positive effects on native invertebrate communities. (See also comments 392-394)

<u>Comment</u>

242 "It might also be very interesting to do a literature search on fire ants and grasshoppers with respect to research indicating connections between severely degraded grazed lands and the abundance of both these insects. Somewhere I have read research papers and reports which noted that heavily grazed areas have higher populations of fire ants, and that grasshoppers flourish under such conditions as well. My observations of grazed lands east of the Cascades in Oregon seem to bear this out--though I have not had the funds to conduct valid scientific studies." (732)

<u>Response</u>. A literature search is possible, and time permitting, Refuge staff would continue to strive to update Refuge files with pertinent references as they become available. The Refuge does not have funds to conduct scientific studies at this time. Anyone interested in conducting research on the Refuge through a volunteer or University cooperative program should contact the Refuge Manager. Fire ants are not present on or near Hart Mountain NAR.

Non-native Wildlife

<u>Comment</u>

243 "Why are non-native animals treated on a different footing than non-native plants? The DEIS does not provide a table of non-native animals analogous to Table E-3 (non-native plants). At a minimum, this double

standard (stocking non-native fish and encouraging chukar while tsk-tsking non-native plants) seems to need a compatibility analysis, given that recreation is a supposedly subordinate goal to restoring native communities. Catlow tui chub and Sheldon tui chub are barely discussed: no location or status data are given. Releasing non-native species may have many adverse environmental effects not analyzed in this document. The glossary definition of "wildlife" should clarify whether non-native species (e.g., hatchery trout) are actually wildlife in view of the wording of Executive Order 7523. (Note feral horses and domestic livestock are not considered wildlife in the DEIS.) Goal 4 restricts recreation if it does not maintain the undeveloped character of the refuge. Stocking hatchery trout is a development. The FEIS should analyze options for eradicating stocked fish." (521)

Response. This comment has several points: (1) The Catlow tui chub is listed as a taxon of special concern by the American Fisheries Society, a sensitive species by the ODFW, and a category 2 candidate species for review as a federally threatened and endangered species. It is known to occur on the Refuge in Rock Creek and Paiute Creek and is suspected in others. The Sheldon tui chub was listed as a federal category 2 candidate species in 1982 and ODFW included it on the state sensitive species list. It was reported in Guano Creek up until 1934 and again in 1955. No chubs were found in upper Guano Creek on the Refuge by ODFW personnel during 4 surveys of fish habitat and distribution between 1980 - 1992. However, tui chubs were found in 1985 in Guano Creek 0.1 - 1.8 km west of the junction of Guano Creek and the Refuge property at the Shirk Ranch (Stern et al. 1993). Surveys done in 1992 found none in Paiute Creek and portions of Guano Creek between the Shirk Ranch playa lakes and ponds upstream to a point approximately 0.5 miles within the Refuge boundary. Additional surveys are planned for 1994 focusing on a resurvey of 1992 sites and an expanded effort to include upper portions of Guano Creek on the Refuge, portions of Guano Slough near Deer Creek where chub were observed in 1985, as well as Barry Reservoir, a site that may also have held water through the drought. The Service believes that any habitat improvements that will benefit the native trout population will also benefit the tui chub through improved stability and downstream distribution of water; (2) Non-native species will not be released or encouraged (with the exception of Warner Pond which is an established rainbow trout fishery). The Service believes that stocking of the Warner Ponds will not have adverse affects on any native species because there were no other fish species in the ponds before stocking of rainbow trout and there is no threat of them spreading to places presently occupied by native species. It is believed that the fish stocked in the ponds cannot perpetuate themselves because a limited availability of spawning habitat (Pyle 1991c). Also, the road to the ponds would be closed in the Proposed Action which would reduce disturbance to wetland-associated wildlife; (3) "Wildlife" includes native and non-native species of non-domesticated animals. Where native species are discussed or highlighted in the EIS, "wildlife" is prefaced by "native". Based on this comment, we developed a list of non-native wildlife species that occur on the Refuge (Appendix H); (4) Eradication of non-native wildlife would be very labor intensive, expensive, would cause environmental problems and would not be possible for some species (eg. European starlings, chukar). The Service feels eradication is not necessary at this time.

Comment

244 "Non-native Animals - Species of non-native animals should not be maintained including, for example, chukar and hatchery trout." (655)

Response. Non-native animals will not be introduced and those currently on the Refuge will not be encouraged. Stocking of hatchery trout in Rock Creek was terminated in 1976. By 1979 trout present in the creek showed characteristics of redband trout. Stocking of hatchery trout in Guano Creek was terminated in 1979. See response above for the Service's position on eradication. Also see point #2 in the response above.

Comment

245 "Prohibit the introduction or promotion of non-native fish and wildlife species such as hatchery trout. Instead, emphasize restoration of native species populations." (542)

Response. U.S. Fish and Wildlife Service Refuge Manual 7RM 10.1 states: "Fishery resources within the refuge system will be managed primarily to maintain balanced, self-sustaining populations. Management emphasis will be placed on species native to the geographic area of the refuge." The Proposed Action is consistent with NWRS policy.

HABITAT CONDITIONS AND THEIR CAUSES

General Comments

246 "Ornithologists and biologists agree that 60% to 80% of all bird and wildlife species found in the arid regions of the west require riparian areas to complete their life cycles." (4)

247 "The most serious damage on the refuge is seen in riparian areas." (4)

248 "...as a trained biologist, I was dismayed to see the condition of much of the refuge." (15)

249 "The "Great Basin" country east of the cascades and all the Rockies has been eroding down to a vast gravel pile ever since the invention of herbicide. I am glad you realize it." (120)

250 "Our understanding of the historic habitat conditions from this region are meager. Our surveys clearly demonstrate however, that aquatic habitats throughout the region have severely degraded from conditions prior to 1900. It also is clear that species such as the Guano tui chub and Catlow tui chub, both of which are category 2 candidate species, inhabit areas that are subjected to periodic extremes in flood and drought. For example, many aquatic habitats in the region dried or nearly dried during the droughts of the early 1930s and the recent drought that ended last year." (314)

251 "I have heard a talk recently by Mr. Dobkin of the Oregon High Desert Museum, a well-respected biological researcher. He estimates that within the high desert/great basin regions, less than 1-1/2 percent of the range lands are in their natural pre-grazed state - free of the effects of overgrazing that has been occurring in these regions since the latter 1800's. Implementing Alternative D is a unique and historical opportunity to start reversing this trend on the 277,000 acres of the Hart Mt. Refuge." (316)

252 "There have been significant impacts on the hydrologic cycle resulting in decreases in water quantity and quality in an area where water was already scarce." (365)

253 Grasslands have lost soil and will take 20,000 years to recover. (773)

Response. Comments noted.

Comments

254 "It seems that cattle grazing is being blamed for all the damage done to the refuge. Nothing was said about the severe drought conditions that existed for the 5 years from 1988 to 1992... From what I've observed, condition of the fish and wildlife in the area is attributable to the drought conditions rather than cattle." (9)

255 "Unless Hart Mountain is different from the rest of Lake County, the heavy damage to riparian areas occurred during the Christmas floods of 1964 and has been aggravated by numerous smaller flooding occasions in the ensuing years. Suddenly, in the last few years, you've become aware of it and are blaming cattle for the problem." (17)

256 "No consideration in the assessment of present conditions on the refuge is given to the seven years of drought preceding evaluation." (66)

Response. Cattle grazing is not being blamed for all damage done to the Refuge. Some of the blame also lies in the suppression of fires on and off the Refuge, innappropriately located roads, and in limited areas, some of the blame lies with feral horses and limited regulation of public use (e.g., uncontrolled camping at campgrounds). These factors are management problems, problems that the EIS/CMP addresses. Deteriorated conditions on the Refuge primarily are a consequence of heavy livestock grazing that occurred in the late 1800s and early 1930s and fire suppression during the 1900s. Habitats have not recovered. Droughts, likely exacerbated conditions created by livestock grazing and fire suppression, but were not the driving force that has resulted in excessive shrub cover, reduced soil productivity, eroded stream channels, and deficient riparian vegetation on streambanks (core problems). The previous drought does not seem to have had any noticeable effects on shrub cover and degraded riparian conditions. Healthy riparian areas can, under most circumstances, withstand large floods. However, in degraded condition (deficiency of deep-rooted riparian vegetation on streambanks, stream channels within gullies, etc.) tend to worsen during high water flows.

Comment

257 "Weeds are a huge problem on Hart Mountain." (205)

Response. Weeds are a problem in a few limited areas on the Refuge. Actions continue to be take to abate the problem.

Comment

258 "In 1984, I designed and conducted a survey of 99 stream ecosystems spread across Oregon and portions of its contiguous states for the U.S. Environmental Protection Agency. The goals of that study were to (1) assess regional patterns in fish, benthos, and algae assemblages and their habitats and (2) estimate potential conditions if streams and their catchments were managed to protect biological integrity. One of the streams we sampled was on your refuge. Although it was in better condition than many rangeland streams, it was not attaining its potential condition because of overgrazing by livestock. The riparian vegetation was in very poor condition, the stream banks were unstable, the stream substrate was highly imbedded with fine sediments and there was a shortage of pools and riffles. These habitat conditions were associated with reduced biological integrity. This was scientifically and personally disappointing because we had naively hoped that a stream on a wildlife refuge would set a standard for rangeland streams in that ecoregion. Clearly it did not, and therefore, the stream did not serve as a refuge for aquatic life. I applaud your decision to change that status by managing Hart Mountain as a wildlife refuge instead of a pasture. We have plenty of the latter in this country and few of the former." (313)

Response. Comment noted.

Comment

259 "What was the pre-settlement distribution of willows? Willows, another crucial taxa to CMP objectives, are inadequately analyzed. Willow ecology is crucial to riparian health, stream restoration, and to several featured species, including native trout, yet willow ecology is given minimal attention. Eight species have been found on the refuge (Table E-1), but no information is given on relative abundance or actual distribution or condition. Habitat niches of individual species (implicit from the speciation of the genus Salix) are not described. Willows are associated with streams (water with significant flow), attributable to a dissolved oxygen threshold not realized in saturated low-gradient swales or turbid playas. (Once established, willows can hold on long after the hydrology changes.) No discussion is given as to why only short stretches of Guano and Rock Creek are of willow vegetation type. On Map 1-4, existing willow areas near Post Meadows are given over to sedge-rush-bluegrass with no explanation of successional reversal. How was historic willow habitat identified? What assumptions were made about beaver and their creation of willow habitat out of current upland? Are there sufficient local willows for plantings at the scale needed? Where are the priority areas for willow plantings?" (521)

Response. Map 1-4 of the Draft and Final EIS/CMP identifies the distribution of the willow vegetation type. The map reflects what we believe to be the historic distribution of the vegetation type. This generally reflects the distribution of willows, but some vegetation types, such as sedge-rush-bluegrass, has willow distributed within it. Not all of the willow vegetation type currently is dominated by willow. A more detailed distribution analysis of actual willow distribution has not been completed for the Refuge. The EIS covers a comprehensive management plan, and detailed descriptions of each species that occurs on the Refuge would be impractical. Historic willow habitat was identified based on remnant willows, stream type, distance from seed sources, willow ecology, and relationships between geomorphology of stream channels, discharge rate, size of stream, and width and gradient of valley bottom. The potential for willow-expansion resulting from beaver ponds was not considered. There are sufficient local willows for plantings at the scale needed.

Comment

260 "Are there earlier historic records of vegetation? Historic vegetation records may be of interest. In 1935, the vegetation at Shirk Ranch was reported by Cressman to be Artemesia tridentata, with Artemisia trifida in higher places. Agropyron cannabinum was still found and Agropyron spicatum was sparse and short, but described by Z.T. Spaulding as once "waved over this county furnishing an unparalleled range for cattle." Mountain mahogany was uncommon at this time, being mostly found of tops of buttes. The earliest aerial photos of Hart Mt. were taken by Dr. Richard E. Fuller of UW Geology in the early 1930's." (521)

Response. Records of vegetation conditions that existed on the Refuge prior to its establishment are limited. A fire ecologist was contracted in 1994 to examine fire history in vegetation types of the Refuge. As part of his work, he will examine historic records and report on historic vegetation conditions.

Comment

261 "I saw no unnatural amount of sagebrush or juniper. The sagebrush is very natural for this part of Oregon. Some areas have only a few inches of ground cover and some areas have four feet of sage but most of it is knee high and very natural to this area and climate." (533)

Response. The writer of this comment is correct in stating that sagebrush is natural for this part of Oregon. It is a very critical part of the northern Great Basin ecosystem. However, the density of sagebrush in late succession stands and the amount of area covered by late succession stands are much higher than what had occurred prior to Euroamerican settlement. Early succession, grassland-like habitat also is a critical part of the northern Great Basin ecosystem, and this habitat type currently is very limited on the Refuge.

Comments

262 "The changes I saw in vegetative response in riparian areas between 1990 when I first camped on Hart and on return trips following the removal of domestic livestock bode well for Hart's fish populations, and for all native life associated with or dependent upon riparian/riverine habitats. Clear in my mind is the response of the burned upland to the absence of domestic livestock. Even though the burn had been done during a period of drought, the native grasses and forbs were abundant and diverse. And the young aspen among the grazed out older aspen trees and young willow sprouting from grazed down "bonsai" willow stumps along the streams were a delight. Certainly, the streams, riparian areas, uplands, meadows and aspen groves have a great way to go before system health is restored, but to witness such a visible vegetative response--in the midst of drought-was very encouraging--and clearly demonstrated the importance of assessing land and native species condition, then halting the activity which was continuing to degrade the most valuable landscape habitat--the riparian/riverine areas." (732)

263 "The results of recent management changes over the last three years is becoming visible in the improvement of habitat for wildlife. They must be continued if the intent of legislation creating the refuge will be carried out." (72)

Response. Assuming that the Proposed Action is approved and implemented, we expect that habitat conditions would continue to improve under an aggressive burning program, absence of cattle, and better control of public use of the Refuge. The response observed by visitors during the past several years following the removal of cattle can be considered an initial expression of the vegetation, upon removing cattle. Actual recovery of the habitat has just begun to occur -- building soil back to its former productivity, re-activating historic floodplains, and obtaining a representative range of habitats in healthy condition will take many, many more years.

Comment:

264 There is no such thing as decadent growth. (773)

Response. We agree.

Comment

265 "My preliminary studies indicate that Oregon range, as a whole, to include Hart Mountain, is in better shape now than at any time in the last 50-70 years. The media doesn't say this. We suggest that if biased media or other entities have not presented this fairly, I suggest legal action." (784)

Response. We cannot dispute that Hart Mountain may be in better shape now than any time in the last 50-70 years. This is relative to the condition that it was in during the turn of the Century. The Refuge has a long way to go to get to what can be considered healthy condition.

Comment

266 "The historical perspective. If you take the time to research early trapper and emigrant journals, you'll find that Eastern Oregon was not the utopia of wildlife as envisioned by the tall tales of the environmentalists. Deer and antelope were far and few between and sagebrush was prevalent. In 1826, Peter Skeen Ogden found food scarce in the Silvies River area. This is in Harney County. They had to eat bear and beaver to

survive. Indians were stealing their horses to eat. When he reached Harney Lake, he discovered years old buffalo carcasses along its shores, but as he said and I quote, "at present, however, none are to be seen nor animals of any kind." He also found the Indians so destitute for food that "they were so extremely reduced for want of food as to be obliged to subsist on the bodies of their relations and children". He later comments on the same day "it is really unpleasant to be situated as we are now without guides and so far as we have seen destitute of animals of all kinds." Three days later, he is traveling south. Ogden describes Harney County as follows: "This is certainly a barren gloomy looking country as far as the eye can reach. Nothing to be seen but worm wood." In other words, sagebrush. On the next day he remarks that "our poor horses fare poorly. Grass is scarce." By the time he reached the Klamath country, his party was buying dogs from the Indians to eat. In 1831, John Work returned to the Silvies River. He was with Ogden on the first trip. His party killed five deer, two elk and half a dozen antelope before they emerged into the John Day Valley from the Silvies. In 1843, Pierson Reading, along with 12 other men, traveled from Fort Boise to California via Harney County, then southward to Sacramento. In his journal of the trip, he remarked that the area south of Harney Valley was dry and sterile and documented that they went 30 hours without having seen one drop of water. The group traveled from Harney Basin to Goose Lake and was forced to share a weak soup twice a day until they killed one antelope and then later a buck deer. When traveling through northern California they were forced to eat their horses and mules until game was procured. In 1845, 800 emigrants left the Oregon Trail and headed for the Willamette Valley to follow his cut off. This route took them past Wagontire Mountain. Eight years later, another wagon train led by Elijah Elliot traveled the same course. One member kept a journal and wrote "In devious, uncertain thrusts, various parties encountered tragedies in hunger, thirst, sickness and death for themselves and beasts." Now in the late 1860s and late 1870s, the story was a little different. Harney County was described as having wildlife in abundance. By then, the cattle industry had been established for more than a decade. The route by which the cattle were herded from California most often was from Red Bluff, California by way of Goose Lake and to other points north. By 1865, cattle were being shipped from Eastern Oregon back to California. So that shows how successful it was. In June of 1869, the Portland's Morning Oregonian remarked on the necessity of bringing cattle "from beyond the Cascade Mountains to supply the market of Portland. Cattle are yet abundant in some of the eastern counties." Dan Wheeler, of Reno, drove cattle from Oregon to Nevada as early as 1867. In 1869, Jack Renihan brought 10,000 Texas Longhorns in. Con Shea did likewise, as well as John Devine who settled the White Horse country that same year with 3,000 head. In 1873, snow covered the sagebrush of Harney County to the depth of three feet. By 1880, eastern Oregon was shipping cattle to the Black Hills of South Dakota to feed miners and sent 58,000 head to Wyoming. Some of the first sheep in Montana were herded and shipped from eastern Oregon. These are all quotes and information from the book "Harney County, Oregon and its Range Land" by George F. Brimlow printed in 1951. Now the DEIS blatantly ignores the historical conditions of the past as well as the heritage of Eastern Oregon." (795)

Response. We agree with the statement that habitat conditions differed between the mid-1800s and today (Young et al. 1976), that sagebrush historically dominated some areas of eastern Oregon (Vale 1975), and that the abundance and distribution of mule deer, pronghorn, and other wildlife species historically were influenced by those conditions (Wagner 1978). However, we disagree with the claim that sagebrush dominated all or most northern Great Basin environments during the mid-1800s, that the citations referred to adequately characterize habitat conditions during that period, and that no area had suitable habitat to support an abundance of game species. Review of early historic records led Vale (1975) and Gruell (1986) to conclude that although sagebrush dominated the aspect of semi-arid lowlands, grass-dominated habitats occurred in association with sagebrush stands in mountain ranges and valley bottoms. Lowlands dominated by sagebrush historically had less cover of sagebrush and greater cover of perennial bunchgrasses prior to the period of intensive use by livestock (Ellison 1960, Tisdale et al. 1969, Young et al. 1976, Heady 1983).

As for wildlife, pre-historic habitat conditions were a "utopia" for some species, were of intermediate quality for some species, and were adverse for still other species. Gruell (1986) and Wagner (1978) indicate mule deer occurred in fewer numbers before settlement than after settlement by Euro-Americans. Changes in succession patterns associated with fire exclusion were attributed as the primary factor that resulted in increased abundance of deer during the historic period (Gruell 1986). However, Wagner (1978) indicates that pronghorn and bighorn sheep were more abundant before than after Euro-American settlement. Kelly (1932) indicated that bighorn sheep, sage grouse, and pronghorn were the primary upland game species routinely hunted by the Northern Paiute of the Surprise Valley and Warner Valleys in the vicinity of Hart Mountain.

In conclusion, we believe that historic conditions reviewed in the EIS provides an adequate characterization of knowledge of game and habitat relationships during the early historic period. This perspective and the perspective of others is not comprehensive and therefore must be critically evaluated. Even if historic conditions were accurately known, it is unlikely that the Proposed Action would direct management to replicate pre-settlement conditions of habitats. Instead, the Alternative directs management to maintain and restore habitats to create a mix of environmental conditions most suited to a wide diversity of native game and nongame species that each differ in their requirement for habitat.

Comment

267 "Anyone who has done even the most basic research into livestock grazing in the west, would agree that especially around the turn of the century, damage was done to the land by cattle, wild horses and sheep. Today there are still areas on public and private land where grazing is being carried out inappropriately. Hart Mountain Antelope Refuge is not one of these places. As a matter of fact, most of the Refuge is in good to excellent condition. There aren't even any endangered or threatened species on the Refuge." (798)

Response. The Service does not consider most of the Refuge to be in good to excellent condition (Chapter 3, Section One). Range condition cannot be equated with condition of wildlife habitat. Even so, the Soil Conservation Service (SCS), using range inventory standards, found that none of the Refuge was in excellent range condition, and less than 20% was in good range condition (USSCS 1969). Based on available information, conditions have not changed appreciably since the survey was conducted.

Comment

268 "It appears the Refuge is in a stable biological condition. Contrary to a statement made by Refuge personnel. Charts comparing percentage components of the total acreage 25 years ago with today show very little change. Developers of the management plan say this shows the ecosystem is stagnant. We believe this evidence shows the system is stable." (808)

Response. We do not dispute that many upland areas of the Refuge are in a stable condition. In fact, stable conditions are the norm in many shrub- dominated sites of the Great Basin (Sneva et al. 1984, Laycock 1991, Winward 1991). The stable state concept described by Laycock (1991) seems to apply to the Refuge (please see Table 3-5 of the FEIS). The point that Table 3-5 makes apparent is that ecological conditions in uplands were relatively poor as far back as 1968, and that conditions apparently have not changed substantially since that time. Change would not be expected without reduction of shrub cover (Sneva et al. 1984, Laycock 1991, Winward 1991). A stable condition, in this context, does not necessarily translate to a healthy condition.

Comment

269 "We believe there is no evidence to suggest such a drastic change in the management of the Refuge. Over a period of years beginning in 1955 and ending in the early 1990s (charts on pages 116, 119, and 123) antelope and bighorn sheep have flourished. Mule deer have declined as have sage grouse primarily due to predation. Over hunting adjacent to the Refuge may be responsible for part of the decline in deer. The Refuge herd has spread out filling the void around it left by excessive doe hunting." (808)

Response. We recognize and agree that bighorn sheep and pronghorn populations have increased during the past 40 years. In fact, sheep populations are nearing carrying capacity on the Refuge. However, sage grouse populations have declined dramatically because of reduced productivity (Table 3-11). Excessive predation on nests and chicks is the primary factor limiting sage grouse productivity on the Refuge. However, excessive predation is only the proximate factor, whereas inadequate habitat is the ultimate factor limiting sage grouse productivity. In other words, excessive predation may be a symptom of poor habitat conditions. Alternative D addresses the problem by proposing management that would allow for improved habitat conditions and ultimately increased populations of sage grouse, bighorn sheep, pronghorn, and many other nongame species. Mule deer populations have declined throughout the intermountain west (please see the Mule Deer section of Chapter 3, Section One, part 2, A, 3). However, there is no data to support the claim that extensive predation or overharvest of does has resulted in decline of the Refuge deer herd.

VEGETATION PROTECTION

Comments

270 "Hire a professional botanist to conduct rare plant surveys prior to any significant management action." (509)

271 "Has there been an adequate survey for rare plants? The Refuge's consultant recommended an annual survey more or less in perpetuity. The problem is a long season, a huge refuge, and wildly dissimilar climatic years. BLM standards for botanical clearances calls for fifty acres a day to be covered. Fairly homogeneous habitat

could be covered much more rapidly than this, but 277,000 acres cannot be done in a season. The proposed list of seven T&E plant species is not defensible. Priority should be given to surveys ahead of proposed actions. Pukey Wright, Tom Kaye, or Peter Zika are Oregon botanists especially well-qualified for such work." (521)

272 "The proposed management plan does an adequate job of addressing rare plants and animals and makes note of the species that are known from the area. The Conservancy conducted the rare plant inventory in 1991 and felt that the one season spent at the Refuge did not do it justice in terms of rare species potentially located. We feel that the new management plan should have additional emphasis on rare species inventories, including plants and invertebrates, and that such inventories need to become a routine part of the Refuge's management. As noted in our 1991 report there is a considerable acreage of the Refuge that was not inventoried. Given the widely fluctuating environmental conditions of the Great Basin there is potential for rare plant discoveries in places already inventoried as well as in more remote areas of the Refuge." (359)

273 "An updated and more detailed plant inventory is needed. The complexity of plant communities should be carefully mapped before significant vegetation management is undertaken." (33)

Response. We acknowledge the importance of plant surveys at Hart Mountain NAR. A rare plant survey was conducted by The Nature Conservancy in 1991. We agree that, because of the highly variable nature of Refuge habitats and climate, more rare plant surveys are needed. We also agree that a staff botanist would be desirable; however, the projected budget would prohibit hiring one, given other, more immediate needs. Habitat surveys would be conducted by Refuge biologists before activities such as mechanical and herbicide treatment, development of new campgrounds, and rerouting of roads. An herbarium is present at Refuge Headquarters, and time permitting, Refuge staff would continue to add to and improve the collection. We have used the services of Oregon State University and University of Idaho botanists for identification of specimens when questions arise. We would continue to solicit volunteers, and where we have specific needs and questions we would also solicit help from the local BLM botanist.

Comment

274 "I don't know whether it is true at Hart Mt. Refuge, but in the east Gorge, conversion of bunchgrass lands to alien annual grasses is probably irreversible, at least on our time scale. So our policy is to try to protect native bunchgrasses wherever they are found in the Gorge. This means protection from any livestock grazing at all, even fall or winter grazing, since these still open the soil to invasion by alien grasses and noxious weeds.

The best policy for Hart Mountain Refuge, indeed for all the public grasslands in Oregon, is to stop the degradation of native bunchgrass stands. For this reason, we support the entire package of Alternative D." (269)

Response. Comment noted; this agrees with what is included in the Proposed Action of the FEIS.

WESTERN JUNIPER MANAGEMENT

Comment

275 "ODFW recently completed a major study of western juniper in eastern Oregon that needs assimilation in FEIS planning and bibliographic citation:

Liverman, Marc. 1993. Western Juniper Woodland Management Policy. ODFW Habitat Conservation Division. 22 pp." (521)

Response. The Service has received a copy of this study.

Comment

276 "Management of western juniper for the benefit of wildlife is a difficult challenge for the Refuge.1 As the distribution and abundance of this species increases, it has the capacity to degrade important resource values. Yet under other circumstances, western juniper provides an important component of structural diversity that greatly increases wildlife species richness.

The low frequency fire prescription (greater than 200 years) included in the Draft Plan to maintain ancient juniper is too long to prevent stand thickening, a problem that is distinct from that of establishment of new juniper woodlands but which can result in similar resource degradation. Much shorter intervals of 20-30 years may be necessary to maintain desirable ancient juniper stand characteristics." (745)

Response. The ancient juniper stands on the Refuge are in very rocky terrain with light fuel loads. It is very hard for fire to carry in these areas. The service believes that the ancient juniper stands were burned very rarely and that due to the rough terrain, 20-30 year intervals did not occur historically. Map 1-3, vol. 1, shows the juniper stands that were present prior to Euro-American settlement, and actually shows only about ten percent of the current juniper distribution on the Refuge. The rest of the juniper has expanded into low sagebrush, big sagebrush, and wheatgrass vegetation types. These are the areas that the Service plans to burn on a 40 - 60 year interval (on average depending on vegetation type).

Comments

277 "Any revegetation projects should be carried out using native vegetation. I believe that the continued use of introduced species is detrimental to native plants." (723)

278 "I support the reintroduction of native species plants." (773)

Response. All revegetation projects carried out on the refuge would only make use of native plant species. Objective number 5 in the long-range objectives for all habitats states "When seeding or planting vegetation during restoration efforts, emphasize plant species that are endemic to the area." (Chapter 1, Section Two of the FEIS). Bitterbrush and willow plantings would be gathered from the Refuge and native grass seeds would be obtained through a cooperative agreement with ODFW.

Comment

279 "There may be a Midwestern bias at work here: "grass is good. brush is bad". But the high desert is DESERT, and let's rejoice that it is." (737)

Response. The Service agrees that shrub cover (sagebrush) is an important part of the Refuge ecosystem. However, due to past management practices, the proportion of shrub cover to grass and forb cover is out of balance creating excessive shrub cover. In order to replace the balance, shrub cover must be reduced.

WETLAND MANAGEMENT

Comment

280 "Natural processes should be relied on for restoration of water ways." (504)

Response. Passive restoration of streams would be emphasized as stated in Alternative D, Section 1, Wetland Habitat Management of Chapter 2. Check dams would be constructed on a limited basis and only in areas where degradation is severe and where natural restoration is not taking place or is occurring at a slow rate.

Comment

281 "Will additional wetland acreage develop during the course of habitat restoration? Future potential wetland is not identified in the DEIS, i.e., current upland that was formerly wetland. Malheur NF has an excellent program underway to do just this, involving soils, geomorphology, vegetation, and, of course, beaver. There would seem to be several thousand acres in this category at Hart Mt. Given the significance of wetlands to Refuge objectives, these lands should be identified." (521)

Response. All potential wetland has been identified in respect to riparian zones. Names of vegetation types reflect the potential vegetation of delineated areas. Present conditions of vegetation types, and their acreages are presented in Table 3-6 (Volume I). Acres under the heading "All stages Combined" are analogous to acres of "future" potential for each vegetation type. As an example, the sedge-rush-bluegrass vegetation type is characterized by shrub-grass and grass shrub for early and mid progression stages (Table B-1, Appendix B). These upland sagebrush stages would be replaced by grass during the late stage and by sedge-rush-bluegrass during the very late progression stage. Table 3-6 shows 1,174 acres currently in the early-mid progression stage (shrub-grass and grass-shrub). Combined early-mid, late and very late, results in a potential 3,745 acres of sedge-rush-bluegrass vegetation type, this is the acreage encompassed within the borders of the vegetation type on Map 1-4.

Comment
282 "Will juniper removal be a hydrological panacea? Liverman doubts that removal of juniper increases soil water, citing five recent studies: "Experiments involving juniper removal often demonstrate only slight or temporary increase in soil water (Schmidt, 1986, Everett and Sharow, 1985, Baker, 1985, Hibbert 1979, 1983). In one case, killing juniper overstory increased water yield only if the dead trees were left in place to ... reduce evaporation." In Table 3, Liverman cites 23 T&E species that make use of juniper. [These mostly occur on the Refuge -- Appendix H.] Patsy Miller's dissertation on physiological ecology of juniper appeared in a series of four papers that need citation. Juniper may find better soil in broken rock piles that are net accumulators in wind events." (521)

Response. We agree that juniper removal is not a hydrological panacea. Although Patsy Miller's dissertation was not cited, we believe there is sufficient documentation to indicate that juniper removal in selected areas would enhance watershed conditions (please refer to sections F, 1 (c) and (e) of Chapter 3, FEIS). The primary reasons for proposed juniper reduction, however, are to (1) restore grassland and shrub communities in the more productive areas of the low sagebrush, mountain big sagebrush, big sagebrush-bitterbrush, and wheatgrass vegetation types, and to (2) restore aspen, willow, sedge-rush-bluegrass, and bluegrass-ryegrass communities. Although we recognize the value of western juniper habitat, we also recognize the importance of grassland and shrub communities where juniper now dominate. Human activities (namely fire suppression) are the main cause of the 10-fold increase in juniper distribution on the Refuge.

Comment
283 "Place more emphasis on wetland restoration." (542)

Response. We believe the Proposed Action places adequate emphasis on wetland restoration. Especially if by "more emphasis" this comment is referring to active manipulation and structures. Often structures and other "quick fix" solutions are not permanent solutions. We must allow time for wetland vegetation to recover and natural stream hydrology to become effective.

Comment
284 "It can only be expected that the identified primary limitation: "Stream channels are eroded, and riparian vegetation on stream banks is deficient along the majority of Refuge streams" would be critical. Many of the "studies" done to support HMNAREIS were done on a short-term basis and cannot be considered valid. The authorship and the actual agendas of these short-term studies are suspect at best. Many available long-term studies and pertinent information specific to the Great Basin and/or comparable to Hart Mountain were ignored, and/or not considered; i.e., comments from the Department of Rangeland Resources, Oregon State University (Observations from August 3-4, 1991 Workshop on Hart Mountain National Antelope Refuge, by: Thomas E. Bedell, Extension Rangeland Resources Specialist; John C. Buckhouse, Extension Rangeland Watershed resources Specialist; and, William C. Krueger, Professor and Head). 1992 was at least the 6th year of a 100 yr. drought. For the riparian habitats on the refuge to be extensively evaluated between June and October, 1992; and the plant communities defined, described, photographed and evaluated as to their site progression, is not "scientific information". This whole program cannot be seriously considered as anything but a "worse case scenario" for an extreme Northern, marginal location of the Great Basin. All species on the refuge and many on adjoining lands were compelled to utilize the riparian areas of the refuge to its maximum capacity from June to October in 1992, as necessary for existence. If the average long-term comparison for riparian vs. other habitat is less than 2%; then, during the short term intensive study time frame, June through October, 1992, the percentage comparison for riparian areas would have been much less than 2%; or, if not, the opposite would have been true. Nevertheless, under either scenario, the fact remains that all species inhabiting the 275,000 plus acres were forced to visit if not live in the (2%) riparian area, for survival." (730)

Response. The purpose of riparian surveys on the Refuge was to determine present condition of streams. These surveys were necessary because other information (i.e., "long-term studies and pertinent information specific to the Great Basin and/or comparable to Hart Mountain") would tell us little about current condition of riparian areas. Furthermore, eroded stream banks and loss of water table and riparian vegetation is the result of long-term abuse by livestock. Because these areas are slow to recover, surveys conducted during a wet period would not have changed results from those obtained during the 1992 survey. Long-term monitoring was initiated in 1992 to determine trend and recovery rates of riparian areas.

Comments
285 "Irrigation -- discontinuance of irrigation by permittees has caused loss of habitat." (775)

286 "Another thing is the encroachment of the sagebrush into the meadows. They stopped irrigating those meadows. When they irrigated the meadows, they had lots of grass and they didn't have the sagebrush. They want to blame it on the cow, but I think the reason is that they stopped irrigating the meadows." (804)

Response. We agree that discontinuing irrigation may have reduced production of herbaceous vegetation in some meadows. However, once riparian meadows have recovered, water tables would be high enough to provide adequate moisture to meadow vegetation.

Comment
287 "They [Krueger, Bedell, and Buckhouse 1991] made another statement here: 'We saw no riparian zones that were seriously degraded so that potential future productivity would be significantly diminished.' " (793)

Response. We agree that most riparian areas are not degraded seriously enough so that future productivity would be diminished, so long as "future" means 50 to 100 years from now. At present, about three-quarters of the length of riparian habitat is considered to be degraded seriously enough to impact productivity of the areas as it relates to functioning of riparian areas and habitat for riparian wildlife. The degree to which an area is productive is relative to the measure of productivity. For instance, a particular riparian area may be productive from the standpoint of ungulate wildlife (big game) or livestock, but it may be relatively unproductive from the standpoint of a riparian wildlife community.

Beaver

General Comments
288 "Post Meadows was strongly influenced by beaver until quite recently. In 1980, an ODFW stream survey found that "beavers have created a series of mud dams from mile 32.00 to 32.50, spreading the creek out in large ponds that have flooded out many aspens. The dams and ponds are old and heavily silted in with deep mud. Much of this area [Post Meadows] is a large bog with a maze of beaver dams and channels. Gradient is 113 feet per mile." " (521)

289 "Guano Creek is 34.75 miles in length, with a drop of 1502 feet and an average gradient of 42 feet per paced mile. Dams and dam remnants are found on a wide range of gradients on Rock and Guano Creeks, from 31 feet or less per mile to 133 feet per mile and higher. Allocating a 3-4' drop per beaver dam, this works out to 400 beaver dams, or 12 dams per mile, or a dam every 430 feet of stream. This system has the capacity to adsorb and slowly release the estimated 100 cfs spring runoff peaks and eliminate long stretches of high temperature, eutrophic, seasonal streams. A single Great Basin beaver family is perfectly capable of building and maintaining a half-mile wide rimrock-to-rimrock dam." (521)

Response. Comment noted.

Comment
290 "How will beavers be managed in the short and long term? Can they be an asset for stream restoration?" (509)

Response. In general, beaver would be managed passively on the Refuge by allowing natural forces to regulate the population. However, if beaver activity causes substantial negative impacts to limited aspen resources, the possibility of reducing beaver populations in a particular area to allow for aspen recovery would be evaluated. With the removal of livestock grazing, negative impacts to aspen resources by beaver is expected to be minimal.

Beaver can be important for stream restoration and an asset to fish and wildlife by providing critical habitat. Beaver dams trap sediment, reduce stream velocity, locally elevate the water table and reduce the effects of seasonal flooding. An elevated water table allows for wetland vegetation to establish and stabilize stream banks. In addition, beaver dams create pools that store water critical to fish populations on the Refuge especially during drought. The wetland habitat created by beavers also provides habitat for wildlife such as waterbirds, amphibians, and small mammals.

Comments

291 "Did beaver historically play a greater role than today in riparian ecosystem management? Beaver, a keystone riparian species, are given short shrift in the DEIS. The most rapid and effective way to restore streams and riparian-associated wetlands to natural conditions is to foster willow, cottonwood, and aspen recovery (i.e., grow beaver food). Beaver are far more effective (and natural) than rock dams and wired junipers in trapping sediments, raising water tables, and maintaining water coolness and quality. No native trout in Rock Creek would have survived the drought if it were not for beaver ponds. A common misconception, due to trapping out of beaver in the 1820's, is that a narrow, deep channel is that natural state of affairs. Actually, a string of beaver dams, one every 100 feet, is the natural state of affairs. Now cows and beaver will deliver a fatal one-two punch: beaver cut larger trees and cows trample and eat restarts. While it may be necessary to keep beaver (and mule deer) numbers low during initial phases of habitat recovery, the DEIS needs to squarely discuss current beaver populations and management (including recent trapping by Refuge staff for aspen aesthetics), and analyze their potential contribution to future desired riparian conditions." (521)

292 "Is it true that Refuge personnel were actually trapping beaver out for "aspen aesthetics" recently? I suggest you network with ODFW and other agencies (Eugene BLM) who are now starting beaver reintroductions." (642)

Response. We do not know whether beaver are native or non-native to the Hart Mountain area. Beaver were not present on the Refuge when it was established in 1936. However, historical records document beaver on Malheur NWR, 50 miles north-east of Hart Mountain NAR, during the 1800s. In the 1960's beaver were transplanted onto Hart Mountain NAR and they have since maintained populations.

We estimate the current beaver population on the Refuge to be 20-50 individuals, based on the number of active beaver colonies. Three active colonies exist on the Refuge, one on Guano Creek at Blue Sky, and two on Rock Creek near the Hot Springs Campground.

Past management of beaver was to document locations of beaver activity and to periodically reduce the beaver population in instances of negative impacts to aspen resources. During the last 10 years, six beavers were trapped from the Refuge, (2 in 1989 and 4 in 1990), and two beavers were trapped on private inholdings by ODFW. Beavers were trapped because adult aspen trees were downed in areas lacking aspen regeneration as a result of domestic livestock and mule deer browsing. The Service is concerned about the maintenance of aspen and willow stands because of their degraded state, their relatively limited distribution on the Refuge (less than one percent of the Refuge) and the critical habitat provided for a diverse array of wildlife species.

Beaver can be beneficial to riparian areas in providing critical fish and wildlife habitat, trapping sediment, locally elevating water tables, and reducing the effects of seasonal flooding. However, the Service is aware of potential negative impacts of beaver in combination with cattle and mule deer browsing and fire suppression to the survival of aspen stands. Beaver cut the aspen overstory which may stimulate sucker regrowth. However, aspen suckers and saplings are susceptible to browsing by mule deer and domestic livestock. Severe browsing and cutting of adult trees in a particular aspen stand could result in the extinction of the stand. In addition, flooding caused by beaver dams could result in the elimination of existing aspen stands if the aspen root system does not extend beyond the flooded area. On the other hand, flooding of an area could enlarge the aspen stand by raising the water table, so long as the entire aspen stand is not flooded.

The Service proposes to passively manage beavers on the Refuge except possibly in cases where beaver activity begins to cause severe damage to aspen or riparian shrub stands. However, we expect adverse impacts resulting from beaver to decline if domestic livestock are excluded from the Refuge for the next 15 years.

Comment

293 "The DEIS makes two significant misrepresentations related to beaver. First, middle Rock Creek does not have floodplain geomorphology or soils -- on the contrary, sediments captured over centuries by beaver ponds are now being downcut by a channel. This is testable by simple excavation. Second, the sub-irrigated connector from Buck Pasture to Rock Creek (improperly described in Map 1-4 as sedge-rush-bluegrass community and upland) was formed by former beaver impoundments of Willow [sic] Creek (which now has captured all but overflows)." (521)

Response. Although we agree that the geomorphology of middle Rock Creek and Willow Creek geomorphology may have been influenced by beaver, geological maps and on-site evaluation indicate that these areas currently are a depositional trough characterized by a wide valley bottom, low valley gradient, and fine grained soils. Willow Creek contains a range of plant communities including willow communities. However, Map 1-4 generalizes the riparian plant communities by illustrating the dominant vegetation of plant communities when the areas are in a healthy state, which in the case of Willow Creek is meadow (sedge-rush-bluegrass community). A lower level of habitat classification would reveal the full range of community types that occur in the riparian complex of Willow Creek.

Comments

294 "Favor beaver to help restore riparian areas over artificial methods such as rock check dams." (542)

295 "Beaver occupation should be actively encouraged as they are an important natural member for maintenance of such wet areas. How more organic can you get for improving riparian areas than allowing the beaver to do the work?" (642)

296 "Vol. 1, Chapter 2- 70&71, Wetland Habitat Management - Beaver are only mentioned three (?) times in the documents. Yet throughout the documents there is much lamenting about the domestic livestock damage to streams and riparian areas and what is needed to repair the damage. Beaver could be the lower bidder on any stream - riparian area rehabilitation contract you might prepare. Particularly where there is sufficient suitable habitat to establish them." (657)

Response. We agree that beavers can be effective at rehabilitating riparian areas and are preferable to rock check dams. However, many riparian areas in need of restoration are currently void of deciduous woody vegetation and therefore unsuitable to maintain beavers. In these areas, riparian systems would generally be allowed to passively restore. In a few areas, rock check dams would be considered to rehabilitate riparian systems.

Comment

297 "Oregon's state mammal, the dam-building beaver, gets the blame by certain special interest groups, or shares the resource degradation blame as "part of the problem," one element of the purported "double whammy" responsible for destroying aspen and other woody vegetation stands. But is the beaver really "part of the problem?" Or do we humans need to accept the responsibility for the human decision to introduce domestic livestock and all their associated negative effects to landscapes and species vulnerable to the effects of grazing? Should humans own their responsibility for introducing cattle to lands "unsuitable" for grazing, "unable to sustain" the impacts of domestic livestock?

My answer is a resounding "Yes!" to the latter two questions. I recommend that beaver research be undertaken on Hart during the unprecedented period when cattle are not allowed to impact the watersheds of Hart Mountain. Taken together with my other research recommendations, we might confirm through new but replicable studies, that indeed the beaver has been maligned with little if any just cause and primarily out of gross human ignorance, or even more sadly, plain stupidity. I suspect this is the case because of the abundance of beaver, and the attractive health of the systems prior to the European invasions. After all, if one were to successfully extirpate the much slandered and libeled beaver--would one then have healthy landscapes and restored native species? Or would one have a "plateau" of degradation--with domestic livestock but no beaver, the naturally evolved native species in this vegetation removal/water storage/use equation? I believe the latter would be the result. No system I have observed indicates otherwise." (732)

Response. Beaver in combination with domestic livestock grazing and browsing by mule deer can severely impact aspen and other woody vegetation. Cutting of the aspen overstory can stimulate sucker growth, which is important for stand maintenance. However, aspen suckers and saplings are susceptible to browsing by mule deer and domestic livestock, and if browsed severely, the extinction of the aspen stand could result.

We agree that the influence of beavers on riparian areas in the absence of livestock grazing is of research interest to land managers. However, limited funding and staff require us to prioritize our monitoring efforts during the next 15 years. Emphasis of the monitoring program would be placed on the response of riparian and upland areas to management practices. The Service invites academic institutions and scientific research foundations that acquire independent funding to conduct research projects on the Refuge that would aid in the management of fish and wildlife.

Check Dams

General Comment

298 "I agree that instream use of structures should be moderate." (670)

Response. Comment noted.

Comments
299 "Check dams should not be used. Rather, if anything, the slightest intervention should be used - perhaps introduction of woody debris or local rocks and planting of native riparian plants (cf. willows)." (504)

300 "Rock Check Dams - We would like scientific evidence that the proposed rock check dams will actually function as they are intended to function before they are put in place. These dams have reputations of not doing the job that the DEIS describes them doing, and many professionals in the environmental community have questioned the use of rock check dams, as they often cause more problems than they solve." (655)

Response. Natural processes and willow planting in appropriate places would be emphasized during this planning period. Check dams may be applicable in certain situations where natural restoration is not occurring or is occurring at a slow rate. Site specific evaluations and knowledge of natural channel adjustments would be necessary before structures are prescribed. Soil Conservation Service professionals have been consulted for ground surveys and design specifications of proposed instream structures. Objective long-term monitoring would be conducted to track the effect of various channel improvement activities. Positive and negative impacts of check dams to soils, water, and vegetation along streams are presented in Part Two of Appendix J of the FEIS.

Playas

Comment
301 "Are freshwater playas distinct from alkali playas? Fresh water playas seem vegetatively distinct from alkali ones. Thus east Spanish Lake has an extensive greasewood/shadscale/budsage salt desert scrub community quite distinct from Long Lake or Big Flat. These perennial shrubs did not get established during a single dry year and are presumably reflective of special soil conditions. Alkali flats generally represent evaporites blown off playas in dry years by southwesterly winds. playas have negligible diversity, despite ample water and soil. Is this because of chemistry, hydrological variation, or homogeneity of habitat?" (521)

Response. We agree that many playas on the Refuge are quite distinct from each other. It is recognized that differences observed in vegetative composition of playas often corresponds to differences among sites in soil composition, water chemistry, and flooding regimes. We do not have information on soil or water chemistry. Soils of the Refuge were surveyed by the Soil Conservation Service (USSCS 1993). Descriptions of the wetland soils will be included in site specific operational management plans. A general discussion of soils has been added to the FEIS (Chapter 3, Section One). There are no "extensive greasewood/shadscale/budsage salt desert scrub community" types found in East Spanish Lake. This community is present at Flook Lake, and it is an upland community located on Murad silt loam found N. E. of the lakebed (USSCS 1993). Long lake soils are mapped as Mudpot silty clay and Big Flat lakebed soils are mapped as Welch clay loam. Please refer to Table O-1, below, for a listing of soils associated with lake basins and playas of Hart Mountain NAR.

Table O-1. Soils, and their acreage, associated with lake basins and playas of Hart Mountain NAR.

WETLAND SOIL NAME	ECOLOGICAL SITE	ACRES
Bicondoa silty clay loam	Wet meadow	776
Boulder Lake silty clay	Ponded clay	1596
Crump muck	Undescribed wetland	161
Playas	Undescribed wetland	55
Mudpot silty clay	Undescribed wetland	3946
Swalesilver	Ponded clay	377
Spangenburg	Clayey Playette	137
Welch clay loam	Lakebed	940

CRITICAL HABITATS

Comment

302 "Have special habitat areas been identified? Special habitat areas are subordinated to a half-dozen major plant communities that receive the exclusive focus of the DEIS. The RNA nominations, however meritorious, provide more of the same -- macro plant community types not selected to identify or protect biodiversity. Rare, or even moderately uncommon species, are found in specialized soil or hydrology situations too low in acreage to attract the interest of landscape ecologists. Unfortunately most of the refuge plant and invertebrate diversity is found precisely in these specialized niches, notwithstanding their small areal extent. Using map 1-3 as a basis for planning prescribed burns or disking treatments in low sage could have disastrous effects on biodiversity." (521)

Response. Specific "special habitat areas" have not been mapped. The Service contracted The Nature Conservancy to survey rare plants and plant communities in 1991. Some of the Conservancy's management recommendations were incorporated in the FEIS. Special habitat areas are highlighted in existing and proposed Research Natural Areas (RNA). Please refer to the table in Appendix E for a partial list of plant communities found in proposed RNAs. Also, refer to the response to comment 542 for more information on rare plants.

Comment

303 "The FEIS should map unusual habitat areas and identify special management needs, so that these are excluded from generic "shrub" treatments, without precluding some other form of custom management. Special habitat area mapping could provide the underpinnings for a proper rare plant inventory and help complete the biodiversity inventory of Table E-3. The Refuge has not yet conducted a proper search for rare and endangered plants and does not discuss the need to inventory areas prior to prescribed burns and re-routing roads. Moreover, not all forb species respond well to fire. Some 29 R&E plant species (list enclosed) could plausibly be found on the Refuge. The DEIS only mentions seven of these in Table E-2. Ironically, the much larger Sheldon Refuge had a superb survey by bona fide Great Basin systematists (Rogers and Tiehm,1979). Liverman (1993) has a similar list for juniper woodland T&E animal species that should be included as Appendix H-16 and analyzed for applicability in the text." (521)

Response. Protection of sensitive plants, animals, and habitats will be addressed at the planning level by the biologists, managers, and the fire management officer. The Refuge contracted The Nature Conservancy in 1991 to survey rare plants and habitats. Recommendations for protection will be considered during the planning of site-specific projects that involve site disturbance such as prescribed burning and herbicide application. It is recognized that response of plants and animals to fire differs among species. Please refer to Appendix J for a description of impacts associated with prescribed burning. Additionally, more detailed examination of plant and animal response to fire will be addressed in the fire management plan under preparation for the Refuge Complex. Refer to response to comment 542 for more information on the rare plant survey.

Comment

304 "The FEIS should at least make a start on tables and maps of special habitat areas that can be added to as knowledge grows. Some obvious nominees are the sand dunes NE of Crump Lake, rimrock breaks all over the Refuge, ponds on the western escarpment of Hart, Goat Peak Playa at 7580' in T37S.R.25E.S4 (about 2000' higher than other Refuge playas and probably unique), tuffaceous habitat for Ivesia, Eriogonum on the MOU area at Guano Creek, the unusual assisted cottonwood at Cottonwood Springs (old maps: Intermediate hills at elevation 6500 feet, south aspect), the high biodiversity sandy creekbed due west of Big Flat, buckwheat ridge west of the road below Deer Creek, the Potentilla fruticosa sub-alpine area on upper Warner Creek, the winterfat area, and the evening-primrose site on Sheep Rock tuff." (521)

Response. The Service will continue to develop and refine databases to improve planning and management of the full range of natural resources found at Hart Mountain NAR as time and funding allow. People with specialized knowledge of natural resources of the Refuge are encouraged to contact the Refuge Manager and provide specific documentation of occurrence, distribution, and abundance of the species, habitat, and location.

Comment

305 "Why are some common plant community components downplayed here? Rabbitbrush seems to be a natural component of lake margins associated with the disturbance of water recession. Great Basin wild rye is scarcely mentioned, though an important component in some places. Note Iva axillaris, the composite povertyweed is reported from the Sink Lake playa. Muhlenbergia richardsonia (mat muhly) and Alopecurus geniculatus (water foxtail) are commonly reported by other observers. Juncus balticus has been steadily reported since the 1930's." (521)

Response. A detailed description of ecological sites, plant communities, and plant species that the writer refers to is beyond the scope of the FEIS. These levels of ecosystem organization are, however, accounted for in the habitat classification (Appendix B) developed by the Service and will be used for site-specific planning of management actions (e.g., prescribed burning). Clearly, it was not our intent to downplay the importance of any habitat feature. Instead, it was our purpose to choose, analyze, display, and emphasize the levels of ecosystem organization (e.g., vegetation type and structural stage within vegetation type) most relevant to the EIS. Habitat management strategies described in Alternative D would result in the maintenance and restoration of structure and functional relationships of all levels of ecosystem organization including vegetation types, community types, and species.

Comment

306 "Also, the Draft Plan contains little acknowledgment or discussion of the location or importance of special habitat areas, such as unique soil or wetland conditions. Indeed, the Draft Plan contains very little discussion of soils at all. These special habitats may account for a substantial portion of the biological diversity present on the Refuge and have unique management needs. The Final Plan and EIS should identify and map such areas (as well as other actual vegetation), and provide prescriptions for the management of special habitat types which insure that they do not receive the same generic treatments as larger, aggregated vegetation types.

Similarly, protection of quaking aspen groves, wetland and aquatic features, and key watershed locations, should be identified in the Final Plan and EIS as the top priority for juniper manipulation. Although protection of resource values on those sites will depend on the health of the entire watershed in the long-run, they are also at greater risk in the short-run than values present in most upland areas." (745)

Response. The writer assumes that special habitat areas were not acknowledged or discussed in the DEIS. Our position is, however, that (1) all habitats are important; (2) some habitats, including all riparian zones, would receive substantially increased management attention compared to past management; (3) the proposed Research Natural Areas highlight some unique areas; and (4) our knowledge of "special habitat areas" is rudimentary at best. Should the writer be aware of such areas on the Refuge that may require extraordinary management attention, please contact the Refuge Manager and provide the detailed information.

Alternative D of the FEIS prescribes a series of management strategies that would result in enhanced condition and protection of aspen groves, wetland and aquatic features, and key watershed locations.

Comment

307 "Aspen Communities: Burning riparian areas and snowpocket communities to encourage aspen regeneration may convert areas from a roughly even-aged old stand to a roughly even-aged young stand. This may have negative consequences for certain species, particularly cavity-nesting birds. If possible, creating aspen communities of mixed-age trees would provide the greatest structural diversity, and should still promote regeneration with the removal of cattle." (540)

Response. We concur that (1) burning of even-aged old aspen will foster development of even-aged young stands; and (2) that some wildlife, including most cavity-nesting birds, will be negatively impacted by the reduction in number of trees available for nesting, roosting, and foraging until that structure regenerates. These are short-term effects. In the long-term, however, structural diversity will increase as a result of burning because (1) burned decadent stands will increase in distribution; (2) patchy burns will result in greater structural diversity on a landscape basis; (3) structural diversity is partly determined by site conditions that influence the occurrence, establishment, and growth of shrub species such as Scouler's willow, a fire-dependent species, that grow in the understories of aspen stands (Mueggler 1988). Additionally, our observations indicate that recovery of decadent aspen stands in the absence of cattle depends on several factors including continued suppression of suckers by older living trees, site productivity, stand size, and intensity and frequency of mule deer use (DeByle 1985a). Without periodic fire, the aspen stands will continue to deteriorate and diminish in the amount of area they occupy (Kauffman 1990).

SOILS

General Comments

308 "Rare plants are often found on rare substrates. Note that Ivesia rhypara var. rhypara is a true petrophyte that occurs on vertical cracks in vitrified welded tuff whereas Eriogonum crosybae is on Pliocene tuffaceous sandstone overlaid with a white pumice and (reworked lake sediment). The soil was observed to be aeolian, with fine particles of volcanic glass, not minerals of surrounding rocks. Eriogonum procidium is reported on darker volcanic substrates or weathered basalt mixed with gray ash deposits [the site may have been bulldozed in September by Refuge road crews]." (521)

309 "Satellite photos of the Refuge seem to show a remarkable pattern in aeolian deposits due to prevailing SE winds in years when the north-central playas are dry. These areas NE of a dozen lakes (e.g., Petroglyph) seem clearly governed by edaphic factors and less so topography or climate. Alkaline soils were also noted during the soil survey. The mounds at Mound Lake may represent loss of soil except where protected by the base of phreatophyte stems. Note Abert Lake is saline because dissolved solids are high and not blown off in dry years because of basin geometry." (521)

310 "Well logs are important sources of soil and climate data and are important in understanding playa surface water capacity. Playas margins have not always been dominated by phreatophytes. Desert Lake had a government relief well drilled in 1934 well as did Shirk Ranch. These logs are likely still available. A south Warner well hit a well-preserved juniper tree at 585 feet; terraces are 215 higher." (521)

311 "Few of these [environmental] groups have specific knowledge of biological processes in relationship to historical cycles of solar production or the second law of thermodynamics. I put that there because the second law of thermodynamics is essentially that anything whether a species or an object if left on its own it tends from a position of stability to instability. In other words there is unnatural erosion and that sort of thing. I put that in there because a lot of obstructionist folks don't understand that at all." (784)

Response. Comments noted.

Comment

312 "Do lichens and cryptogamic soil play a significant role in biological processes? Lichens are probably the dominant refuge plant and may also significantly impact biological processes considered by the DEIS. It is possible to quantify per cent rock cover from aerial photos using computer techniques. Unfortunately, this was not done in Map 1-3. In many areas of the Refuge, rock cover would exceed 75%. Lichens on these rocks are then a major vegetation community type not considered by the DEIS. Lichens could dominate carbon fixation quantitatively and play a major role in furnishing soil nutrients. Slow-growing lichen could be very late in recovering from prescribed burns. To actually "restore and maintain processes of native ecological communities of the northern Great Basin" (Goal 3) would seem to require consideration of lichens in the DEIS. Cryptogamic soil is expected here though it may have been severely impacted by hooves and is not ubiquitous now by any means. It can be an important cheat grass excluder. It would be adversely impacted by prescribed burns and slow to recover. What is the. current status of cryptogamic soil on the Refuge?" (521)

Response. We agree that lichens, and in some areas cryptogamic soils, play an important role in ecological communities on the Refuge. Understanding of lichens and cryptogamic soils on the Refuge is limited.

Comment

313 "How much is known about soils at Hart Mt.? Soils need the discussion promised on page 92 but never delivered. Four major soil orders are alluded to but nowhere described or mapped. In Table C-1, we do see reference to seven soil types. (Platy deserves a glossary entry.) Listed hydric soils deserve a special discussion since wetlands are so important for wildlife. Thor Thorson of Portland SCS has a major correction to the hydric soil list distributed by Lakeview SCS. The work of Cahoon (1970) and the SCS 1993 draft soil map for Lake County are cited but not summarized in the DEIS. No sample soil maps are given so that their resolution and quality may be assessed. Text for a limited number of soil types could be included in an appendix. If the soil map has been digitized, it should be provided. Important work by refuge staff to map

inclusions could be shown for key examples. The FEIS needs to summarize soil information because it very much affects the outcome of the vegetation succession analysis." (521)

Response. We agree that soils need greater coverage than what they received in the DEIS. As such, we expanded the Soils section (Chapter 3, Section One, part I, C of the FEIS). A soils map was developed during the planning process based on USSCS (1993), but has not been included in the FEIS.

Comment
314 "Understanding vegetation succession is crucial to the whole enterprise of the CMP, yet there is no discussion of edaphic climax. It is important to identify pockets of deeper soils (such as the outwash area NW of Spanish Flats). Van der Schaaf states that big sage predominates when surface loam is 6" or more and gravels are between 5-20%. Low sage will be found with surface loams as thin as one inch and gravel content between 20-60%. Lithosols should be delineated as they are important sites for Pauite food plants." (521)

Response. Site-specific soil characteristics are beyond the scope of this EIS, but will be addressed where appropriate in operation plans.

Comments
315 "On Page 189, Vol 1, under the "Soils" heading: What was the method for determining the soil erosion rate? Natural revegetation of roads is a long term process especially on highly compacted roads - have you considered other road restoration efforts that may speed up the recovery rate? Maybe ripping or placing temporary water catchment devices would serve a better function? Just a thought." (531)

316 "Soil management, soil erosion and resulting sedimentation are, in our opinion, important to this management plan. Soil erosion is not quantified or qualified in the report. It is only mentioned to support the bias against domestic livestock grazing. The literature cited is selectively used to sell the preselected alternative. Soil erosion is only mentioned when it appears there is no other negative bias to include." (605)

Response. Soil erosion rates have not been measured on the Refuge. We agree that recovery of two-track jeep trails is a long-term process; we have not considered other road restoration efforts to speed-up the recovery process. Two-track jeep trails in riparian areas would not take as long to recover as roads located in uplands. Only two-track jeep-trails are being proposed for closure.

Comment
317 "App. J p3 last par. I'd guess the most important measure of soil health is the type and number of organisms that inhabit it... my impression is that any chemical entering the soil is injurious to the organisms there and therefore to the soil health. We apply chemicals to the land with too little knowledge and too little monitoring of what the full effects are. We need to be more cautious and more observant. I hope you will do thoro monitoring if you do resort to chemicals: it would probably contribute greatly to our knowledge to their harmful effects." (555)

Response. Monitoring would be a critical component of herbicide treatment programs (refer to comment 388).

Comment
318 "It has come to Lakeview SWCD's [Soil and Water Conservation District's] attention, through a literature review, that a detailed soil survey was completed on the Hart Mountain area in 1960. The soil survey was updated and range site and condition map developed. This basic resource information is not used! Why? There is no soils inventory used, and therefore, no soils interpretations on which to base sound resource management decisions." (605)

Response. Our records indicate that a detailed soil survey was conducted in 1969 on Hart Mountain NAR (USSCS 1969), and this has been updated (USSCS 1993 -- draft). Rouse (1958) had conducted a forage inventory during 1955-1957, but this did not include a soil survey. USSCS (1993) was used extensively in developing vegetation type maps for the EIS (Maps 1-3 and 1-4). Soils of Hart Mountain NAR were digitized using Autocad (a computer software package for mapping), but we did not include maps in the DEIS. Acreages of each soil type were computed based on the digital information (Appendix C, FEIS), and we expanded the Soils section in the Chapter 3 of the FEIS (Section One, part I, C).

Comment

319 "Cryptogammic Crust - We note that nowhere in the two volume DEIS is this extremely important component of the Great Basin ecosystem mentioned. Cryptogammic crust is the collection of mosses, lichens, algae, and bacteria which form a crust which filled the spaces between the clumps of bunchgrasses throughout the Intermountain West before the arrival of Euroamericans. These spaces are now, for the most part, bare because of the effect of ubiquitous trampling by cattle. The cryptograms provided the important functions of absorbing rain water, thus preventing erosion, and providing a hospitable substrate for the relatively sparse seeds of the bunchgrasses to germinate. The cryptogams, composed of very slow growing plants, may be impossible to restore, but if any are left at Hart Mountain Refuge, they must be carefully protected." (655)

Response. Based on the many comments that the Service received stating that soils were inadequately covered in the DEIS, we expanded the Soils section (Chapter 3, Section One, I, C and Appendix C of the FEIS). Cryptogamic crusts were not included in the discussion.

Comment

320 Soil productivity should be mentioned as core problem. (773)

Response. We agree that reduced soil productivity is a problem on the Refuge; however, we did not add it as a core problem for this planning period. Reduced soil productivity will be one of the factors that managers will have address in their efforts to reach long-range objectives. Reduction of sagebrush cover and subsequent increases in herbaceous vegetation may be limited by reduced soil productivity in some areas, namely the Wyoming big sagebrush vegetation type. In other words, reducing shrub cover in many areas will not automatically result in the treated area being restored to a healthy condition.

Comment

321 "Soil is an essential component of any land-based ecosystem. It is often the prime differentiating factor in respect to site potential regarding the kinds of vegetation that can and cannot be grown as well as the relative production that can be expected.

The Table of Contents, page iii, Section One---Refuge Ecosystem shows Soils as one topic discussed on page 92 under Habitat. On page 92, the soils of Hart Mt NAR are described in 24 words! One statement is "Four major soil orders are represented on the Refuge" but the four orders are not named. In the national system of soil classification, the Order is the broadest generalization; there are only 10 Soil Orders recognized in the U.S.A. It is ludicrous to use only the Soil Order in describing soils of an area when ecosystem management is involved.

On page 92, the Team also says "soils are discussed under the Vegetation and Watershed Values of each major habitat of the Refuge". However, nowhere in the EIS is there a description of the soils of the Refuge.

It is doubtful that the EIS Team had any real knowledge or appreciation for the very important role that soils have in ecosystem evaluation and management. This is incredible in view of today's advanced science of resources and the demands made by today's resource issues. In addition, the data on soils and ecological sites was in their files and readily available." (807)

Response. We agree that soil is a critically important component of the Refuge ecosystem. Based on comments that the Service received regarding deficient information on soils, we expanded the Soils section in Chapter 3, Section One, I, C of the FEIS. We also provided additional information in Appendix C of the FEIS. A soils map was developed during the planning process based on USSCS (1993), but has not been included in the FEIS.

HABITAT ANALYSIS

Comment

322 "Incidentally, the narrative nowhere makes clear whether Map 1-3 vegetation classes show current condition, future desired condition, potential natural vegetation (PNV), sub-climax PNV, PNV assuming total fire suppression, PNV assuming long fire cycles (setting back juniper but not low sage), or PNV assuming no beaver? Both the upland and wetland maps show regrettable lumping of vegetation classes not required by spatial resolution of an 11x17 page. The components of "mixed deciduous shrub" need to be defined (willows are deciduous shrubs but evidently excluded). Why not let the people see winterfat, greasewood, saltgrass, and squirreltail areas? Herbaceous spiderflower areas NE of Flook Lake and ENE of Petroglyph Lake are classified as "other desert shrubs." A fine-structure map showing current actual vegetation is needed in the FEIS." (521)

Response. Maps 1-3 and 1-4 show vegetation types, a single level of a multi-level land classification used by the Service. Map 1-3 shows potential dominant vegetation that would occur on a site in a late (e.g., shrub types) or very late (e.g., conifer types) stage of succession in uplands. Map 1-4 shows potential dominant vegetation that would occur on a site in a very late stage of site progression.

The vegetation maps are admittedly coarse-textured. Vegetation types that comprise minor acreage are lumped into an "other" category and existing succession and progression stages are not depicted. Levels of classification below the level of vegetation type were not included in the vegetation maps of the FEIS because of problems associated with presenting too detailed a map given constraints imposed by size of maps in relation to size of area represented. Volume I, Chapter 3, provides information on characteristics of vegetation types. Appendix B of Volume 2 provides the basis for the classification used in the FEIS.

Comment

323 "What remote sensing data was consulted in preparation of the DEIS? The remote sensing data consulted should be tabulated and discussed in the FEIS. Apparently, orthophotoquads with soil overlays were used with 7.5' topos and four inch to the mile color infrared stereo pairs; this should be so stated, along with access information for the negatives. As a courtesy, I am enclosing a downloaded the 640 agency 1993 APSRS CD-ROM file uploaded as a flatfile aerial photo database with Refuge coverage. This needs annotation to include custom fly-overs and other photos consulted; the table should be inserted in the FEIS for reference purposes and to support the analysis. The oblique fly-over of 1933 by a UW geology professor would be very useful to obtain." (521)

Response. Vegetation types and associated information were mapped onto mylar acetate overlaid on 7.5 minute orthophotos published by the U.S. Geological Survey. Primary sources used to delineate vegetation on mylars included: (1) the orthophoto itself; (2) maps (2.6":1 mile) and supporting documentation from a recent soil survey done by the Soil Conservation Service in the late 1980s (USSCS 1993); (3) near-infrared, stereo pair pictures (4":1 mile) taken of the entire refuge in July 1991; and (4) near-infrared pictures (2.6":1 mile) taken by the National Oceanographic and Atmospheric Administration in July 1983.

Maps, photos, and negatives owned by the Service are available for public use; materials can be requested for use by writing the Refuge Manager.

Comment

324 "There seems to have been no use made of SLAR imagery. The west-side canyons are best viewed with east-directed side-looking airborne radar. SLAR can penetrate dry soils up to 2 meters and thus give a unique look at the playa regions, their soils, sediments, hydrology, and vegetation potential. Only a SLAR to the west is enclosed because of deadline constraints. Also needed in the FEIS is analysis of satellite data from the non-R,G,B,IR channels of the multi-spectral scanner, preferably from SPOT rather than Landsat. Channels 5, 6, 7 could be useful. Because of time constraints, only a RBV ERSAL grayscale of Hart Mt. is enclosed. The Gap Analysis program supposedly posted high resolution satellite files at SSCGIS that would be available to the Refuge at no charge." (521)

Response. This assessment is correct. SLAR imagery was not used in the development of the EIS.

SUCCESSION

Comments

325 "A common ecological mistake that many people make is to believe that if some form of perturbation caused the deterioration of a site, removal of that perturbation will reverse the sequence and enable the site to return to climax. The reason this is flawed logic is that as sites are altered through the loss of soil and the encroachment of long-lived perennial (such as juniper or big sagebrush) the site is permanently altered. It will not return to a pristine condition simply by leaving it alone. (Laycock 1991, Westoby, Walker, and Noy-Muir 1989). It seems short-sighted, therefore, to eliminate what is a potentially useful tool (herbivory) to reverse deterioration (especially if it could be used in conjunction with other restoration techniques) simply because that tool has been misused in the past. On Hart Mountain there is ample evidence that the refuge is experiencing a positive trend, ecologically. The evidence, some quoted in the DEIS, indicates that the abuses of the past century have been stopped and that most, if not all, of the vegetation types have been improving over the past several decades." (205)

326 "Enclosed is a symposium proceedings that dealt with the question of how appropriate range condition is, given current ecological thinking. Unfortunately, the older view of ecology, that if we remove a given disturbance the site will return to climax vegetation still shapes management." (730)

Response. We recognize that removal of cattle grazing would not allow many upland habitats to return to a condition considered healthy with respect to the amount of soil organic matter and ratio of shrub cover to native herb cover. The primary problem with upland habitats on the Refuge is excessive sagebrush cover, which has resulted in reduced herbaceous understory. Elimination of livestock grazing for the next 15 years is not being proposed because of past mismanagement, but because it is not a useful tool in rehabilitation of upland sites on the Refuge, and we have not determined it to be compatible with the goals and objectives of the Refuge. There are no grazing systems under which cattle would effectively reduce sagebrush canopy cover over a broad area (Laycock 1991). That is why prescribed fire and other methods would be used to reduce shrub cover over the next 15 years. Additionally, sites subject to shrub reduction would be seeded with native grass if low grass cover existed prior to treatment.

Comments

327 "The definition of vegetational succession given on Page 94 is archaic and should be restated to incorporate our present understanding of community processes, as described by Laycock (1991) and others. Also the statement on Page 117 that there is little competition for forage between livestock and pronghorn on rangelands in good ecological condition (O'Gara and Yoakum 1992) ignores the facts that (1) past livestock grazing left little land in good condition, and (2) livestock concentrate along rivers, where they overgraze and deprive pronghorn of riparian-zone forage." (519)

328 "Vegetation Succession as discussed on p. 94, Volume I, is currently being questioned by rangeland scientists. This definition is not consistent with the National Range Handbook of the Soil Conservation Service (SCS). Another theory receiving considerable attention which you may wish to consider is that of multiple steady states." (541)

Response. We agree that the definition of vegetation succession used in the EIS is simplistic. The concepts of stable states and thresholds described by Laycock (1991) are important in order to successfully manipulate and manage rangelands. However, the purpose of a simplistic definition is to provide a basic understanding of how the composition and structure of upland habitats changes over time with or without stand-replacement distarbance (e.g., prescribed fire). Woody vegetation tends to increase dominance as succession advances over time in the majority of upland vegetation types of the Refuge. For example, western juniper distribution and cover will increase in the mountain big sagebrush type in the absence of fire.

Lakebeds on the Refuge are where cattle and pronghorn compete for forage. The creeks where cattle concentrate are generally not in pronghorn habitat. However, condition of riparian areas on the Refuge is of concern and is addressed in the EIS. Concerns regarding pronghorn are addressed in Chapter 3, Section One, part II, A of the FEIS.

Comment

329 "What exactly does the upland plant succession map show? Upland plant succession has been given appropriately thorough consideration in the DEIS. Still, there are no comparable sites of any significant acreage in the Great Basin not under extreme domestic livestock grazing pressure. Euro-settlers kept exceedingly poor records of pre-settlement ecological conditions. There being no studies of areas "ahead" or "behind" Hart Mt. in terms of recovery, how then can Great Basin ecology predict the vegetation on Hart Mt. 40 years from now, as implied by Map 1-3? The DEIS cites the Gap Analysis GIS program, but does not discuss its independent and variant analysis of vegetation classes at Hart Mt. nor any discussion of how the CMP jibes with the gap program vis-a-vis hot spots of biodiversity. This needs clarification in the FEIS, especially if there are inconsistencies. The Refuge community classification system does not seem compatible with that of the revised Oregon Natural Heritage Program. This also stresses codominant bunchgrasses. Note big sage/Indian ricegrass/needle-and-thread [Long Draw RNA]is a distinct community from big sage/needle-and-thread [Guano Creek pRNA]. Both are found on sandy soils. These would be lumped as big sage under the Refuge system. The Gap Analysis program developed 133 primary vegetation types of actual vegetation cover in Oregon. Note that the juniper woodland types don't correspond to Refuge classes, generally having a specific bunchgrass component (i.e., juniper/big sage/Sandberg bluegrass)." (521)

Response. Map 1-3, Upland Vegetation Types is not an "upland plant succession map". It simply shows broad vegetation types found on the Refuge and is based on dominant species of woody vegetation that occur in a late stage of succession. Succession stages within vegetation types also were delineated, but this map layer was not presented in the EIS.

Comment

330 "How can we be sure the upland plant succession scheme is valid? Here is an alternative analysis to that of Map 1-3, based on field visits to some three hundred small RNAs, ACECs, TNC preserves, kipukas, dry benches, and other residual natural areas in eastern Oregon. First, the macho woody-dominant canopy-understory metaphor is more appropriate to forests than rocky deserts, where small, well-spaced plants (water stress and phytotoxins) scarcely compete for sunlight (present in excess; evaporative stress is the issue). Second, native bunchgrass and forbs continue to fully cover ungrazed and unburned areas at Jordan Craters, Cottonwood Creek WSA, The Island, Lawrence Grasslands, Long Draw, etc. There is no indication whatsoever of succession to woody shrubs after centuries. (For that matter, look at the biscuitroot rock garden south of Petroglyph Lake, the sedum community on North Mt., or the balsamroot above Rock Creek.) Plant community ecology have a known predisposition to lump habitats -- some strikingly dissimilar to botanists -- in order to reduce reality to fit simple academic successional schemes. At Hart, non-palatability of sage to livestock (plus fire suppression) has not created a near-climax seral stage, but perhaps a vegetation state that never existed in nature to any appreciable extent, like a cheatgrass flat (grazing), a blackberry patch (logging), a phylaris marsh (disturbed wetland), or a tamarisk riparian lock-up (grazing). The DEIS' prescription is fine but its outcome won't be Map 1-3. Once the ecology is back on track, many microsites will fail to follow the instructions of Table B-1." (521)

Response. We disagree with the writer's contention that the scheme used in the EIS for description and classification of succession stages is invalid. As described in Appendix B, we used a hierarchal classification system that organized vegetative information by multiple scales of descriptive detail that range from biogeographic realms to plant communities. We emphasize description of vegetation types and succession/progression stages of vegetation types in the EIS because these levels were deemed appropriate for the purpose of broad-based resource planning. Additionally, the description of succession stages was based on a foundation of technical information and on-site observations of Refuge personnel. Consideration of more detailed vegetative information will be incorporated in operational management plans developed for specific sites.

Comment

331 "Isn't a better understanding of microclimates needed to predict vegetation patterns and fire response? The paragraph on climate is perfunctory. Evidently, the Refuge has sixty years of monitoring data from a Headquarters gauging station that were not summarized for the DEIS. The DEIS speaks of a 110 day maximum frost-free growing season on the western foothills which is probably generic crop forecasting data. It would be instructive to include a plot of rainfall by year (to help understand droughts) and also average rainfall by month -- see attached charts. May and June are surprisingly the wettest months. July and August rainfall is the crucial determinant of juniper growth according to Dr. P. Miller. The same analysis is needed for temperature highs and lows. Mean wind direction and velocity are important for understanding evaporative stress and modeling water balances. Several observers at Hart have remarked on wind influences on playa dunes and precious topsoil erosion. Prevailing winds from the southwest created a terrace at the south end of Long Lake, fine material actually being observed to sift over by Cressman. Thunderstorm frequency would be helpful in understanding potential natural fire frequency as a function of location (e.g., Warner Mt and areas just east of the gap seem to be "hot spots" for lightning fires) and the viability of winding down prescribed burns. Micro-climates are not addressed, though Refuge staff has long observed the area and the mountain seems to make its own local weather to a considerable extent (e.g., is wetter and cooler in the Rock/Guano divide area). Tree-ring climate fluctuations studies of F.P. Keen go back to the year 1268. He was at the Bureau of Entomology, Forest Insect Laboratory, Portland and published in 1936. Isaiah Bowman published tree-ring growth charts in 1933 in "Our Expanding and Contracting Desert" in the Geographical Review, vol. XXV pp. 43-61. L.T. Jessup published "Precipitation and Tree Growth in Harney Basin, Oregon" in Geographical Review, XXV (1935) pp. 310-312. The USDA Weather Bureau has records from the Blitzen station from 1920 to 1933 in "Summary of the Climatological Data for the United States by Sections, Section 18 Eastern Oregon." Hart Mt. shows some signs of glaciation according to Cressman. These are not cited in the Bibliography. The climate has important influences on vegetation and the CMP will founder to the extent that they are not understood." (521)

Response. We recognize the importance of micro-climate as a factor that influences composition and structure of plant communities. However, limitations in our knowledge of micro-climate preclude practical use of the concept at this point in resource planning.

The level of detail used in the EIS adequately describes the sources of information used to predict vegetation types (see Appendix B) independent of microclimate information. Technical reports and field experience of resource professionals provided a sufficient basis for characterization of existing vegetation and expected potential vegetation. Some of these technical reports quantify the relationship between microclimate, vegetation occurrence, and response of vegetation after burning (Winward 1980, Bunting et al. 1987, USSCS 1993)). As for predicting pattern of vegetation, site-specific plans that describe expectations of burn pattern (e.g., edge/area ratio, ratio of burned/unburned area) would be prepared before each prescribed burn. Additionally, burn plans would describe the methods of firing and prescription conditions used to influence the extent and pattern of burning.

Weather records were generated from 2 stations at and near Refuge headquarters. This detailed information is regularly used for development of burn prescriptions, and is summarized annually in Refuge Narrative reports. The description of climate found in Chapter 3 of the FEIS is based on SCS records (USSCS 1993). The description is perfunctory but sufficient for characterization of variation in climate found in different areas of the Refuge and correlates with data derived from Refuge Headquarters.

Reports cited in the comment were noted but do not have immediate relevance to the FEIS.

SITE PROGRESSION

Comment

332 "What is the definition of wetland community progression? Wetland plant progression in the DEIS is, to some extent, a welcome relief from upland seral succession schemes. However appropriate progression might be to neartic [sic] wetlands, it seems inapplicable to the SE playas that form the heart of the Refuge. Although progression is never really defined, for playas it seems to predict what might happen under progressively wetter conditions (but not too much wetter!). [Water chemistry -- salinity, alkalinity, solubility products, osmolarity, selenium, borates etc. -- plays no role because we are plant community ecologists.] Thus Flook Lake could progress from its current poverty weed-[evening] primrose state to rush-spikerush-arnica state in wet years, but it is not allowed to progress to cattail-bulrush [now both Typhaceae], much less to pondweed or open aquatic, no matter what the water depth. Yet Mound Lake, named in the last century, doesn't seem to be progressing at all from its remarkable perched silver sage-caespitose bunchgrass-forb state. While silver sage is a component, it is showing no signs of dominating, (cf., wetland vegetation map) even within its gradient ring." (521)

Response. As defined in the glossary of Volume I, site progression is the change in structure and species composition of wetland vegetation types associated with the change in water availability to plants (Leonard et al. 1992). The site progression concept was originally developed to deal with management of riparian zones associated with stream channels (Leonard et al. 1992). However, the concept also can be applied to characterize the relationship between vegetation composition and the frequency and duration of flooding described for palustrine wetlands of playas of the Refuge (Cowardin et al. 1979).

Comment

333 "Will wetlands follow the progression scheme under an erratic climatic regime? The problem with playa progression is that precipitation at Hart Mt. is highly erratic. Playa basins can provide extremely gradual changes in hydrology over relatively long distances, allowing highly structured concentric vegetation rings to develop, bearing no resemblance to the homogeneous solid areas of Map 1-4. (See enclosed computer-generated false-color maps of Spanish Lake.) These rings presumably move outward in a highly hypothetical consistent succession of wet years, maintaining their order. No doubt antelope prefer certain rings to others. The DEIS errs in attributing turbidity to incoming sediment: the origin is exceedingly fine clay already present, stirred up by wind, invertebrates and wading birds. There is no evidence that this inhibits plant growth. Playa vegetation can change from year to year. Thus Billy Burr was described in 1991 as a barren playa dominated by Oenothera tanacetifolia, which could scarcely be found in the lush 1993. Silver sage dominance could be an artifact of over-grazing on Poa nevadensis. Many playas show sand dunes and elevation lines established in dry years, such as Alger Lake and Spanish Lake. Map 1-4 does not recognize these. The ODFW stream survey found remnants of a cattail marsh that varied from 50 to 150 feet in width along a stretch of Guano Creek [stream mile 21.40 to 22.75] of virtually no gradient. This could very well be an old playa bed that has sedimented in and now overflows, or an old beaver pond. On the wetland map 1-4, this is shown as willow. Why? Large number of NWI wetland features have been dropped despite adequate

size relative to map resolution. For example, two wetlands just below the Poker Jim escarpment are not shown.

While management options for playa vegetation are few, the DEIS could include a table (and classification system) for all lakes and playas, noting actual condition for various years (based on aerial photo history and field work) and acreage of various rings for various water years, along with antelope forage preferences." (521)

Response. Year-to-year and long-term change in flooding regime can result in relatively rapid change in progression stage and associated playa vegetation. Our treatment of progression in playas emphasizes (1) dominant vegetation types, which usually consists the dominant species of the dominant plant community; and (2) the normal range of change expected to occur in flooding regimes, progression stages, and associated vegetation on a given site. This broad level treatment does not account for conditions on playas subject to extreme drought and flooding unless they occur regularly (e.g., barren and aquatic non-vegetated stages of progression). However, this treatment does recognize the fact that a variety of other, less dominant plant communities are associated with different progression stages on playa wetlands (lower level in the ecosystem classification of Appendix B). The level of plant community would be considered in operational management plans that may influence playa vegetation and associated wildlife species.

We agree that many factors influence turbidity in flooded playas including sediment inflow from the watershed, lake sediment composition, vegetation cover, and wave action. Some plant species such as leafy arnica and spikerush apparently are adapted to erratic water supplies, alkaline water chemistry, and high levels of dissolved solids, such as fine clays, that reduce light penetration in the water column. We find no evidence, however, to suggest that growth of some plant species, especially submergent aquatics, is positively related to dissolved solid level.

Wetland map 1-4 shows the potential vegetation of valley no. 12 of Guano Creek as willow. Potential vegetation was inferred in this valley as with many other low-gradient valleys because the site was subject to heavy historic use by livestock and much of the original vegetation consequently was altered. Kovalchik and Elmore (1992) indicate that willow stands subject to such intensive livestock use may persist in low numbers or die-out. Since the original vegetation was altered, our inference of willow potential was mainly based on 3 considerations: (1) increase in stream energy and scouring frequency associated with such a narrow valley, stream gradient notwithstanding (2) perennial water supply; and (3) the site's proximity to existing willow populations (1/2 mile upstream).

Clearly, some features shown on the National Wetland Inventory (NWI) Maps (USFWS 1989) were not shown on vegetation maps used in the FEIS. It is our judgement, however, that wetland map 1-4 is consistent with the NWI maps in that they both display the majority of wetland features found on the Refuge that can be adequately mapped at a 1 inch to 2000 foot mapping scale. The NWI maps have and will continue to be used for reference and planning purposes by the Refuge staff.

MANAGEMENT "TOOLS"

Comments

334 "The plan, as drafted, lacks objectivity and logic. It states categorically that the tools of available management are machinery; chemicals; fire and livestock grazing. The plan then summarily eliminates grazing as a viable alternative. In addition, the present project leader envisions a mandate for managing the refuge with very narrow parameters excluding the expertise and methods of previous managers Kashke, Carter and Bronson, one of whom received a Gold Medal for distinguished public service during his tenure. No such mandate exists." (66)

335 "My number one objection to the preferred alternative is the total exclusion of livestock grazing. I feel that any competent resource manager would never exclude the use of any tool." (601)

Response. Livestock grazing, after thorough evaluation, was determined not to be necessary for managing Hart Mountain NAR during the next 15 years, based on Refuge goals and objectives and current habitat conditions. The Service, however, does not dismiss the use of livestock for managing wildlife habitat. Our understanding of livestock-wildlife relationships has increased substantially in recent years. Past management of the Refuge focused primarily on big game species (USFWS 1970). Past management also based management objectives on upland habitat standards (USFWS 1970). Focus has shifted to account for all native wildlife species on the Refuge, while still continuing to highlight species of special interest (e.g., pronghorn), based on Executive Order 7523 (Appendix A). Riparian habitats, under the Proposed Action, would be recognized for their importance to native wildlife communities.

Comment
336 "Not only mechanical and herbicide brush-removal treatments but also prescribed burning should be evaluated on an experimental basis before large-scale treatments are initiated. Because of the ability of invasive weeds such as Bromus tectorum (cheatgrass) to increase in importance and become permanently established after fire, even prescribed burning should be approached with caution. Each major vegetation zone in the Refuge should be tested before any treatment is introduced. Without intensive research, shrubs should not be removed mechanically or by herbicide inside the Refuge. Mechanical treatments encourage the invasion of cheatgrass by disturbing the soil, and herbicides have potentially lethal effects on soil organisms, non-target plant species, insects, and larger wildlife. The DEIS stated that mechanical and herbicidal treatments may be used to remove shrubs because of insufficient fuel to carry prescribed fires. Although this may currently be true, managers of NAR should wait before undertaking such interventions to see if the release of lands from livestock grazing and improved rainfall (as in 1993) provide enough biomass to allow burning." (519)

Response. The Service agrees that prescribed burning should take place on a small scale in habitats where response is poorly understood or where threat of cheatgrass invasion is high. As pointed out in Alternative D, mechanical treatment and use of herbicides would be conducted on an small-scale. The vast majority of the Refuge has not been grazed by livestock for several decades. It is within some of these areas that prescribed burning may be most difficult because of the deficiency of fine fuels.

Comment
337 "Of all the tools available to manipulate natural resources in brittle environments, fire, rest and poisons are the most expensive and dangerous. They are the least effective." (600)

Response. The effectiveness of a "tool" depends on the what is to be accomplished (i.e., objectives). To reach Refuge goals, through the resolution of core problems, the most effective way to accomplish them is by making use of prescribed burning, rest from livestock grazing, and, on a limited basis, mechanical and herbicide treatments. If the Service does not have the option of using prescribed burning or herbicides, the only other feasible option for reducing shrub cover on the Refuge would be mechanical treatment. Otherwise shrub cover would remain at its present high level (Sneva et al. 1984, Winward 1991, Laycock 1991). In other words, "rest" from disturbances (e.g., fire, livestock grazing) in uplands would not result in reduced shrub cover. However, rest from livestock grazing in riparian areas would allow these areas to recover at the fastest rate possible (Platts 1989), and provides the least expensive means of restoring these habitats.

Comment
338 "I request a revision of the preferred alternative to reflect the negative environmental and economic impacts associated with the high expenditure of public funds to burn and mechanically treat 35,000 acres of shrublands in order to convert them to temporary grasslands." (600)

Response. Prescribed burning is the most economical and least environmentally hazardous means of reducing shrub cover on the Refuge (Appendix J). It also is imperative to wildlife species and wildlife communities that depend on conditions that fire creates. Periodic fire historically was a major factor that produced conditions under which native wildlife communities evolved. As pointed out in the comment, grassland habitats would only be temporary in many areas because of the process called succession. Therefore, periodic burning of these habitats will be necessary.

Comment
339 "They [Krueger, Bedell, and Buckhouse 1991] made another statement here.. 'The tools at hand to influence vegetation change are readily apparent: fire, livestock grazing, mechanical devices and herbicides are most commonly used. Each is an excellent tool when used to direct vegetation change toward a definite objective and within ecological potential of the area.' " (792)

Response. We agree.

PRESCRIBED BURNING

General Comments
340 "...a managed burn near the source of Guano Creek appeared to be very successful in reducing sagebrush cover and stimulating the growth of many grasses and forbs." (24)

341 "It (Alternative D) fosters the regeneration of quaking aspen stands, which are especially important to wildlife." (358)

342 "The Oregon Chapter of TWS [The Wildlife Society] has drafted a position statement regarding burning and livestock grazing as management practices on public lands, and specifically for those public lands designated as national refuges, parks, monuments, and wilderness... Burning is supported as a management tool when it is used to either maintain or restore perennial species and native habitat mosaics, and when it can be used to reduce the likelihood of catastrophic fires through fuel load reduction... in terms of consistency with the position of the Oregon Chapter of TWS, Alternative D (Ecosystem Management) appears most appropriate." (540)

Response. Comments noted.

Comment
343 "Kick the cows off if you like, but please do not burn the vegetation."

Response. Fire historically has been a major influence for vegetation distribution and composition in the Great Basin Region. Overgrazing and fire exclusion have produced an unnatural landscape. The Proposed Action (Alternative D) describes reintroducing fire to regain a more natural distribution of vegetation communities.

Comment
344 "We would view the preferred alternative as an experiment and would support such an experiment if it proceeded slowly and were adequately monitored. However, we also strongly urge caution when it comes to removing the amount of sagebrush called for in the preferred alternative. Nobody wants to remove sagebrush to the detriment of sage grouse. But how much is beneficial and how much is too much? We've suggested in the Sage Grouse of Oregon report the creation of small openings in large stands of big sagebrush and that 60%-70% of the area be left in big sage. We've recently talked to Jack Connelly who has been doing a research project for seven years on the effect of burning on sage grouse in southwest Idaho. He is more convinced than ever that his experiment was quite harmful to sage grouse in the area even though they created a mosaic of 58:42 burn to unburned area in Wyoming big sagebrush habitat and got a good response from grasses and forbs. He went from 3 leks in his study area with the largest > 200 males to 1 active lek with 7 males now. He also noted that fire burned best in those areas that were being used by grouse for nesting because the herbaceous cover carried fire well. Those areas that weren't being used by nesting grouse didn't carry fire well and were left unburned. He is urging extreme caution in removing large amounts of sagebrush in sage grouse nesting habitats." (7)

Response. The suggestion to create "small openings in large stands of big sagebrush and [to leave] 60%-70% of the area" in big sagebrush concurs with what the Service proposes in Alternative D. Approximately 81-88% of the big sagebrush would remain in late succession, at the end of the 15-year planning horizon. This amount of treatment would not conflict with the suggested proportion of land to be left in of big sagebrush (60-70%). Figures are based on projected amount of treatment to occur in mountain and Wyoming big sagebrush under Alternative D (Table 2-2, FEIS), amount of the big sagebrush vegetation types (mountain and Wyoming combined) already in early succession (Table 3-3, FEIS), and the total acreage of the vegetation types. If the treatment program proposed by Alternative D were carried out over the long-term, from 56% to 76% of the big sagebrush vegetation types would be maintained in late succession, which generally falls within the range of the suggested 60-70%.

Relatively small openings, 200 to 1,200 acres in a mosaic pattern, would be targeted for mountain big sagebrush and Wyoming big sagebrush, based on long-range objectives for these vegetation types (Chapter 1, Section Two of the FEIS). This means that each opening would be between 0.2-5% of the vegetation type. Because the Service would strive for a mosaic pattern, the openings would not be solid block openings.

We agree that burning sage grouse nesting habitat would have negative short-term impacts on nesting in burned areas. However, we have the choice of maintaining degraded sage grouse nesting habitat (e.g., no prescribed burning or other shrub reduction treatment) with the realization that a wildfire eventually will burn the area anyhow. Or, we can plan for the future by setting the stage for improved sage grouse nesting habitat 30 to 50 years down the road, at the expense of losing a small amount of degraded nesting habitat.

Results of Jack Connelly's study suggests relatively short term negative impacts of prescribed burning to lek attendance and nesting habitat; however, long term impacts remain undetermined. It is difficult to ascertain the exact reasons for the decline in sage grouse numbers that Connelly observed. Burning over leks and surrounding roosting habitat may have impacted lek attendance on Connelly's study area in Idaho. Fairly dense stands of big sagebrush near leks have been reported as being important for roosting areas of breeding males (Ellis et al. 1989). A mitigation measure, based on Connelly's work, would be to ensure that existing leks and the surrounding area is protected during prescribed burned. Another consideration, however, is that Connelly et al. (1981) reported that a lek was created in a burned area approximately 3 years following the burn. In addition, 2 years following a 1,600 acre burn near Flook Knoll on Hart Mountain NAR, a sage grouse lek was established.

Comment

345 "We believe that < 15% cover on 3/4 of the area is too little sagebrush cover for the reasons stated above for sage grouse and pygmy rabbits and disagree with the statement concerning the preferred alternative (page 196): "Upland habitats would be improved... and enhance sage grouse nesting and early brood rearing habitats". We believe, based on the numerous studies of sage grouse and particularly the current one in Idaho, that the stated long-term objectives for this vegetation type will not leave enough sagebrush." (7)

Response. During the 15-year planning horizon, 7-13% of the Wyoming big sagebrush would be targeted for treatment. Shrub cover on the remaining 87-93% of the area would remain at current high levels (average of about 27%). Monitoring is an important component of Alternative D.

The Service believes that shrub cover in Wyoming big sagebrush is in excess of what it was prior to Euroamerican settlement, and that shrub cover of 12-15% in late succession stands represents an approximation of the conditions prior to Euroamerican settlement, based on Winward (1991). However, the objective of maintaining shrub cover of less than 15% is the expected result of initially reducing shrub cover, and subsequent to restoration of the herbaceous understory. Without heavy livestock grazing pressure on re-established herbaceous vegetation, shrub cover would remain at a lower level than currently exists (i.e., 12-15% versus 27%). The Service, at this time, has no intention of actively managing late succession stands of shrubs to maintain a certain amount of shrub cover while at the same time maintaining them in a late stage of succession.

Please also refer to comments specific to sagegrouse (comments 225-227 for further details) and pygmy rabbits (comments 234 and 235).

Comment

346 "As far as we know low sagebrush rarely burned because it does not carry fire well. It is very important habitat for wildlife. Why do you want to burn it?" (7)

Response. The vegetative makeup of what is now low sagebrush communities is not well documented for the time period preceding livestock grazing and fire suppression. However, the Proposed Action characterizes the use of fire to promote more diversity in what now is large tracts of late succession low sagebrush to improve wildlife habitat. Low sagebrush does not encourage fire spread under mild to moderate burning conditions, and may require burning under more severe conditions. An alternative is to combine the use of fire with pre-treatment by mechanical or chemical means.

Comment

347 "Spending 22,000 to 40,000 dollars per year to pollute our air is a questionable benefit, not to mention that most government controlled burns aren't." (9)

Response. The values of 22,000 to 40,000 refer to acres, not dollars, as found in Tables S-1 and 4-7 of the FEIS. An air quality analysis has been added to the FEIS. In addition, several prescribed burns have been conducted on the Refuge that have been successfully held to pre-determined boundaries that have satisfied objectives.

Comment

348 "Lightning fires should be allowed to burns, especially in the Wilderness Study Areas." (14)

Response. All fires that occur on the Refuge are required to be managed as per Department of Interior and Service Policy. The degree of management depends on the environmental and political conditions during the period of time the fire takes place. A Fire Management Plan is currently under development for the Refuge that addresses the management of Prescribed Natural Fire and more flexible fire suppression strategies. The role of prescribed natural fire is noted in the FEIS in Chapter 2, Section D.

Comments

349 "Prescribed fire should be used so that it mimics natural fires (done in the same season) in areas that fuel has built up due to past fire suppression." (14)

350 "Last but not least reinstate a fire regime that, to the best of your ability, mimics the natural fire frequency and intensity and eliminate chemicals in the management of unwanted species." (127)

Response. The seasonality for executing management ignited prescribed fires is often dictated by non-environmental factors such as availability of funding, local, regional and national fire activity, hunting seasons and other human activities. In addition, execution of burns during the peak of wildfire season will increase costs due to more complex requirements for holding greater intensity fires to predetermined boundaries. The ecological effects of burns conducted during natural fire season are varied by vegetation type, but more severe fire effects can be anticipated in general. The target species for most burning is sagebrush, which is easily killed by even light severity burns. Aspen, on the other hand, requires higher fire severity to promote mortality. Management ignited prescribed burns will occur during spring and late summer/fall, based on burn objectives.

Comment

351 "Fire, since it was a natural feature of the landscape, is certainly preferable [compared to using herbicides]." (19)

Response. This statement is consistant with the intent of the Proposed Action. However, the use of herbicides or mechanical treatments should also be maintained as viable options in the event future legislation or mandates preclude or restrict the application of management ignited prescribed burning.

Comment

352 "If fire won't be a viable management tool in the future, what other means will you employ to create forage [based on air quality regulations]?" (25)

Response. The Service does not have any specific objectives for creating "forage". The long-range objectives call for increasing cover of herbaceous vegetation which has many uses in addition to forage. Increased herbaceous cover would result in increased forage. The use of herbicides or mechanical treatments should also be maintained as viable options in the event future legislation or mandates preclude or restrict the application of prescribed burning. Please refer to Chapter 2, Section D, of the FEIS.

Comment

353 "Many controlled burns, never do a good job covering a large area, at a cost of $5 an acre and more. BLM Figures. Grass that is harvested by cattle and sheep is turned into food, revenue for grazing is returned to the government." (29)

Response. Livestock grazing and fire are not comparable in terms of habitat that they produce. The Preferred Alternaive describes the use of management ignited prescribed fire to convert late succession shrub communities to temporary grassland communities, which would diversify wildlife habitat, and to eventually produce higher herbaceous cover in late succession shrublands. It can be generalized that wildlife diversity would benefit from vegetation types in a variety of successional stages.

Comment

354 "But, leave the tall shrubs alone on the steep ground. Nothing else will stop erosion." (120)

Response. The removal of tall shrubs on steep slopes will occur with the use of management ignited prescribed fire. As a result, some increase in errosion can be expected in the first years following burning. However, patchy mosaic burns and the residual presence of herbaceaous and shrub roots will moderate errosive effects on soils. Herbaceaous vegetation that returns will further stabilize soils.

Comment

355 "There are no alternatives that allow naturally occurring fires to burn without suppression. Consider Goal 3 of the NAR to "restore and maintain the structure, species composition, and processes of native ecological communities and ecosystems of the northern Great Basin Region." Naturally occurring fires are one of those processes, and suppression of such fires will directly contradict that goal. Particularly when the refuge has

reached a condition that becomes considerably close to natural conditions, or if a fire starts in an area that would have benefitted by a prescribed fire anyway, there should be a way to let it take its natural course." (483)

Response. Alternaive E in the FEIS characterizes a virtually "hands off" management strategy that allows all natural processes to occur without the intervention of humans. Alternative E is not the Preferred Alternaive. All fires that occur on the Refuge are required to be managed as per Department of Interior and Service Policy. The intensity of management depends on the environmental and political conditions during the period of time the fire takes place. A Fire Management Plan is currently under development for the Refuge that if approved, will allow Prescribed Natural Fires to be managed as such when meeting prescription parameters. In addition, the Fire Management Plan will also provide for more flexible fire suppression strategies. However, the management of wildfires to achieve natural resource goals is clearly in violation of the above stated policies. As such they must be suppressed because wildfires are defined as emergency situations.

Comment

356 "Alternative D: On page 70, Vol.1 under "Fire", 3rd paragraph down - How will fires be suppressed? Will you put in cat lines, will retardant be used to stop wild fires?" (531)

Response. Fire suppression strategies will be developed that are consistant with the goals and objectives of the Refuge in the Fire Management Plan that is currently under development. Suppression tactics will be employed that result from an Escaped Fire Situation Analysis that incorporates such suppression considerations as public and employee safety, values at risk from fire spread, available suppression forces and current and forecasted weather and fire behavior. Tactics employed will be dictated by the current fire situation and will range from simple and expedient methods such as application of water and handtools to more complex methods like dozer lines and aerial retardant. However, the overriding consideration will be to utilize "light hand on the land" suppression actions when possible so that our suppression actions do not create more disturbance than would result from the wildfire.

Comment

357 "The prescribed burning! I saw NO unnatural amount of sagebrush or juniper. The sagebrush is very natural for this part of Oregon. Some areas have only a few inches of ground cover and some areas have four feed of sage but most of it is knee high and very natural to this area and climate. The letter [Sierra Club] speaks of restoring natural ecosystems and burning what is normal for this area in the same paragraph. This is wrong! The letter also failed to mention that a tractor will likely plow a path around a planned burn area before it is burned. This path of upturned boulders and dirt banks is unrepairable and will look like ugly patchwork similar to clear cuts in the forest. And even if the fire line is not made by a tractor, the vegetation that grows after a burn is grass and what's grass good for - cows!" (533)

Response. Fire historically has been one of the major factors that influenced the habitats of the Great Basin Region. As such, fire is an important component of the ecosystem that has been excluded by overgrazing and fire suppression. The intent of Alternative D is to reintroduce fire to convert late succession sagebrush communities to promote greater diversity in habitat types. Other alternatives which may be used include use of existing roads and trails, "beating" the brush down using a variety of methods, use of water and handtools, natural breaks in the horizontal plane of the fuel bed and the reliance on night time increases of relative humidity and lowering of windspeeds and temperatures. Mosaic, patchy burn patterns and increased cover of herbaceous species are also objectives of the FEIS.

Comment

358 "The proposed level of shrub removal under Alternative D may be excessive in a 15 year period." (540c)

Response. The Service does not feel that it is excessive.

Comment

359 "Habitat mosaics created by burning should emphasize patchiness, particularly in riparian areas so as to provide suitable habitat for a diverse assemblage of species, and in upland habitats to ensure sufficient cover is available for deer." (540d)

Response. This assessment is consistant with the intent of the Proposed Action of the FEIS.

Comment

360 "Prescribed burning should begin with the bottom of Potter Canyon. It is extremely difficult to cross from one side to the other." (549)

Response. Potter Canyon represents a riparian area that is in better ecological condition than most other riparian areas on the Refuge. As such, Potter Canyon will not be a high priority for treatment.

Comment

361 "Also, I am very pleased that the refuge will begin instituting fire management on the refuge. Theory has moved beyond on the research stage here and has been proven to help limit sagebrush and juniper invasions." (561)

Response. This statement is consistant with the FEIS rationale for use of fire as found throughout Chapter 3.

Comment

362 "We would suggest two additions to Alternative D that we feel will improve the plan... Establishment of a system of prescribed burning to improve conditions for native vegetation." (627)

Response. Use of fire to improve the ecological condition of the Refuge is a primary basis of Alternative D (Proposed Action).

Comment

363 "I am concerned about the high percentage of prescribed burning that is in the preferred alternative. I am afraid that State of Oregon air pollution laws and regulations would not allow that high of a acreage to be accomplished. I believe that the "window of opportunity" for a safe and controllable prescribe burn are not frequent enough to accomplish the ambitious targets in the preferred alternative. I feel that the spread should be higher to mechanical treatment." (670)

Response. Under the current definitions of the Oregon State Implementation Plan of the Clean Air Act, the burning of sagebrush falls under agricultural burning, which is not regulated. Future regulations may impact burning on the Refuge, and as such, mechanical and chemical treatment methods should remain alternatives to burning. The target acreage for treatment was established to meet the final desired acreage at the end of 15 years of management. The comment regarding the ability of the Refuge to accomplish these targets is noted.

Comment

364 "Oregon Wildlife Federation prefers a prescribed burning program which recognizes that naturally occurring fires are preferable to prescribed burns. We urge the Service to demonstrate a similar commitment by stating that its goal is to return the Refuge to such a high state of health that it can rely on natural fires, and not prescribed burning, for renewal." (695)

Response. A Fire Management Plan is currently under development for the Refuge that addresses the management of Prescribed Natural Fire and more flexible fire suppression strategies. In addition, the FEIS refers to managing prescribed natural fire in Chapter 4, Section D. A new planning strategy will be formulated following analysis of the results of the proposed management plan after the prescribed 15 years of treatment. It is not possible at this time to determine what that new strategy will be.

Comment

365 "Cattle grazing has been so destructive to the Refuge that the continued absence of cattle from the Refuge will not be sufficient to heal the land. As the DEIS so clearly points out, much of the Refuge's uplands are in a state of successional stagnation. Without prescribed burning, too great a portion of the Refuge's uplands will remain overrun by sagebrush, juniper, and other plants adapted to a low water table. These plants make it impossible for earlier successional plants such as grasses, forbs, and sedges to claim their potential habitat. As the Service states in its DEIS, fire will give these displaced plants a chance to recreate the mixed succession level habitat that most favors wildlife abundance and diversity. Fire can also aid in riparian area recovery, as the DEIS mentions, by speeding aspen and willow recovery." (695)

Response. This observation is consistant with the intent of the Proposed Action (Alternative D).

Comment
366 "Vegetation management through the use of fire is very appropriate for this area. Based on what you have accomplished in the past though. I don't think you can conceivably expect to burn the 22,000 to 45,000 acres as shown in Alternative D. I believe that Alternative C would be more realistic, even though it is extremely high compared to your past accomplishment." (723)

Response. For the Service to burn through prescription 22,000 to 45,000 acres would require, on average, a minimum of 1,500 acres to be burned per year on average. Based on current and projected staffing and budget levels, this amount of burning would be achievable.

Comment
367 "The direct adverse effects of prescribed burning would not be mitigated by prescription, as stated. With little or no monitoring in place; and considering a maximum of 15 years of vegetative buildup in riparian areas, upland, and high elevation open rangeland; and having no vegetative management tools at hand; there would be **no control** for a prescribed burn **under any conditions**. There will be risk to human life, property and natural resources will be destroyed and the ecosystem devestated." (730)

Response. A fire effects monitoring system has been established which will study the impact of implementing prescribed burning throughout the 15 year period. Management ignited prescribed fire, under Alternative D, is the vegetative management tool identified for the Refuge. Remember that the vast majority of the Refuge has not been grazed by livestock for many years for a variety of reasons. Note also that management ignited prescribed burns have been conducted on the Refuge in recent years that have been successfully held to pre-determined boundaries and have met project objectives.

Comment
368 "We believe ecosystems without man's intervention and natural wildfires, allowed to burn annually or successionally are the type fire referred to as "beneficial"." (730)

Response. Alternative E, Custodial Maintenance, fully explained in Chapter 2, Section E, of the FEIS, was considered but not selected. Under Alternative E, naturally occuring fires would be allowed to run their natural course without human intervention. This is not possible due to physical, environmental and political limitations. Phyisical limitations include the presence of high value structures, cultural sites and the proximity of Refuge neighbors to Refuge boundaries. Fire spread is not impeded by political boundaries. Environmental limitations include air quality concerns and undesireable fire effects based on burn severity and current drought conditions. Political limitations include Service Policy, which mandates that all fires be managed appropriately, regardless of cause or objectives. In addition, local, regional and national fire activity may also preclude allowing a natural fire to range freely. It is probable that if there is a natural lightning fire on the Refuge, there will be fires on local BLM and USFS lands as well.

Comment
369 "'Prescribed Burns', taking into consideration fire having been suppressed for 20 plus years, without planning, and having vegetative management tools, such as cattle grazing, as a management option, for fire-breaks, etc. will not work. We have managed our public lands for too long to burn indescriminately. Malheur Wildlife Refuge has a fire record that will varify our statements. Most prescribed fires of any consequence, in the last 5 years, swiftly progressed to "out of control", endangering wildlife, neighboring ranches, rural communities and individuals. Wildfire, in excessive fuel buildup areas, causes vegetative cover, in all habitat descriptions, to be indescriminately exterminated, leaving the topsoil to erode, and the water quality to be such as to take decades to recover. The air quality in this instance is always negatively affected. This scene would increase runoff and sedimentation, at least temporarily." (730)

Response. The use of cattle for improvement of prescribed fire breaks is not feasible for Hart Mountain NAR. The objective of burning on the Refuge is to generate as much interspersion as possible through mosaic, patchy burns. A clearly defined fireline, such as found along fencelines, is not desired. In addition, fences may be required for each burn project, not only to keep cattle in a "firebreak" area, but to ensure that the target area for the burn project is rested sufficiently to contain enough grasses and forbs to promote fire spread. Use of cooler and more moist burning conditions rather than extensive firelines would promote desireable burn patterns. In addition, the target vegetation for treatment by fire is late succession sagebrush, which is not, in many areas, productive for forage production in its current state (e.g., Wyoming big sagebrush). A number of successful management ignited prescribed burns have been conducted on the

Refuge during the past 5 years, even in the absence of cattle grazing. These prescribed burns were successfully held to pre-determined boundaries and have met project objectives. We agree that wildfires, given the degraded condition of many habitats on the Refuge, can adversely affect vegetation and soils. Cheatgrass appears to favor sites that have experienced severe fires, such as those that occur during the peak of fire season and drought conditions. Therefore, it is important to maintain a fire suppression program. Less severe burning conditions during spring and fall and avioding burns during higher levels of fire danger will lessen the opportunities for fires to escape. It is unfortunate that the public is aware of only the ones that got away.

Comment
370 "We also ask that the Refuge seek establishment of (or support of) a restoration and burning fund. This would create a wonderful research possibility for the Great Basin and provide much needed information on the effects of burning." (735)

Response. The Refuge has sought and will continue to seek funding for fire related research projects. Currently, a fire history study based on Aspen fire scarring is being pursued.

Comment
371 "Restoration of natural fire regimes is a strong emphasis of the preferred alternative, yet this part of the objectives and descriptive narrative is not well developed. It would be helpful if the Final Plan and EIS included greater discussion of Refuge fire history, vegetation response and a representation of what conditions the prescribed fire program may be expected to produce. Also, fire prescriptions or objectives should be added for each upland shrub community. While this may be implicit in language calling for maintenance of a proportion of each type's area in various seral conditions, it could be stated much more clearly in terms of, for example, desired fire frequency or natural fire return interval. Calculation of these intervals may alter the quantity of habitat proposed for early to mid successional condition for various habitat types." (745)

Response. Since the release of the DEIS, we have re-created ten years of fire history for the Refuge that will be included in the FEIS as a table. A fire return interval research study is also planned for implementation during 1994. In addition, a Fire Management Plan is currently being developed for the Refuge that will include burning prescriptions, fire management units and their unique objectives and documented fire history. The target date for a completed draft of the plan is September 30, 1994. Figures in **Table 2-2** for Alterantive D were based on treatment return intervals based on historic fire return intervals, predicted number of years from treatment to initiation of late succession, targeted treated:untreated ratio within project areas, long-term objectives, and total acres of each vegetation type. Treatment return intervals used in the calculations were: 100 years for Wyoming big sagebrush, 60 years for low sagebrush and big sagebrush-bitterbrush, 40 years for mountain big sagebrush and mountain shrub, and 30 years for Ponderosa Pine (underburning). Treatment return intervals used in the calculations were fixed averages. However, we do not propose that a particular area in, for example low sagebrush, would be treated exactly every 60 years. A particular area could potentially be re-treated after 33 years, then after another 79 years, etc., so long as the average treatment for the low sagebrush vegetation type occurs every 60 years. Actions taken after 15 years are beyond the scope of this EIS, but because we are dealing with processes that operate on time-scales well beyond the 15-year planning horizon (i.e., decades, centuries), this short-term planning must be based on long-term objectives.

Comment
372 "Fire prescriptions for tree communities, except Ponderosa pine, appear to be far too long to maintain desired successional characteristics. Also, define "protection from surface fire" in terms of the probability of a relatively longer fire return interval and not necessarily as fire exclusion." (745)

Response. The fire return interval for all of the tree communities was derived from a review of the available literature listed in FEIS Citation section. The statement relating to protection of ancient trees from surface fire has been clarified in the FEIS to include that the reason these trees are present in such an ancient and established stand, is that they are located in rocky areas that promote natural barriers to fire spread.

Comments
373 Why such a big range - 22,000 to 40,000 acres - why not 31,000 ± smaller amount than 9,000? (766)

Response. We agree that 22,000 to 40,000 acres is a big range. Treatment of 40,000 acres would be the most desirable under Alternative D, although 22,000 acres would be acceptible. A wide range was provided to allow for variable climatic, habitat, budgetary, and staffing conditions, and to allow for changes in management based on monitoring results.

Comment

374 "We don't like the burning. We don't think burning, perse, is the way to manage wildlife habitat or any habitat. Burning totally destroys things. When a building burns down, it's gone. When a tree burns down, it's gone. Burning part of our natural resources is absolutely wrong." (785)

Response. Fire is important to many plant and wildlife communities that occur on the Refuge. In the short-term, it kills or damages individual plants in plant communities. However, many plant communities native to the Hart Mountain area depend on fire for their continued existence. For example, early succession grassland communities in the mountain big sagebrush vegetation type depend on periodic fire to reduce shrub cover. Late succession mountain big sagebrush communities in many areas of the Refuge depend on periodic fire to eliminate western juniper. The late succession mountain big sagebrush community does not return immediately after a fire -- it could take up to 25 years or so, but it still depends on periodic fire for its continued existence over a large area. So, while individual plants are killed or damaged by fire, the plant communities of which they are a part depend on fire for their continued existence. As such, individual plants in future generations depend on fire.

Comment

375 "I would like to quote some of the things [from Krueger et al. (1991)] that John didn't get into detail on but that I thought was significant in this report. One being: 'The disruption of natural fires by modern fires control has been a norm on Hart Mountain. The result is an existing fuel load that exceeds that expected prior to settlement. The introduction of cheat grass on Hart Mountain adds to additional complexity to fuel load evaluation questions. For the most part, we would except natural burns under the current condition to be extremely large and of greater severity than historical burns and perhaps more destructive of vegetation and soil organisms than they would be in average rejuvenating organisms.'" (792)

Response. We agree that current conditions, namely high composition of woody fuels, increase the likelihood of wildfires being more severe than what they were prior to Euro-American settlement. This, along with the threat of cheatgrass invasion in some areas makes it necessary to control fires through prescription, as opposed to allowing all wildfires to burn without restraint. Mechanical treatment and herbicides also could be of importance in restoring areas where fire may not carry, or would only carry under severe conditions, increasing the risk of escape and damage to soils and vegetation.

Comment

376 "It is quite obvious within the DEIS that the government or somebody wants to burn Hart Mountain into an antelope habitat. The Oregon Department of Fish and Wildlife has objected to the amount of burning proposed." (795)

Response. This comment apparently refers to comment 344. After clarification of the proposed strategies and long-term objectives, ODFW stated that they generally support what the Service is proposing (Refuge files). They do not feel that the proposed amount of burning is excessive, so long as the Service proceeds slowly and monitors.

Comment

377 "Kindschy, et al, state that vegetative treatment, by chemical or fire, should not exceed 1,000 acres at any one time. Not too long ago, Hart Mountain attempted to manipulate a small amount of habitat by fire and a resulting wildfire quickly rendered prime antelope and deer habitat into an 11,000 acre wasteland, if you want to use authentic ecosystem terms, useless to both pronghorn and deer." (795)

Response. Long-range objectives call for 500-2,000 acre project areas. Given a targeted burn:unburn ratio, we would not be burning more than 1,000 acres for any given prescribed burn. Herbicide treatments would not exceed 400 acres. Note that management ignited prescribed burns have been successfully conducted on the Refuge in recent years. From the standpoint of wildlife, the 11,000 acre wildfire is in no way a wasteland. It is a highly productive area and is highly utilized by pronghorn.

Comment

378 "Although I am not against burning, several issues must be addressed. I seriously question the ability of man to manage a fire within the designed boundaries of the project. All too often the fire grows out of control and we consequently lose thousands of acres of habitat and spend millions of dollars to control them. Considering that one controlled burn resulted in an 11,000 acre wildfire, 200,000 acres under the Fish and Wildlife Service's proposal could be a reality. Currently such mistakes are offset with the utilization of the resultant resource which is grass through increased grazing opportunities and an increase in fees received by the governing agency. The current proposal is just to let it rot." (795)

Response. Service Policy requires that escaped prescribed burns be suppressed. Suppression actions must be defensible in terms of values at risk from fires and suppression operations, and cost of suppression. Utilization of fire stimulated forbs and grasses by cattle grazing is not included in the long-term objectives of the Proposed Action.

Comment

379 "Man cannot duplicate the processes of a thunder and lightning storm. As a storm passes through it simultaneously cools ambient air temperature and frequently wets the area in an uneven pattern. Typically, natural fires occur during the warmer summer months. How can we duplicate the natural process in the spring? It would seem to me that if we are to treat vegetation on Hart Mountain by fire, we would have to burn in the months of July and August which is during the natural fire season. In other words, if mother nature says that I'm going to burn in July and August when it's hot and I've got thunder storms, what are we doing in April and May running around burning. We are burning at the wrong time." (795)

Response. We agree that humans cannot duplicate all the processes that occur in a lightning storm. The natural season for lightning fire is July-September. However, fires during the peak of wildfire season can be difficult and costly to hold to predetermined boundaries and given the current degraded condition of the Refuge, may produce higher severity burns resulting in undesirable fire effects. The target vegetation for treatment by fire are late succession sagebrush communities. All species of sagebrush common to the Refuge are succeptable to mortality by fire, regardless of season. Live fuel moisture is the key phenological condition that either promotes or reduces fire spread. Live fuel moisture is the ambient moisture content of the plant expressed as a percent of oven dried weight, and is lower in the spring and fall seasons. During the summer months, the plant is putting on new growth, which contains a high percentage of moisture. Fires do frequently occur during this growth stage, but are normally accompanied by high temeratures, long days, low humidities and relatively high surface wind speeds. Fires are more easily held to predetermined boundaries during spring and fall because of cooler temperatures, shorter days and higher humidities at night.

Comment

380 "By the same token,... we are going to have to hire these people to go out there and do these prescribed burns [compared to revenues generated through cattle grazing]. They don't have enough fire equipment to do it. Some of it's going to have to be contracted, the BLM, Forest Service. This isn't going to be an economically feasible situation by the time we get all through with it." (801)

Response. We currently have on station four wildland fire engines and a variety of heavy equipment that is available for use on fires. We expect to continue to use BLM and USFS resources during the execution of prescribed burns as well as continuing to assist those agencies when needed. In addition, the Refuge is currently training existing employees to enhance the fire management staff for use during prescribed burns. Generation of forage for use by cattle is not included in the long-term goals of the Refuge.

Comment

381 "By the time you go out and do your prescribed burn and you burn all of this undesirable sagebrush; how much environmental damage to sage grouse and other wildlife; small birds, mice, kangaroo rats and things that environmentalists are screaming about every day. How much damage are we going to do to that environment?" (801)

Response. Sagebrush is a critical component of upland habitats on the Refuge. Alternative D does not propose to burn all of the sagebrush on the Refuge. The prescribed burn program on the Refuge would not damage the environment, but would allow degraded habitats to recover and enhance wildlife populations. For example, current habitat conditions are not optimal for sage grouse. For optimum productivity, sage grouse require a greater abundance of herbaceous plants (grasses and forbs) than what currently occurs on the Refuge. Under current conditions, herbaceous plants are limited by excessive shrub cover.

In order to optimize habitats for sage grouse, sagebrush cover must be reduced, and fire is the most practical method. Initially, burned areas will produce an abundance of forbs, which is an important sage grouse food source during spring and summer. Sage grouse will use burned areas for nesting after sagebrush re-invades and grows among the grasses and forbs. Without an artificial disturbance, such as excessive cattle grazing, grasses and forbs will be able to compete with sagebrush and maintain co-dominance on the site.

It is recognized that fire-induced habitat changes may adversely affect some wildlife species, particularly those dependent on cover associated with late successional stands of sagebrush. However, by maintaining a variety of succession stages (e.g., a combination of recently burned areas and areas not burned) in sufficient amounts, habitat would be provided to all species of wildlife species that differ with respect to requirements for food and cover in sagebrush. Please see section on species richness in the EIS.

Air Quality

Comment

382 "Are you going to be able to [use prescribed fire to a great extent] and meet the new Oregon Clean Air requirements? The Forest Service is running into problems at present finding enough opportunities and windows to do prescribed fire management and meet the requirements." (25)

Response. An Air Quality Analysis is included in the FEIS, which indicates that under the current requirements of Oregon air quality guidelines, the targets for burning are reachable.

Comment

383 "Since prescribed burning is proposed under four out of the five alternatives, information regarding the location and frequency of prescribed burning activities and the potential downwind air quality effects will be needed on a site specific basis. Particulate concentrations that exceed health standards have been measured up to three miles downwind of a prescribed burn. Residences, recreation sites, or areas of expected human activity potentially affected by burning activity should be identified in the final EIS. In addition, burning from the proposed project could have adverse impacts on Class II areas and federally-designated Class I areas.

The air quality analysis should not be based entirely on compliance with the State Smoke Management Plan. Blanket statements regarding compliance with applicable plans and regulations do not inform the public or decision makers of actual anticipated air quality impacts. A quantitative assessment of air quality impacts is needed to illustrate that burning can be done in compliance with applicable plans and regulations. The CAA and State Implementation Plans (SIPs) require that prescribed burning not cause or contribute to violations of National Ambient Air Quality Standards (NAAQS) or Prevention of Significant Deterioration (PSD) increments. In addition, burning may not cause visibility impairment in federally-designated Class I areas.

A comprehensive air quality analysis should be completed if burning is a component in the alternatives. This analysis should include the following steps:

(1) An assessment of the need for burning as compared to alternate site preparation methods;
(2) Quantification of the amounts, types of material and acreage to be burned;
(3) Description of the types(s) of burns proposed (e.g., broadcast burns, piled burns, understory burns);
(4) Description of measures to reduce emissions;
(5) Quantification of emissions of regulated air pollutants;
(6) Description of applicable regulatory and/or permit requirements, including smoke management plans;
(7) Qualitative description of air quality impacts focused on new or increased impacts on downwind communities and visibility impacts in Class I areas; and
(8) Modeling of downwind concentrations of pollutants to document compliance with NAAQS, PSD increments (if applicable), and visibility impacts in Class I areas (if affected).

Modeling We acknowledge that air quality modeling of emissions from prescribed burning in mountainous terrain is a difficult problem. We recommend that the best model available be utilized considering such aspects as location, terrain, type of burn, and direction and distance to critical receptors. EPA Region 10 and Forest Service Regional Offices are having ongoing discussions to develop more specific prescribed burning modeling guidance. The Forest Service regional air quality specialist should be contacted for the latest information. It should be noted that steps 1 through 7 above can be completed without modeling. The information from these steps should be included in the final EIS since it provides useful information about air quality impacts and project planning.

Class II Airshed The final EIS needs to address two air quality issues for Class II airsheds: the NAAQS for particulate matter less than 10 microns (PM10) and the PSD Total Suspended Particulate increments. Neither the NAAQS nor the PSD increments may be violated.

In addition, the final EIS should describe meteorological conditions and existing air quality, using data applicable to the project site. If the analysis indicates that potential exceedances could exist, reductions in particulates from burning activities may be necessary. The air quality analysis must demonstrate that the proposed action will not cause or contribute to any violations of the NAAQS, that it will not cause air quality to degrade by more than any applicable Class II PSD increments, and it will not cause or contribute to visibility impairment.

In certain situations modeling of the PSD increment can be "short cut" if the emission rates are below de minimis levels. If the PSD increment is protected, it follows that the NAAQS will be protected. If the emission rates are above the de minimis cutoff, dispersion modeling must be performed.

Class I Airshed EPA requires air quality impact analyses for sources within 200 kilometers from a Class I airshed, if such sources have large quantities of emissions and substantial plume heights. The following are the PSD Class I airsheds within 200 kilometers that could be affected by activities in the Hart Mountain NAR:

Gearhart Mountain Wilderness Area, Oregon
Lava Beds National Monument, California

A Class I designation imposes the most stringent requirements under the CAA. The final EIS needs to conduct an air quality analysis as described above and specifically demonstrate compliance with Class I increments and other air quality related values that could be affected by burning.

Cumulative Effects Regardless of the amount of prescribed burning recommended in the Alternatives, a cumulative effects analysis should be undertaken to determine the air pollution potential from a number of different burning sources including Hart Mountain NAR. The EPA is aware that there are serious forest health problems in the Ochoco, Willowa-Whitman, Umatilla, Deschutes, and Malheur National Forests that may only be resolved by heavy prescribed burns in these areas. It is quite possible that particulates from prescribed burns in the Hart Mountain NAR could drift to the northeast and increase the effects of the burns in these forests. Any additional particulate input to these areas should be carefully considered. The final EIS should, therefore, incorporate a section that discusses the cumulative effects of these different burn areas along with the burning in the Hart Mountain NAR." (32)

Response. The FEIS contains an Air Quality Analysis that addresses these concerns (please refer to Appendix J).

MECHANICAL TREATMENT

Comments

384 "If mechanized means of elimination of the sage/juniper cover is used, how will the soil damage be minimized if chaining or cat work is involved?" (182)

385 "The environmental impacts of the mechanical treatments are not adequately discussed either. Limitations on these treatments should be set and more carefully described, and their environmental impacts should be assessed if they are to remain options in the Plan." (622)

386 "I prefer hydraulic weed-wacking to discussing or chaining. The goal should be to minimize ground disturbance." (33)

Response. Clearly, the objectives of mechanical treatment as referred to in the EIS are to kill shrubs, reduce shrub cover, and promote an increase in cover of native herbaceous species on sites with excessive shrub cover, and insufficient fuels for sustaining spread of prescribed fire. An ancillary objective of such mechanical treatment is to minimize soil disturbance. Soil disturbance can be minimized by selection of the appropriate mechanical method that results in the least soil disturbance. Additionally, the selected mechanical method would be applied terrain of low percentage slope (e.g., < 15%) at a time of year when soils are least vulnerable to disturbance from churning or compression (e.g., when the soils of a site are frozen during a severe cold snap in winter). Use of the Schmeiser Till an' Pak® pulled by a tractor is an example of a mechanical method that may result in death of shrubs with the least possible disturbance to soil, provided that the method is used on terrain of low percentage slope at the appropriate time of year.

Refer to Pechanec et. al (1960) and Koehler (1975) for discussion of environmental impacts associated with traditional mechanical methods such as roto-beating and chaining. Any mechanical method that may be used to reduce shrub cover would initially be applied on a small-scale, experimental basis to assess its effectiveness with respect to vegetation composition before and after that specific application. Until biological effectiveness is demonstrated, no large-scale mechanical applications would be planned. Please refer to Part 1, Appendix J, for discussion of direct and indirect impacts of mechanical treatment. Monitoring standards described under Alternative D, Chapter 2 and Appendix N, for prescribed burning would also be applied in the case of any mechanical methods used to reduce sagebrush cover.

Comment

387 "Additionally, use of soil-compacting equipment to eradicate unwanted vegetation is also contradictory. What about the impacts to the soil, soil organisms, and invasion of unwanted species such as cheat grass? I suggest the careful use of fire and manual methods to restore the natural vegetation patterns." (642)

Response. Alternative D emphasizes prescribed burning as the habitat management strategy of choice in Refuge uplands. However, it is recognized that conditions such as fuel type, fuel loads, and fuel continuity have changed on sites that once readily burned when subjected to wildfire or cultural broadcast burning. Cover of shrubs is excessive and cover of native herbaceous species is deficient on some sites in the Wyoming big sagebrush and low sagebrush vegetation types. Prescribed burning of such sites would require high management risks in terms of the probability of escape of fire and safety to personnel.

Restoration of habitat diversity, native herb cover, and the natural influence of fire on such sites entails an initial reduction in shrub cover. A relatively severe initial disturbance is needed to kill shrubs and reduce shrub cover by either mechanical methods or herbicides. Sites with deficient perennial grass cover before and after mechanical, chemical, or burning treatments would be promptly seeded with a mix of perennial bunchgrass species appropriate to that site (e.g., squirreltail, Thurber's needlegrass, bluebunch wheatgrass). Please refer to our response to comment 182 under mechanical treatment for discussion of how soil damage would be minimized. Other comments about fire and manual methods were noted.

HERBICIDES

Comments

388 "The use of herbicides to treat vegetation in the area should be analyzed with regard to WQS [Water Quality Standards]. To say that "(a)pplication policies would be developed, standards would be prescribed, and effects would be monitored to minimize risk of contamination of streams and lakes by herbicides (Appendix J, page 5)," is not sufficient to understand the possible impacts to water quality. Specific mitigation measures should be identified in the final EIS, along with a methodology for vegetation treatment (frequency, duration, time of year). A monitoring plan should be fully developed to determine if the vegetation treatment is working as expected and to measure water quality impacts." (32)

389 "App. Jp5, Water Quality When chemicals are used anywhere, more attention needs to be paid to the effects on ground water quality. Such effects could be an irrevocable commitment of this valuable resource. All over the world we find we are contaminating our groundwater. Still, we continue to blithely spread the contaminants. We must stop ignoring this aspect of our lifestyles." (555)

390 "We believe that herbicides should be used only in extreme situations as a last resort. Although the Plan indicates that herbicides would be used "on an experimental basis,"it leaves open the question of the extent to which they may be used and does not adequately discuss the environmental impacts of their use." (622)

391 "Each herbicide is different. The Service has not yet decided which herbicides it may use in the future. Before the Service decides whether it will use herbicides, OWF strongly urges the Service to list those herbicides which it may use over the course of the planning period. The public will be able to comment meaningfully on herbicide use only when the Service lists the herbicides it is considering." (695)

Response. Herbicides to reduce shrub cover would only be used where prescribed burning (first option) and mechanical treatment (second option) would not be effective in reducing shrub cover. As explained in the introduction to Alternative D in Chapter 2, we do not anticipate more than one treatment of herbicide in any given area. Once the herbaceous component returns to any area, we expect that prescribed burning can be used subsequently.

Herbicides that the Service would primarily consider to reduce shrub cover on the Refuge are granular tebuthiuron (trade name Spike 20P) and 2,4-dichlorophenoxyacetic acid (2,4-D, a low volatile ester). With respect to water quality, the DEQ identified 2,4 D as a pesticide of concern in Oregon because of its chemical and physical characteristics were likely to pollute ground and surface water. However, statewide assessment resulted in no evidence of 2,4-D contamination in Oregon ground water (Pettit et al. 1987). EPA (1988), through laboratory experiments, concluded that although 2,4-D can move through the soil profile, its potential to do so under practical conditions in the field is limited. DowElanco (1994, producer of Spike 20P) reported that "the physical/chemical properties of tebuthiuron suggest that it has a theoretical, but limited, potential to leach into groundwater." At this time the DEQ has not identified tebuthiuron as a pesticide of concern in Oregon.

Both herbicides appear to have limited potential to leach into groundwater because active ingredients bind to soil particles and compounds are broken down in the soil by soil microorganisms (DowElanco, USEPA 1988). However, 2,4-D residues decline slower in cold, dry soils compared to moist, wet soils (Norris 1981, Newton 1990) and tebuthiuron may persist in the soil available for root uptake for up to 10 years following application. Tebuthiuron was not detected below 24 inch soil depths several years after application (DowElanco). Newton et al. (1990) found no evidence that large amounts of 2,4-D moved to a 24 inch depth in the soil but found considerable evidence that 2,4-D concentration in vegetation was not readily reduced until the vegetation became litter. Heavy rainfall and overland runoff following tebuthiuron and 2,4-D application could result in transportation of herbicides to non-targeted waterbodies and result in reduced water quality. The concentration of herbicides in runoff water is dependent on numerous environmental and site dependent variables.

On Hart Mountain NAR, low doses (maximum of 0.75 lb. active ingredient/acre) of tebuthiuron would be applied from the ground to Wyoming big sagebrush or low sagebrush sites to thin sagebrush stands. Tebuthiuron would be applied once within the next 15 years for any particular area, but would gradually kill 50-75% of sagebrush over 10 years following application. Proposed 2,4-D application rates would be a maximum of 4 lbs active ingredient/acre. Granular tebuthiuron needs precipitation to dissolve and should be applied when sagebrush root uptake would occur. Therefore, tebuthiuron would be applied in spring or early summer and may coincide with the nesting season for ground nesting birds. 2,4-D would probably be applied during summer, and may coincide with the breeding season of some wildlife species as well.

Any herbicide applications would be scheduled and designed to minimize potential impacts on water quality and nontarget plants and animals while meeting treatment objectives. To prevent herbicide contamination, close attention would be paid to pesticide labels. The rates of application would depend upon the target species, the presence and condition on nontarget vegetation, the soil type, the depth to the water table, and presence of other water sources. Mitigation measures to minimize potential herbicide impacts on water quality and nontarget plants and animals would include:

1. Minimizing chemical applications prior to anticipated heavy rainfall period;

2. Minimizing concentrations of pesticides remaining in the soil after the growing season;

3. Timing pesticide applications so that they have more time to be taken up by growing sagebrush;

4. Minimizing pesticide application in late fall or during winter months.

A monitoring program would be developed to evaluate herbicide treatment on vegetation and water quality. Vegetation monitoring consist of Level 1, 2 or 3 monitoring as developed for prescribed burns (Appendix N). Water monitoring program would be implemented to assess the impacts of herbicide treatments on water quality. Prior to any herbicide application, a Pesticide Use Proposal that includes specific prescription would be developed by the Refuge and would be approved by the Regional Integrated Pest Management Coordinator. Appropriate NEPA documentation would accompany the proposal if necessary.

Appendix J has been modified to reflect the potential effects of proposed herbicides on water quality.

Comment

392 "If prescribed fire is unacceptable for certain areas of concentrated sage and juniper cover, which herbicides will be used, how will herbicides be applied, and what is their residual effect on the riparian areas, fish and invertebrates and on the early vegetative succession and the grazers and browsers following the eradication of the sage/juniper." (182)

393 "OWF also suggests the Service offer sufficient evidence to support its conclusion that herbicide use will not significantly harm refuge ecosystems (See statement regarding water quality, page 203). If sufficient data is not available to support these conclusions, then the Service should error on the side of safety and postpone plans to use herbicides. If sufficient data is available to support its conclusions regarding herbicides' impacts, the Service should include that data in the FEIS' appendices. The data should consider every herbicide which

the Service may use and should consider each herbicide's impacts on plants, invertebrates, and all other ecosystem components. The data should also discuss each herbicides' potential for bioaccumulation and resultant delayed effects on large mammals." (695)

394 "Herbicides' possible effects on aquatic invertebrate populations especially interests OWF." (695)

Response. Herbicides primarily considered to reduce shrub cover on the Refuge are tebuthiuron and 2,4-D. Herbicides would be applied manually from the ground or from a vehicle. Tebuthiuron would be applied in granular form at low doses (approximately 0.75 lb. active ingredient/acre) and 2,4-D would be applied in liquid form at a maximum rate of 4 lbs. active ingredient/acre. Herbicide treatments would occur once per area within the next 15 years only after prescribed burning and mechanical treatments were considered inappropriate.

Residual effect of herbicides on riparian areas, fish, and invertebrates and grazers and browsers are expected to be minimal because of the relatively low doses proposed, one time application, and relatively short half live of 2,4-D. Wauchope et al. (1991 as cited by USBLM 1991:3-45) reported that a representative half-life for 2,4-D was 10 days; however, half-life for tebuthiuron was 360 days. Tebuthiuron is relatively selective for sagebrush and may allow for greater herbaceous cover (Johnson et al. 1993). However, tebuthiuron may be translocated to shrub shoots for several years following application and therefore browsers may be exposed to residues for several years. Residues of tebuthiuron and 2,4-D are readily passed through vertebrate systems and these compounds have little potential for bioaccumulation (USBLM 1991).

Although the Service would not apply herbicides within a buffer zone of 100 feet surrounding riparian areas, overland runoff could potentially carry herbicide into riparian systems. 2,4-D is labeled for use in water and should have limited negative effects on aquatic wildlife because of the low herbicide application rate and other mitigation measures. 2,4-D at 3.0 ppm had no effect on water fleas (*Daphnia pulex*) for 8 days (Sigmon 1979 as cited in USBLM 1991). Tebuthiuron at 21.8 ppm had no effects on reproduction, growth or survival with lifetime exposure for water fleas (USDA 1986 as cited in USBLM 1991). Please refer to Vol. II, Appendix J for more information on impacts of herbicides on wildlife species.

Comment

395 "On Page 189, Vol. 1, under the "water quality" heading, last sentence in the paragraph - need to define and clarify this sentence and be more specific on actual effects." (531)

Response. We agree that this sentence was inadequate and was modified in the EIS. Use of herbicides could potentially impact water quality. Herbicides could contaminate non-targeted waterbodies when, for example, large amounts of precipitation follows herbicide application and overland water run-off occurs or when herbicides in liquid form are applied during high winds. Leaching of herbicides into the groundwater also could potentially occur; however, in practice, the potential to do so is limited. Herbicide applications would be scheduled and designed to minimize impacts on water quality and nontarget plants and animals. The rates of application would depend upon the target species, the presence and condition on nontarget vegetation, the soil type, the depth to the water table, and presence of other water sources.

Comments

396 "It's doubtful that any of you are thrilled by using herbicides to remove excess sagebrush, but I can understand that you may find it necessary in some instances." (19)

397 "The use of herbicides ought not to be considered as an option in vegetation control." (47)

398 "May God help you! I have been screaming to the BLM, Forestry, State Fish and Wildlife and everyone who will listen ever since I observed the terrible damage to the environment after the airplane herbicide spraying 30 years ago." (120)

399 "I am deeply concerned about the use of herbicides on the refuge. In the preferred alternative it is proposed to use them on an experimental basis. In my opinion any use of herbicides to restore and maintain ecosystems are experimental at best. Without a greater understanding of the long term effects of herbicides on the environment and human health we stand a good chance of making serious mistakes that could result in permanent damage. Lets leave the chemical experiments out of this and let solid science be your guide to restoration." (483)

400 "Is herbicide use worth the controversy it generates? Use of the organochlorine herbicide 2,4-D is proposed in areas unsuited for prescribed burns. This chemical is a carcinogenic, mutagenic, persistent drifter whose use and registration is strongly opposed by medical scientists (see enclosed). The FEIS should not include controversial minor components likely to generate appeals and delay much-needed implementation of habitat restoration proposals." (521)

401 "One drawback to prescribed burning is that exotic grass species may encroach on a freshly burned area to the ecosystem's detriment. Oregon Wildlife Federation understands the Service's interest in experimenting with herbicides in limited areas to prevent exotic grass encroachment. OWF, however, opposes any herbicide use on the refuge." (695)

402 "I've hinted at my concerns earlier in the listed research. To be blunt, I am opposed to the use of chemicals. We know so very, very little about even the ones which have been on the market and used indiscriminately on farms, tree plantations, city yards and public lands alike (Roundup for example), that I believe we should be more patient with the land before even considering chemical interventions. Northwest Coalition for Alternatives to Pesticides also has information on herbicides, weedicides, fungicides, etc. Some "-icides" persist for years in dry climates, some leach quickly into streams, and poison substrates and/or macroinvertebrates, others move through the food chain from plant to animal to human. Many chemicals are broad spectrum--that which takes out sage may poison the ground preventing the establishment of desirable species." (732)

403 "Rather than contemplate "experimenting" with chemicals on Hart, why not research existing data--especially on the effects of the inerts and surfactants which comprise the greatest proportion of most "-icides"? The information sheets I have on Roundup and Picloram together with my own sensitivity to chemicals (weeping eyes, running nose, burning nose, throat, lungs and lung and sinus congestion) have convinced me we humans need to learn to live more cautiously, more responsibly, and more patiently. Fast fix chemicals can be the death of us--and of the great diversity of life now found on our public lands." (732)

Response. Herbicides would be used only on a very limited basis, if used at all, during the next 15 years. Use of herbicides to reduce shrub cover would be considered only after prescribe burns and mechanical treatment were determined to be unsuitable. Prior to any herbicide use, potential impacts of herbicides would be evaluated on a site specific bases in a Pesticide Use Proposal. The proposal would be accompanied by appropriate NEPA documentation and reviewed by the Regional Integrated Pest Management Coordinator, U.S. Fish and Wildlife Service. In addition, monitoring programs for vegetation response and water quality would be implemented for treatment areas.

Comment

404 "Additional Helpful Resources
Northwest Coalition for Alternatives to Pesticides (NCAP)
P.O. Box 1393
Eugene, OR 97440" (732)

Response. Thank you for this information. We have sent a letter requesting additional information.

LIVESTOCK GRAZING

General Comments (against cattle grazing on the Refuge)

General Comments

405 "You have my support for no cows." (1)

406 "We also know that the riparian areas are favored by livestock seeking food, water and shade throughout the refuge." (4)

407 "The exclusion of livestock from the public land is the first step in providing better habitat for antelope and other wildlife for which the refuge was established." (4)

408 "We have personally seen the recent positive response of riparian habitat along Rock Creek after a few years without livestock grazing." (5)

409 "First, grazing should be eliminated permanently as cattle and the desert of Hart Mountain are not compatible with the wildlife of the area." (14)

410 "Prohibiting livestock grazing for 15 years isn't enough, of course, but I assume that the figuring is that by then we'll have come up with other solutions so that there won't be so much pressure to re-introduce livestock." (19)

411 "...cattle should not be allowed to compete with wildlife for food and habitat on a refuge which is dedicated to preserving wildlife species." (24)

412 "...a long term exclosure on lower Guano Creek... contained many species of plants not found directly outside the exclosure. In addition, the creek within the exclosure meandered through the exclosure and provided a wide riparian zone which was virtually absent immediately downstream from the exclosure." (24)

413 "I know that after over 100 years of grazing, the damage is profound, but it is still potentially reversible if something is done soon. However, for some species, if the balance does not shift right away, it will be too late. I ask you therefore, without further delay, to move quickly and decisively to remove all cattle from Hart Mountain, and to begin the long and delicate task of restoration before it is too late." (83)

414 "I certainly support the Innovative Grazing Policy, especially pertaining to the Nat'l Antelope Refuge - it seems, overall, it would benefit all the grazing interests from a long-term standpoint." (136)

415 "There is no valid ecological reason or need for livestock grazing on this wildlife refuge and given its location in south-central Oregon where there is a preponderance of public lands that are almost solely dedicated to livestock grazing, restricting grazing from the Refuge should not unduly impact the regional economy." (359)

416 "With millions of acres devoted to cattle grazing in this country it certainly would seem that the small area of your reserve could be managed for its intended and designated purpose, as an Antelope Refuge without the intrusion of more cattle. With millions of acres for cattle, surely we should be able to devote a few thousand acres exclusively to Antelope!" (438)

417 "TWS [Oregon Chapter of The Wildlife Society] supports a 15 year rest from grazing at HMNAR and encourages every effort to maximize learning opportunities on the manner in which Great Basin ecosystems (including plant, animal, soil, and water resources) respond in the absence of livestock. To achieve this end the USFWS and HMNAR are encouraged to enter into cooperative research programs to the maximum extent possible." (540)

418 "Western cattle ranching has been a tradition for only 150 years or so. It is much more efficient to raise cattle on richer soils found in the midwest than vast amounts of nutrient poor, fragile, desert lands. Let's return more of the West to the native creatures who are part of the natural landscape (elk, deer, antelope, buffalo, etc.)" (551)

419 "I believe that research may show that cattle grazing, in some circumstances, may enhance habitat. It is still clearly in the preliminary research phase and I strongly oppose using the Hart Mountain Refuge as a large-scale testing ground for unproven theories." (561)

420 "Wildlife should be given priority over grazing uses. If reducing the grazing will provide for more feed and cover for wildlife, it should be corrected. As a rancher I know how cattle and sheep can ruin a stream bed." (628)

421 "I have visited the refuge many times and have led field trips through it including ecologists and geographers from Switzerland. I have not been able to defend past management of the refuge for any of these groups (none were "environmentalist" groups). When refuge workers and managers have met with us, none of us could believe that cattle have "improved" the land as claimed." (633)

422 "It would be unconscionable to ever return cattle to this refuge. Any surplus grass or forage should be utilized to increase the winter survival rates for additional wildlife populations. Migrations to Sheldon may not be necessary." (656)

423 "I realize that the next planning process is fifteen years away, but am concerned that cattle may be allowed back at that time if the refuge is deemed to have recovered sufficiently. I'd just like to sound an early warning against beginning an ongoing cycle of degradation and recovery. Reopening the refuge to cattle after fifteen years would only re-introduce local economic and political pressure to refuge management." (725)

424 "When public lands and public resources, such as Hart Mountain National Antelope Refuge, are in degraded condition eliminating the pressures of domestic livestock grazing and all the associated negative effects of that activity is the responsible action for management to take. The severity and range of degradation, the large number of sensitive or at risk species known to inhabit the Refuge, the diversity of habitats represented on Hart--as well as the value of the Refuge for study and recreational purposes--demand fast action. Throughout the western states, livestock grazing "experiments" are being tried in the attempt to argue that the negative effects of grazing are less harmful than current research indicates. Yet the single most effective and sure restorative action is simply to halt the grazing, remove the non-native (alien) species (domestic livestock)." (732)

425 For volunteer projects (willow planting, bitterbrush planting, etc.), people won't show up if livestock are allowed into the area--livestock could curtail any benefits at projects. (750)

Response. Comments noted.

Comment

426 "From the data presented in the DEIS, it is evident that the total removal of livestock from the refuge is the most important step of all toward restoring habitat for wildlife." (47)

Response. We would like to point out that exclusion of cattle from riparian habitats can be considered the most important step in these habitats. However, the most important step for restoring many upland habitats is reducing shrub cover, mainly through prescribed burning. Removing livestock from most upland habitats without active reduction of shrubs would have little effect.

Comment

427 "I am writing you to commend your recommendation for no cattle on the Hart Mountain Antelope Refuge Environmental Impact Statement. Cattle and wildlife are not compatible in any meaningful way and it is about time this was acknowledged. Allowing cattle to graze in an area meant for wildlife is an oxymoron manifested." (71)

Response. Comment noted. As we have pointed out in responding to other comments, cattle can be used to manage for particular wildlife species under some circumstances by creating habitat conditions that benefit these species. Whether livestock grazing should be used depends primarily on objectives.

General Comments (supportive of cattle grazing on the Refuge)

General Comments

428 Closing off grazing shuts off little guys like me because I run a few cows. Either they're going to go out of business or I am. (749)

429 "Fifteen years of no grazing. Probably a cow will starve to death on the mountain after that length of time." (785)

430 "Throughout the DEIS, whenever cattle are considered as a management tool, their importance is down-played by phrases such as "study not substantiated" or "will slow the process". Why are we in a hurry. I am not aware of any condition on Hart Mountain that needs instantaneous results. The DEIS fails to identify why we need instant results and why or how long the desired changes would be slowed down by cattle grazing." (795)

Response. Comments noted.

Comment

431 "To say that cattle grazing cannot be used as a suitable tool for wildlife management is, in my view, blatantly preposterous... I feel that grazing should be closely monitored, but believe it is a viable tool." (9)

Response. We agree that livestock grazing, under some circumstances, can be used as a means to manage habitat for particular wildlife species. Whether it should be used depends on the objectives at hand and the potential to which livestock grazing could be used to reach those objectives. Currently, the Service does not have any objectives on Hart Mountain NAR for which cattle grazing could effectively be used.

Comment

432 "Significant portions of the DEIS deal with the problems associated with grazing on Hart Mountain NAR. Many paragraphs describe the problems, many pieces of literature are cited - they all have one thing in common, they all deal with intensive grazing. 4,300 AUMs annually on a 275,000 acre refuge is not intensive grazing, on any year most of the refuge would be ungrazed. Hart Mountain, like much of the West did receive grazing damage early in this century. The desert to the East of what was to be the Hart Mountain NAR had much to offer the large bands of sheep and herds of cattle early in the spring when water was available. Later in the year the springs and creeks on Hart Mountain were one of the few sources of stock water in the area and livestock use was extremely heavy. Since the formation of the refuge in 1936 the refuge has made remarkable recovery from damage done in the early 1900s. This recovery happened with grazing levels of over 12,000 AUMs annually, yet the writers of the DEIS would have you believe that grazing at a level of 4,300 AUMs annually is incompatible with further recovery." (206)

Response. We agree that 4,300 AUMs spread out over 275,000 acres would not be considered intensive livestock grazing. As pointed out in the comment, however, 4,300 AUMs would not be spread out over 275,000 acres under Alternative B. Very little of the Refuge would actually be grazed by livestock under the alternative, and much of it would occur in riparian and other wetland areas, which comprise approximately 6 percent of the Refuge. For instance, about one-quarter of the AUMs (under Alternative B) would be taken from Big Flat, North Post, and South Post units alone (LCCC 1992). These areas comprise less than 1 percent of the Refuge. Big Flat is a unique and critical wetland on the Refuge.

Evidence suggests that progress has been made in restoring conditions within late succession stands of upland habitats on the Refuge since the Refuge was established in 1936. However, few upland areas are in early/mid succession (about 6% of Refuge uplands), and most uplands in late succession still are in relatively poor condition as indicated by excessive shrub cover and depleted understories. Little information exists on recovery of riparian habitats, but only about 13% of the length of riparian areas is at what can be considered potential. It's important to realize that the Refuge is still in degraded condition and will take many more years to recover completely. The Service does not dispute that recovery can occur even with the annual removal of 4,300 AUMs by cattle, assuming highly controlled grazing. However, restoration would occur more rapidly without any cattle at all. Additionally, continued livestock grazing at any level would adversely affect those species that are impacted by conditions created by livestock. Remember that grazing by large herbivores did not influence habitats to any large extent prior to introduction of domestic livestock (within the last 10,000 years).

Comment

433 "In each alternative the report is very specifically and selectively biased, in a negative way, against domestic livestock grazing. For example, fences adversely effect mule deer, but no mention of how fences effect pronghorn antelope. On page 195, no fencing is now a benefit to pronghorns; fencing was not mentioned in other alternatives." (605)

Response. The treatment of the effects of fencing on wildlife admittedly should have been more consistent, as pointed out by the writer of the above comment. The FEIS has been revised accordingly. Removal of fencing would benefit both mule deer and pronghorn.

Comment

434 "I would be prudent with the use of livestock, and may be necessary for the wild sheep." (670)

Response. The Service is unaware how cattle can be used to benefit bighorn sheep.

Comment

435 "Approximately 1972, the USFWS policy changed, and through demands from the radical environmental communities, cattle were deemed to be undesirable on Malheur Refuge. Refuge managers were very successful in nearly removing the grazing rights and permittee program; and, the Animal Unit Months permitted on the refuge were reduced from more than 130,000 AUM's to less than 30,000 AUM's. The predator controls were stopped and the improvements being done by the permittees were disallowed. Malheur's experience is continuing; however, the waterfowl numbers have diminished dramatically since removing the cattle. The fuel awaiting uncontrolled wildfires and/or uncontrolled prescribed burning is astronomical, and has been, and will be devastating, when the fires happen. The productive grasses have been replaced with rank unproductive vegetation and much of the land has become completely unproductive. Many of the water rights have been abandoned and a state of the art water management system has ben allowed to disintegrate; all of this with a spiraling multiplication of budgetary demands. The economy and life style of Harney County has been drastically effected and the cost to the United State Tax Payer is monumental. Our ranch is also in control of approximately 12,000 acres of private land that is cooperatively managed with Bureau of Land Management and USFWS lands that are contiguous. Our land is successfully managed to benefit cattle and the economic potential of the ownership. Our land raises deer, elk, antelope and is host to many migratory waterfowl; therefore, we feel qualified to evaluate similar neighboring land and management.

The purpose of this comparison is to reveal the adgenda of the U.S. Fish and Wildlife Service and/or their personnel. We are thoroughly convinced, from first-hand experience that there was a "no cattle" or Cattle Free" goal prior to the development of any alternatives in the Hart Mountain Comprehensive Plan; and, that all of the alternatives recognized were goal oriented at the onset. The mind set of the USFWS is very evident on National Refuges and is very destructive to the environment, socio-economic community and future economic potential of our nation. To plan to burn or chemically destroy natural resources without considering economic benefit or loss should be a criminal offense." (730)

Response. The Service, at the outset of the planning period, recognized that better control of the livestock program on Hart Mountain NAR was necessary, but did not have plans to eliminate cattle grazing from the Refuge. The proposal to eliminate cattle grazing from the Refuge evolved over the course of the development of alternatives. Through an objective review of available information, including Refuge habitat conditions, the Service concluded that livestock grazing would not contribute to the resolution of core problems, would not benefit native wildlife communities, and would inhibit habitat restoration efforts. Prescribed burning, and a possible limited use of herbicides, would benefit, not destroy natural resources (e.g., native plant communities and wildlife).

Comment

436 "On 98% of the refuge, the thick brush or tree cover will not be influenced one way or the other by cattle grazing; yet, grazing seems to be the primary focus of the EIS." (730)

Response. It is unfortunate that cattle grazing is the primary focus of the EIS, but because of the controversy surrounding the issue, the negative and positive impacts of livestock grazing must be evaluated in detail. The writer is correct in their assessment that cattle grazing will not influence the high amount of shrub and juniper cover throughout most of the Refuge. Removing cattle from areas of dense shrub or juniper cover will not result in lowered sagebrush cover (Laycock 1991, Winward 1991) or reduced cover of juniper. However, cattle grazing becomes a concern once an area is burned (this is speaking strictly on the subject of shrub cover). After an area is burned, cattle grazing can, if not carefully controlled, cause sagebrush to increase in cover at a faster rate than if it were left alone.

Comment

437 Renewable resources need to be used. (749)

Response. We do not know of any components of the Refuge ecological system that would not be used by wildlife, remembering that wildlife is the dominant use of the Refuge. Grass as a resource provides an example. Grass provides hiding, thermal, and nesting cover for birds and small mammals, and it provides food and cover for many insects. Insects that utilize grass provide food for other wildlife. Standing grass helps to protect soil from erosion caused by raindrops and its roots hold soil in place. Once it has fallen and accumulates as litter, grass provides food and cover for even more insects and other invertebrates that feed on decaying plant material. It provides protection for the soil and provides organic matter for soil formation. Productive and stable soils enhance grass growth. And so the cycle continues. This is a very simplistic view of grass as a resource, but it provides a glimpse into the complex interelationships between all components of ecological systems.

Comment
438 The Refuge has set up areas for minority groups such as backpackers. Why can't areas be set up to graze? (749)

Response. Alternative D does not designate specific areas for backpackers, although several sites are designated for camping. Several different levels of camping opportunities are evaluated in the FEIS. Livestock grazing as a potential use on Hart Mountain NAR is assessed at three different levels in alternatives A, B, and C of the FEIS. Although wildlife/wildlands-dependent recreation is a secondary use on NWRs, its continued use is in one of the goals of the Refuge and NWRS.

Comment
439 I agree there has been mismanagement. Ranchers would help repair it if you would sit down and talk with them. A cow is worth $1000. If even 200 cows are cut out of feed because of the Hart plan and sold instead of kept, this hurts the economy in Lake County. (762)

Response. The socio-economic impact analysis of the FEIS (Appendix L) suggests that elimination of cattle grazing from the Refuge, in addition to implementation of the other strategies of the Proposed Action, would not significantly impact the Lake County economy.

Comment
440 "The commission is particularly concerned about the failure of the agency to use the body of scientific evidence produced by the agency's own employees working to develop a scientific grazing plan on the Hart Mountain Refuge. (Tab 12, Anderson, E. William, David Franzen et. al. 1990. Rx Grazing to Benefit Watershed-Wildlife-Livestock. Rangelands 12(2):105-111.)

According to the table found on page 108 of the cited reference, the number of AUMs of antelope grazing has nearly tripled between 1970 and 1987 while the number of AUMs utilized by feral horses has increased from 750 to 2,640 and the number of AUMs devoted to cattle grazing has remained quite stable, ranging from a low of 9,923 to a high of 14,289. During the last ten years studied, the 1977-87 period, the range of cattle grazing AUMs was 9,928 to 12,615. According to the evidence developed by the Federal Fish and Wildlife Agency, which is discussed in the cited work, all of this occurred while the vegetation cover on the refuge was improving, rather than deteriorating. Thus the Commissioners are concerned when the work of the agency's own employees is dismissed as outdated in the DEIS. (See DEIS, Sum. xi; Ch.1, p.3;)" (808)

Response. A more detailed assessment of Anderson et al. (1990a) is provided in Appendix I of the FEIS (also see comment 460). Essentially, available evidence suggests that vegetation conditions on Refuge uplands have not changed substantially since at least as far back as 1968. We do not know of any information that would indicate that riparian areas have improved considerably during the same period. Pronghorn are only one of the 302 vertebrate wildlife species that inhabit the Refuge.

Comment
441 "The Commissioners have concluded, based on the actual scientific data developed by the Federal Fish and Wildlife, as well as the data of other independent scientists included in their response and comment, (Tab 2,3,4,5, and 12) that there is no reasonable factual or scientific support for the preferred alternative.

All the credible scientific evidence, particularly that collected and produced by the Federal Fish and Wildlife Agency, shows that the grazing of livestock on the Hart Mountain Refuge is not only compatible with the primary goal of the refuge, but actually produces better habitat for the wildlife to be found on the refuge than would the implementation of the preferred alternative. (Tab's 2-5 & 12; also see Tab 10 Comment of Oregon Fish and Wildlife)." (808)

Response. We do not agree that information contained in Tabs 2, 3, 4, 5, and 12 (Lake County Commissioners 1993) indicates "that there is no reasonable factual or scientific support for the preferred alternative." Concerns that were expressed about the Proposed Action are (1) weed management was not addressed and (2) livestock were not included as a management tool. Comments did not bring to the attention of the Service any potential flaws of the strategies that were included in the Proposed Action (i.e., only the absence of cattle as a management tool and absence of a weed control strategy were addressed). Information contained in Tabs 2, 3, 4, 5, and 12, when evaluated in the context of other available information and Refuge goals and objectives, does not provide sufficient support for the use of cattle on Hart Mountain NAR for the next 15 years (refer to comments 194, 471, 472, 481, 482, 484, 489, 491, and 497 for further discussion). Based on concerns related to weed control, a section on weed control was added to the FEIS (Chapter 2 for each alternative). Concerns regarding the use of soils and range site information, and the use of Hitchcock and Cronquist (1973) have been addressed elsewhere (comments 197, 201, and 321), but these do not have any bearing on the selection of a preferred alternative.

The concerns raised by ODFW (Lake County Commissioners 1993:Tab 10) regarding the Proposed Action were discussed at a meeting with ODFW personnel that submitted the comments (Refuge files). After discussing their concerns, they pointed out that they generally were in support with what the Service is proposing, so long as the Refuge proceeds slowly and monitors the progress of management (Refuge files).

As discussed elsewhere, cattle grazing has not been shown to be compatible with the purpose for which the Refuge was established. Aside from the suggested use of cattle to enhance willow growth, reduce cheatgrass while increasing perennial bunchgrass, and disseminating seeds of native vegetation, the Service did not receive information that addresses the use of cattle to achieve long-range objectives of the Refuge (Chapter 1, Section Two, FEIS). We did not receive any information to indicate that cattle could successfully be used to enhance willow growth, reduce cheatgrass and increase cover of native perennial bunchgrasses, or to re-establish native vegetation by using cattle to disseminate seeds.

Comment

442 "Historically according to early trappers, scouts etc., in the early to mid 1800s there was virtually no wildlife such as pronghorn, mule deer and bighorn sheep. Records are full of comments about eating horses to survive, Indians and scouts eating ants and other insects, eating soles of shoes and even cannibalism.

When we look at that 150 year period, what has changed that makes wildlife relatively abundant compared to the 1820s and 30s? Man has invaded the area. Common sense and observation show us wildlife tend to avoid humans, so man must have had a negative effect. However, the settlers brought domestic animals and for the first time in modern history grazing took place. It seems obvious grazing of stagnate, low quality habitats or ecosystems resulted in alterations over time which stimulated a virtual explosion of wildlife populations.

We do not claim that uncontrolled grazing, as it occurred early in this century is good. Nor do we believe grazing alone can alter the ratio of brush cover as it now exists. But we do believe grazing can and should be used to maintain desired conditions.

We would support naming a team to monitor and recommend grazing levels annually. Given Refuge goals and actual biological conditions, a team of professionals should be able to prescribe grazing times and levels to help achieve and maintain desired conditions. Well managed grazing has been beneficial in the Trout Creek Mountains as one example." (808)

Response. Desired conditions were outlined in Refuge goals and long-range objectives (Chapter 1, Section Two of the DEIS); also identified in Section Two of Chapter 1 were core problems that are the primary limitations to reaching these desired conditions. We did not receive any comments, nor have we received any information to indicate that cattle can effectively be used to resolve core problems on the Refuge. We did not receive information on how the Service could achieve long-range objectives (i.e., desired conditions) through the use of cattle. As such, we are unclear as to how cattle can be used to maintain desired conditions. We also are unclear as to how cattle "grazing of stagnate, low quality habitats or ecosystems [would result] in alterations over time which [would stimulate] a virtual explosion of wildlife populations." Without a livestock grazing program, a team of professionals to monitor and recommend grazing levels would not be needed. One last point is that well-managed grazing in riparian areas of the Trout Creek Mountains is beneficial as it compares to less than well-managed cattle grazing (not as compared to exclusion of grazing from riparian areas). Cattle grazing was not considered beneficial to riparian habitats or riparian wildlife in the Trout Creek Mountains (USFWS 1992b).

General guidelines

General Comments

443 "If we must have livestock, then:

a) fence off riparian areas,
b) limit utilization to < 40%,
c) eliminate spring grazing,
d) burn off juniper."

444 "I'm not totally opposed to allowing some grazing on the refuge, provided it is done during seasons and at an intensity that will not adversely impact the full variety of nesting birds (not just waterfowl). Current USFWS mandates for managing refuges to sustain biodiversity at a regional scale should be your guiding principle." (73)

445 "I believe that recovery, followed by an effort to better manage livestock access in the future, will result in the best use of the refuge for people, livestock, and antelope. Once the system has recovered, we can assess the degree to which it can tolerate further livestock use." (125)

Response. Comments noted.

Comments

446 "The Oregon Chapter of TWS [The Wildlife Society] has drafted a position statement regarding burning and livestock grazing as management practices on public lands, and specifically for those public lands designated as national refuges, parks, monuments, and wilderness. The Oregon Chapter of the Wildlife Society position currently reads that livestock grazing is supported as a management tool on wildlife refuges only when it can be expected to achieve specific wildlife management objectives and when an approved management plan is in effect...Livestock grazing would be eliminated for a 15 year period under this plan, primarily for the purpose of reducing adverse effects identified with livestock grazing on riparian areas and the maintenance of senescent shrub-dominated communities. Rest from grazing and prescribed burning would represent the primary management tools for restoring native vegetative communities. Anticipated benefits of restored habitat mosaics would include a more balanced assemblage of plant and wildlife species that would ultimately contribute to increased biological diversity." (540)

447 "TWS [Oregon Chapter of The Wildlife Society] recommends that any future livestock grazing should be implemented only after specific well-defined objectives have been defined, including intensity and duration of grazing levels required to achieve stated objectives. Strict herd monitoring should be maintained so adjustments in herd distribution and grazing effects can be controlled." (540)

448 "There's a place for cattle grazing in habitat management, primarily uplands. Better control and distribution is needed wherever it occurs. I suggest using a variety of techniques to control cattle use and distributions (e.g., riding). Don't limit yourself to fences." (760)

449 "Cows should not be permitted within 100 feet of riparian areas." (773)

Response. Thank you for providing these guidelines for our potential future use.

History

Comment

450 "The history of livestock grazing seems to end at the establishment of the Refuge in 1936. The improvements made as a result of the elimination of domestic sheep; and the resulting improvements from the reduction of AUM's of other livestock, under the management of the USFWS, does not seem to be relevant. What has the federal management accomplished? The improvements are not given relevance in the plan, and they are, in fact, very relevant to this whole discussion. Fifteen years of cattle elimination seems to be a "shot in the dark". Goals and monitoring are sadly missing. The refuge management had complete control over livestock management since 1936; if there were problems, why weren't they addressed." (730)

Response. Information on the amount of use the Refuge received from livestock prior to 1936 is virtually non-existent. Review of information in Refuge files reveals that some habitat conditions on the Refuge likely have improved since 1936. The extent of improvement is unknown and cannot be varified because most records are qualitative assessments. Other conditions (e.g., shrub cover) continued to worsen (Deming 1961b). Whether riparian habitats have improved in condition is unknown. Livestock grazing prior to Refuge establishment in 1936 is probably the main culprit of the current riparian conditions on the Refuge. Continued livestock grazing after 1936, although reduced in amount, has at least maintained the degraded conditions in riparian zones, with possible improvement in some areas. Livestock grazing on the Refuge since 1936, which primarily was concentrated in riparian zones, may have continued the degradation of some riparian zones. Management objectives for allotments were based on upland habitat conditions while cattle concentrated in riparian areas.

Using Cattle to Improve or Maintain Vegetation Health

<u>Comments</u>

451 "The concept of livestock as a tool for upland improvement is addressed in Appendix I, but is apparently discredited as either too cumbersome to implement on a management (rather than research) basis or disbelieved on the grounds that livestock grazing is uniformly detrimental to habitat, vegetation, soil, and watershed values. This DEIS does not recognize prescription grazing for its importance in enhancing these values. In the DEIS, discussion of livestock use seems to be couched in terms of numbers of animals and volume (AUMs) of forage consumption. Increasing evidence exists that the timing of grazing is as, or more, important than the amount (Bedell, ed. 1993)." (205)

452 "Strictly controlled livestock grazing represents a management tool that should remain an option at HMNAR." (540)

453 "We suggest that you consider retaining the potential for using livestock grazing as a vegetation manipulation tool in the preferred alternative (D) as it could become evident in the future that it is the most viable management method to obtain the desired vegetation conditions." (541)

454 "We feel that the addition of 4,000 AUM's as has been suggested by a committee associated with the Lake County Chamber of Commerce, would be beneficial to the health of the Hart Mountain NAR." (732)

455 "I believe this decision [to eliminate cattle from the Refuge] is a tragedy in the overall progress that is being made in respect to management of rangeland resources to benefit wildlife habitat, watershed quality and livestock ranching." (807)

<u>Response</u>. The EIS does not recognize prescription cattle grazing as important for enhancing habitat, vegetation, soil, or watershed values on Hart Mountain NAR because there is no compelling evidence to suggest that it can enhance these values to any significant extent on the Refuge, with the possible exception of enhancing habitat for a few wildlife species (though there are no specific objectives for this). In regard to the statement that cattle grazing may be the most viable method to obtain desired vegetation conditions, there is little reason to believe that cattle grazing would be effective for periodically reducing shrub cover to create early succession grassland-like communities, and for stabilizing streambanks and increasing the abundance and distribution of riparian vegetation. This is the primary focus of long-range objectives, which define desired vegetation conditions. Cattle grazing also would hamper restoration efforts. Additionally, funding, staff and other resources allocated to a livestock program would be unavailable for working toward obtaining desired vegetation conditions. Please refer to Appendix I for further detail.

Research on the use of cattle to control cheatgrass and broad-leaved weeds, and to disseminate seeds of native plants appears to be in an early stage. As yet, there are no indications that cattle can effectively and consistently be used for these purposes on Hart Mountain NAR.

Jim Yoakum, a Wildlife Consultant under contract to the Service, met with the BLM Lakeview District office to obtain further information on how livestock can be used on Hart Mountain NAR to manage vegetation for wildlife (Yoakum 1994a). Four possibilities were identified by BLM: 1) livestock can be used to increase upland shrubs, 2) livestock can be used to disturb soil and aid in implanting seeds, 3) livestock can be used to decrease plant fuel in firebreaks for prescribed burning, and 4) livestock can be used to break up overgrown, thick, dense, vegetation in riparian areas. The first and fourth would not contribute toward desired vegetation conditions -- in fact, they would be in direct conflict with resolution of core problems and long-range objectives. In regard to the second potential application, there is no indication that cattle would contribute to the re-establishment of native grasses and forbs. During the meeting, it was decided that the third potential application would be most relevant in areas where cheatgrass is abundant, and thus would have limited application to the Refuge at this time. Please see Appendix I of the FEIS for further detail.

Effects on Refuge wildlife and habitats were evaluated based on season, duration, and intensity of cattle use. AUMs were presented in several tables to allow readers to make general comparisons among alternatives. More information was provided in the livestock grazing sections in Chapter 2 and 4, which should make this more apparent.

<u>Comment</u>

456 "That livestock grazing can be used as a management tool to "improve and maintain vegetation condition and vigor" is recognized in other alternatives. In recent years the cooperative efforts of the Permitees is amply demonstrated on the ground. The cattle rancher of today, for the most part, is a product of not alone

"learning from the past" but a student of Agricultural evolving disciplines of economics and range management, which are necessary in this field of business, and ongoing in all future planning.

No one is more qualified to judge the grazability of a land area, each year, than the person who's livelihood depends on livestock and has the responsibility of generating and protecting this valuable source of food supply. My association with cattle growers has enlightened me when I find they, annually, appraise their public land allotments and voluntarily, through personal inspection and a certain intuition based on years of experience, decide which lands may be grazed by how many AUMs and those that should not be grazed. These are important decisions which are established not alone through personal experience but through higher education at the University level demanded by continually evolving scientific information. Their training and education cannot be underestimated insofar as their charge is to maintain a food-chain business which is fraught with challenges (mostly climate and weather consequential) which change as regularly as a shuffled deck of cards." (603)

Response. The main factor that currently limits vegetation health is excessive shrub cover in uplands and lowered water tables in riparian areas. The Proposed Action calls for the resolution of these core problems as the focal point of management for the next 15 years. Please refer to Appendix I for a discussion on the potential use of cattle to improve and maintain vegetation vigor on the Refuge.

Comment

457 "With the reduced opportunities to find the "window of opportunity" to burn and the need to maintain healthy vigorous vegetation I feel that the grazing AUM's should be equivalent to those in alternative B. Grazing, when done with appropriate control, is a good way to keep the grass stands healthy." (670)

Response. Prescribed burning and cattle grazing, as methods for manipulating vegetation, are not interchangeable (i.e., cattle generally cannot be used to accomplish the same objectives as prescribed burning). Please refer to Appendix I for discussion on the topic of using cattle to maintain healthy vegetation; available evidence suggests that cattle grazing would not be an effective means of accomplishing this task on the Refuge.

Comment

458 "I know that some livestock use can provide benefits for some vegetation types. It can also benefit mule deer in certain vegetative types if done at the right time of the year. I think that livestock should be kept out of riparian zones until these zones have recovered to a sustainable level. This may take additional fencing. Grazing should be confined to the uplands. Riders would need to be used to keep livestock from overusing any one area. I think Alternative B comes closest to what could be maintained as a safe livestock grazing level." (723)

Response. The Service agrees that cattle can be used to benefit mule deer under some circumstances. Bitterbrush plants can benefit from livestock grazing, but whether bitterbrush communities benefit from livestock grazing (grazing of surrounding grass) depends on objectives (desired characteristics of the bitterbrush community). Exclusion of cattle grazing from riparian areas merely would transfer impacts from riparian zones to upland habitats. The Service does not have any objectives for conditions created by cattle grazing in upland habitats.

Comment

459 "I would much prefer to see livestock used to keep the Refuge ecosystem intact than the toxic chemical suggested in the preferred alternative the United States Fish and Wildlife has supported." (798)

Response. Herbicides would only be used where treatment is necessary, but where prescribed burning or mechanical treatment would not be feasible. Herbicides would only be used as initial treatment in limited areas; it would not be used to "keep the Refuge ecosystem intact." Once herbaceous cover has rebounded as a result of shrub reduction, prescribed burning would be used. Cattle would not be an effective substitute for reducing shrub cover.

Comment

460 "With over 50 years resource management experience in the field, I can say with confidence that the management programs on Hart Mt and Sheldon Refuges in the late 1980's were, with all their recognized deficiencies, outstanding examples of the way all public rangelands should and could be managed where the rangelands are comparable. Hart and Sheldon were examples of ecosystem management with the prime

purpose to benefit wildlife habitat yet being duly sensitive to economic, social and resource needs. Progress in resource improvement is slow, at best, in such arid environments but our monitoring studies to determine trends in ecological and soil status 1979-87 due to management were positive. The ecological trend appeared to be upward, even during drought." (807)

Response. Many improvements have been made in the livestock grazing program since the establishment of Hart Mountain NAR in 1936 (Refuge files). Changes in livestock grazing practices resulted in improved conditions on the land, according to periodically recorded observations (Refuge files). The extent of improvements are uncertain. By identifying Alternative D as the Preferred Alternative, we do not wish to pass judgement as to whether past management of Hart Mountain NAR provides a good example for management of public rangelands in general. However, we do maintain that continuation of past management would not accomplish Refuge goals and long-range objectives. Remember that Hart Mountain NAR is to managed first and foremost for wildlife.

The comment refers to information that was presented in Anderson et al. (1990a) and Anderson and Franzen (1988), both of which were submitted with letter 807. These papers, upon their review and review of other relevant information, were found not to provide any indication that cattle grazing management during 1979-1987 resulted in improved ecological and soil status on Hart Mountain NAR (DeLong and Yoakum 1994). To conclude that changes in vegetation were a direct consequence of management, it is necessary that management (i.e., cattle grazing) affected the sampled plots at described prescription levels (Range Inventory Standardization Committee 1983). Available information suggests that no more than a small number of upland plots were grazed by cattle, and the level of utilization of those that may have been grazed remains unknown (DeLong and Yoakum 1994). Use of plots by cattle was not monitored by Anderson et al. (1990a). In comparing distribution and utilization maps (Refuge files) with locations of Anderson and Franzen's (1988) plots, DeLong and Yoakum (1994) found that between 72-100% of plots in upland range sites were in areas that did not receive use by cattle during years when cattle distribution and utilization levels were mapped in grazing units that encompassed the permanent plots (Table O-2). The four plots in riparian areas may have been used more frequently. Because utilization of plots was not measured, utilization levels of zones surrounding plots only provides an indication that particular plots may have been grazed. A plot located within a particular utilization zone does not signify that the plot received the designated utilization, or that it was grazed at all. Soil status apparently was not monitored, although it likely can be inferred from vegetaton data that was collected.

Table 1. Number of occasions that upland vegetation plots[a] were encompassed within non-use, light-use, moderate-use, and heavy-use zones[b], Hart Mountain NAR, 1978-1989[c].

Vegetation Type	Utilization Zone			
	None-use Zone	Light-use Zone	Moderate-use Zone	Heavy-use Zones
Wyo. Big Sage	1	2	3	1
Low Sage	9	0	0	0
Mtn. Big Sage	13	3	0	0
Bitterbrush	6	0	2	0
TOTALS	28	5	5	1
	(72%)	(13%)	(13%)	(2%)

[a] Anderson and Franzen (1988) established 26 permanent vegetation plots in upland range sites in 1979. Of these, 17 were located within the 11 management units where cattle utilization and distribution had been mapped at least once between 1978 and 1989 (apparently the only period for which utilization mapping occurred on the Refuge).

[b] A plot located within a use zone does not signify that the plot received the specified amount of utilization, or that it was grazed.

[c] Utilization mapping occurred during 1978, 1979, 1980, 1981, and 1989 in 11 management units. Not all 11 management units were mapped each year.

The study design employed by the authors does not provide data of sufficient quality for changes in vegetation to be detected with an adequate degree of confidence, based on standards set by the Range Inventory Standardization Committee (1983), and an assessment by Edge (1993) for a similar monitoring program on Sheldon NWR. This aside, DeLong and Yoakum (1994) combined all plots and found that the only significant positive change that was detectable on sampled plots was an increase in the number of perennial forbs (P=0.021, sign test; DeLong and Yoakum 1994). Grass cover and forb cover, however, were lower in 1987 than in 1979 (P=0.008 and P=0.021, respectively). Changes in shrub, litter, and moss/lichen cover were not apparent. A higher number of perennial forb species, alone, does not substantiate the conclusion that ecological trend was upward. Additionally, the above results cannot be considered representative of the Refuge because sampling was not stratified among range sites. Plots also were not stratified by treatment (e.g., fire, cattle grazing pressure). Shrub cover does not appear to have changed since at least as far back as 1968 (Appendix C). As such, we would not expect significant changes in the understory, based on Sneva et al. (1984), Laycock (1991), and Winward (1991). These authors point out that high levels of shrub cover limit cover of herbaceous vegetation, and that increased herbaceous vegetation will only occur after shrub cover is reduced. Additionally, the degree to which plant species composition compares to potential composition in climax communities only provides information on conditions of communities that are in late succession. Condition of early succession communities and the amount and interspersion of various successional stages in uplands, and condition of riparian areas also are important in evaluation of the condition of ecological systems from the standpoint of wildlife.

Co-existence/Commensalism between Cattle and Wildlife

Comment

461 "Cattle and wildlife have co-existed for years and can do so in the future." (9)

Response. Wildlife have existed in the presence of cattle for a very short amount of time in the history of the Hart Mountain area. Some species likely have benefited, some species may not have been affected, and other species have been adversely affected. Co-existence does not necessarily mean that the existence is beneficial to all species involved.

Comments

462 "The chart on page 116 of the document shows a total increase in pronghorn population from 1955 to 1991. The increase was from 347 to 1763. The chart on page 118 of the document shows that bighorn sheep increased from 46 in 1955 to 363 in 1992. The write up on page 120 of the document declares that mule deer populations are up from the beginning of inventory until the present. From these figures, all I can deduct is that livestock grazing did not contribute to the decline in wildlife population over the years. If you implement Alternative [D], livestock grazing would be eliminated from the Refuge for 15 years or more. If grazing is not contributing to declines in wildlife why eliminate it? I agree with reduced numbers of livestock." (25)

463 "The most "telling" thing I can find with the voluminous DEIS is the consistent criticism of livestock grazing. On the one hand this document consistently shows substantial increase in both Prong Horn and the Big Horn Sheep, which are the "star" attraction and gives minor information on Mule Deer which are also a related quantity of species at large." (603)

464 "Are things really that bad at Hart Mountain? Why have wildlife populations increased on other public lands that continue to be grazed, yet post a problem for Hart Mountain?" (730)

465 "With regard to the wildlife issues, it is my understanding this is what the Refuge is being managed for; again I have lived here my whole life and I haven't been here as long as some people sitting here, I know. But I have hunted up there for an awful long time and used to hunt back there when I was in high school and that was about 25 years ago. And I used to see a lot more wildlife up there than I do now. And I would challenge the Fish and Wildlife to show me that - and there was a lot of cattle being grazed up there then. I would challenge the Fish and Wildlife to show me that, you know numbers of antelope, and as well as other wildlife species have been drastically hurt by the cattle and the grazing. Thank you." (791)

Response. Pronghorn, bighorn sheep, and mule deer account for three of the 302 vertebrate wildlife species known to occur on Hart Mountain NAR. Numerous other invertebrate wildlife species (insects, spiders, etc.) also inhabit the Refuge. Evidence indicates that livestock grazing may be one of the primary factors influencing the declining sage grouse population on the Refuge. Redband trout habitat on the Refuge has been degraded by livestock grazing. Habitat of wildlife associated with riparian areas has been seriously impacted by livestock grazing -- approximately three-quarters of the wildlife species on the Refuge use riparian areas. The Service proposes to eliminate livestock grazing from the Refuge because its continued use would slow recovery of habitat, would take away resources (e.g., staff, funding) that could be used toward restoring wildlife habitats. Additionally, cattle grazing has not been shown to be compatible with most wildlife that inhabit the Refuge.

Comment

466 "Ranchers furnish water, salt and tender grass for wild life. On the desert years ago, there was no water and no deer and antelope. When ranchers put cattle on the desert, drilled wells for the cattle to water, the deer and antelope came too. Now there are lots of deer and antelope, other wild life. Grazing cattle on Federal lands, benefits all." (29)

Response. The Service does not wish to minimize the contributions that ranchers make to maintaining wildlife resources. The selection of an alternative that does not include livestock as part of the plan is based on circumstances that are unique to Hart Mountain NAR -- namely that the Service is to manage first and foremost for wildlife. After thorough evaluation of habitat data and consultation with experts in wildlife biology and management, fisheries, range ecology, and riparian ecology, we determined that livestock grazing was not a method that could be used to achieve Refuge goals and objectives.

Comment

467 "We have personally attended "public comment" meetings where the benefit of cattle to the wildlife on the mountain was discussed. Numerous people have stated that the cattle are historical and beneficial and should be used as a management tool, for the benefit of the Antelope and other wildlife. Any open-minded person experienced in the way of wildlife and cattle knows there is a simbiotic relationship that is positive. Cattle can be used to manipulate vegetation, in lieu of mechanical treatment, in a very positive economic scenario, vs. mechanical manipulation at a terrific cost." (730)

Response. Whether cattle grazing is beneficial to wildlife depends on the species of wildlife (302 vertebrate species on the Refuge), vegetation type inhabited by the particular species of wildlife (31 on the Refuge), succession stage inhabited by the species of wildlife, preferred vegetation composition, specific use of the habitat by wildlife (e.g., fawning, nesting, feeding), time of year, habitat status, moisture conditions, level of livestock grazing, frequency of livestock grazing, and other factors. The proposed limited use of mechanical treatment on the Refuge would be to reduce shrub cover, an objective for which cattle would be ineffective.

Forage management

Comment

468 "Several studies have shown that sage grouse prefer meadows which have been moderately grazed. Therefore, low intensity livestock grazing would enhance the use of meadows by sage grouse. At the same low intensity grazing would not negatively impact other wildlife species (e.g., pronghorn, mule deer, wildlife diversity), once riparian zones and meadows have met condition standards." (7)

Response. In one study conducted on Sheldon NWR the researcher found that sage grouse use of grazed meadows was higher than that of ungrazed meadows after mid-July in 1982 (Evans 1986:38). In another study, Klebenow and Burkhardt (1982) observed that meadows with vegetation height of 3-6 inches seemed to be preferred by sage grouse. This suggests that cattle grazing of meadows has potential for reaching specific objectives in sage grouse management if conditions created by cattle are determined to be needed. As yet, however, there is no indication that grazed meadows are necessary for managing sage grouse on Hart Mountain NAR.

Cattle grazing treatments were not characterized by Evans as low intensity. In fact, utilization levels were only presented for two of the six grazed meadows. Utilization on one of the two meadows was characterized as severe-use and the other was moderate-use (Evans 1986:56,69). Evans did not recommend specific grazing prescriptions that would produce beneficial conditions for sage grouse. Although sample size and replication is limited, her results suggest that higher utilization rates may produce the best short-term results (Evans 1986:99-100). Utilization of grazed meadows in Klebenow and Burkhardt's (1982) study ranged from moderate to heavy. In general, sage grouse seem to avoid meadow areas with tall, dense vegetation (Oakleaf 1971, Klebenow and Burkhardt 1982).

Based on the above information, it appears that low intensity grazing may not produce conditions considered beneficial in the short-term for sage grouse. As yet, we have not received information to show that cattle grazing of meadows, at the level needed to produce benefits to sage grouse, would not impact other wildlife species in the short- and long-term. Additionally, the comment points out that "low intensity grazing would not negatively impact other wildlife species... once riparian zones and meadows have met condition standards" (emphasis added). We expect that few, if any, riparian meadows would reach this condition during the 15-year planning horizon.

Comment

469 "The private lands in the Warner Valley, while being grazed intensely, feel a great impact from wildlife. The wildlife seem to almost follow a rotation with the cattle. The cattle eat the coarser, ranker grasses and expose the greener, softer new growth the wildlife prefer." (9)

Response. There is little doubt that some herbivorous species of wildlife select new growth that is accessible rather than "old-growth" grass when given the opportunity.

Comment

470 "Deer and antelope need cattle so they can get the feed they need. One observer said to me not too many moons ago that, "deer and antelope are leaving Hart Mountain since the cattle were taken off." I'm beginning to trust his judgment over some of the people with the Fish and Wildlife service that just might be influence by the wrong environmentalist." (44)

Response. The number of pronghorn using Hart Mountain NAR continues to climb. Cattle have not been grazed on Refuge lands since 1990, and there have been no apparent changes in the rate of increase.

Comment

471 "A number of excellent research reports deal with livestock as a tool to enhance forage availability and quality for wildlife (Urness and Austin 1989; Austin, Urness, and Fierro 1983; Reiner and Urness 1982; and Anderson, Franzen, and Melland 1990). These studies reflect how herbivory can be used to change physiologic maturity, succulence, and palatability." (205)

Response. The Service agrees that there is evidence to suggest that cattle can be used to enhance forage availability and quality for some species of wildlife in some habitats under some circumstances. Although the Service does not have any long-range objectives specifically aimed at enhancing the nutritional quality of individual plants on the Refuge, the achievement of long-range objectives would increase the amount of quality forage. As discussed in the EIS, the primary factor that limits grass and forb cover (forage) in Refuge uplands is the high amount of shrub cover. Lowered water tables in riparian meadows limit the amount and duration of succulent forage in these meadows. Implementation of Alternative D (Proposed Action) would place emphasis on reducing shrub cover and restoring riparian areas.

The following is a review of literature cited in the comment.

Austin, Urness, and Fierro (1983) was mis-interpretted. It does not support the contention that cattle can be used to "enhance forage availability and quality for wildlife". In fact, it provides information in opposition to assertion. It provides an example where mule deer favored ungrazed areas, and where regrowth of crested wheatgrass was typically higher in ungrazed areas compared to areas that had been grazed by cattle during the spring.

Reiner and Urness (1982) provide an example in which heavy utilization of grass by horses benefited bitterbrush under a highly controlled program (pastures were less than 3 acres) indicating that livestock can, under some circumstances, enhance bitterbrush. However, increased twig production of bitterbrush apparently did not result in increased use by big game species.

The popular article *The Effects of Grazing and Browsing Animals on Wildlife Habitats*, written by Urness and Austin (1989), cites research studies that support the assertion that livestock grazing can benefit wildlife. With few exceptions, Urness and Austin (1989) limited the scope of their article to studies, or portions of studies, that provided support for the use of livestock in enhancing forage for big game species. For instance, they cited a minor statement that was made in the conclusion section of Austin, Urness, and Fierro (1983), but did not present the major conclusions of their study -- that ungrazed areas were favored by mule deer and ungrazed areas had higher regrowth of crested wheatgrass. The statement Urness and Austin (1989) cited was not based on results of Austin, Urness, and Fierro (1983). Adverse effects of livestock grazing were not discussed.

Anderson, Franzen, and Melland (1990b), although not a research report, summarizes several studies that provides evidence that spring grazing by livestock can, under some circumstances, improve the nutritional quality of forage for autumn and winter grazing. Removing livestock prior to about mid-growing season delays phenology of plants and, according to the concept, results in nutrients being "cured" by heat and lack of moisture before the plants reach full maturity. It assumes that adequate moisture is available for regrowth after grazing. Please refer to Appendix I for further discussion on this subject.

Comment

472 "Prescribed livestock use can also be used to enhance wildlife habitat by altering vegetation structure and/or composition to favor target animal species (Kie and Loft 1990; Guthery, DeYoung, Bryant, and Drawe 1990; Kontrod 1990; Urness 1981; Neal 198[2]; Strassman 1987). This is done by recognizing that through prescription grazing one can alter the plant physiology and therefore its distribution, density, and nutritional status. Consequently the herbivore, properly used, can... promote forbs necessary for upland birds and big game animals; or adjust the plant's growth stage in order to maintain energy, protein or palatability levels later into the year." (205)

Response. The Service agrees that livestock can "be used to enhance wildlife habitat by altering vegetation structure and/or composition to favor target [emphasis added] animal species" in some situations. Some of the citations used to support the quoted statement provide evidence for this, while others contradict the argument put forth by the authors of the comment. Evidence provided in Kie and Loft (1990), Kantrud (1990), Urness (1981), and Neal (1982) supports the use of cattle to manage some species of wildlife. Kie and Loft (1990) provide some gross approximations (yet untested) regarding the benefits and drawbacks of livestock grazing in annual grasslands and wet meadow communities in California. Kantrud (1990) discusses the use of cattle grazing to reduce overly dense and tall emergent wetland vegetation for waterfowl in the prairie pothole region. Urness (1981) and Neal (1982) described how livestock can be used to enhance bitterbrush for mule deer. Please refer to Appendix I for further detail.

Strassman (1987), on the other hand, concluded that cattle grazing and haying, although in theory can be used to manage wildlife habitat, they currently are doing more harm than good on the 123 National Wildlife Refuges that were surveyed. She surmised that grazing and haying programs primarily accomodate economic needs of permittees rather than ecological needs of wildlife. Strassman pointed out that prescribed burning may be a better wildlife management option than cattle grazing or haying. Guthrey et al. (1990) concluded that instillation of a short duration grazing program (topic of the paper) solely to manage wildlife habitat seems unlikely because costs likely would outstrip the benefits. They did, however, summarize a number of situations where short duration grazing seemed to have positive effects on some wildlife species.

Increasing the availability of forbs using cattle has been documented in dry meadow habitats (Evans 1986), but not for upland habitats in the Great Basin. The concept of using cattle to prolong the duration of green-up and to increase nutritional value of bunchgrasses later in the year seems to have merit, and has some supportive evidence (Evans 1986, Pitt 1986, Rhodes and Sharrow 1990).

In general, any alteration to habitat benefits some species of wildlife and adversely affects others. As such, cattle grazing undoubtedly benefits some species of wildlife at some stage in their life cycle on Hart Mountain NAR -- which species (of the 300+ species) and which part of their life cycle remains uncertain, except possibly mule deer and sage grouse. Habitat conditions created by livestock, although beneficial to some species, are detrimental to others. This can also be said of prescribed burning and restoration of riparian areas. However, conditions created by burning and healthy riparian areas are critical for species that have adapted to these conditions. Grazing by large herbivores was not a major factor influencing habitat prior to domestic livestock.

Comment

473 "The following items from the scientific literature need to be cited to balance ludicrous assertions of the private-sector range consultant Anderson on "pre-conditioning" of forbs:

Belsky, A.J., 1986. Does Herbivory Benefit Plants? A Review of the Evidence. American Naturalist127:87-892.

Belsky, A.J., W.P. Carson, C.L. Jensen, and G.A. Fox. 1993. Overcompensation by plants: optimization or red herring? Evolutionary Ecology 7:109-121.

Painter, E.L.. and A.J. Belsky. 1993. Application of Herbivore Optimization Theory to Rangelands of the Western United States. Ecological Applications 3(1): 2-9." (521)

Response. The above listed literature does not address the concept of "pre-conditioning". The papers only addressed the concept of "overcompensation" as it pertains to bunchgrasses. In other words, they examine the question, "does grazing benefit grass plants?" The papers provide a thorough review of the subject, concluding that the prevailing evidence indicates that grazing of grass does not benefit individual plants. This is a different subject than "pre-conditioning", which has been shown to have some merit under some conditions (Pitt 1986, Rhodes and Sharrow 1990).

Comment
474 "I'm concerned that without grazing, there will be increased/thick vegetation (tall, rank stands of grass)." (765)

Response. This concern has been expressed by many people. If forage production was our only objective, this may be a valid concern. Savory (1988), Anderson (1993), and others have pointed out that bunchgrasses become stagnant if they are not grazed. Forage is only one small element of ecological systems. Standing dead grass and accumulations of dead plant material are important components of the ecological system of the Hart Mountain area. One other point to consider is that Holechek et al. (1989:130), in their range management textbook, stated that excessive accumulations of vegetation usually do not occur where annual precipitation averages less than 16 inches, due to aridity.

Comment
475 "We have seen a number of evidences where, indeed, livestock have been used to change plant communities so that a targeted species, a targeted wildlife species can be benefitted. I would quote some of the work that our department has done over on the Beneke Elk Range as an example of this. The grass was growing up and coarse and elk were moving off of the refuge areas down into the farmer's fields. Consequently, there was concern about predation of haystacks and stuff like this. Research indicated there were three things one might do. You could graze that old standing stuff and have it resprout as green lush forage which elk would enjoy. You could mow it and get the same response. Or you could burn it and get the same response. Now, depending upon one's goals or objectives, burning or mowing or grazing might fit into the scheme better than one of the others might. But the point is that there are ways that one can manipulate the system if they choose to do so." (787)

Response. We agree that under some circumstances livestock grazing may be beneficial to some species of wildlife. As pointed out in the comment, the method that would be most suitable for a particular situation depends on goals and objectives. Alternative D proposes what the Service believes to be the most suitable methods given Refuge goals and long-range objectives.

Comment
476 "Wildlife and livestock grazing. You do not need to go to Hart Mountain to examine this. And you don't need to be a botanist, a biologist or a zoologist. Just drive one mile west on Highway 140 and you can see for yourself. Spend fifteen or twenty minutes and see how the cattle grazing and the antelope are truly a management tool. The antelope follow the cattle throughout the season. Adjacent on this Section 17, there are 180 acres that is in the soil bank. No cattle graze on this land and neither do any of the antelope. They follow the cattle." (788)

Response. Several of the Refuge staff have observed this type of situation. Grass and other plants, after being grazed, respond by regrowing (like mowing your lawn). The new growth generally is more succulent than ungrazed plants, and pronghorn prefer this growth when given the opportunity. This, however, does not mean that pronghorn depend on these conditions -- they, like people, are opportunistic. Please refer to Appendix I for further discussion of this topic.

Comment
477 "Specifically, [Krueger, Buckhouse, and Bedell 1991] addressed livestock grazing on the mountain because it was a major issue. And I quote them, 'If you intend to manage the vegetation of Hart Mountain Refuge so that you can influence palatability of forages for wildlife, control prescribed burns and direct changes in vegetation composition and provide sustainable and changing habitats, livestock grazing is probably the primary economically feasible tool to accomplish these purposes. Livestock grazing programs can and do provide a low cost, even profitable process, to accomplish specific objectives when they are defined and the ecological processes being manipulated are understood. Any machine needs maintenance if it is to be available to be used when needed. Livestock grazing is no different. If grazing is to be available to do

specific jobs on the Refuge, the cattle need to be available. Much of the use of livestock should be to harvest forage that exceed the needs of wildlife on the Refuge. This maintenance grazing should be done responsibly as it has been, but need not have direct wildlife benefits. Providing this grazing opportunity to the ranchers will be necessary so they can provide the proper cattle grazing treatments when and where primary wildlife habitat treatment requires some cattle use. We are sure that you can provide a better and a more sustainable wildlife habitat on Hart Mountain Refuge if you use the benefits of vegetation manipulation by cattle than if you exclude cattle from the area.' " (792)

Response. The Service does not intend to manage vegetation to influence palatability of forage for wildlife, as we have not determined palatability of forage to be a problem on the Refuge (Chapter 1, Section Two of the FEIS). Although some people have used cattle to create fire-breaks for prescribed burning, the Service would, under the Proposed Action, make use of other, more effective methods. Whether cattle should be used to direct changes in vegetation composition depends on the desired vegetation composition. As identified in long-range objectives and core problems (Chapter 1, Section Two), the Service wishes to direct upland vegetation composition to plant communities with less shrubs and more herbaceous vegetation. Prescribed burning with limited use of mechanical and herbicide treatments are proposed to accomplish this; as discussed elsewhere, cattle would be ineffective for this purpose. In riparian areas, lesser amounts of upland vegetation and greater amounts of riparian vegetation are sought. Rest from livestock for the next 15 years would allow a substantial progress to be made in reaching this objective. We agree that cattle can be used to sustain or change habitats, but again, whether cattle should or can be used to sustain a particular habitat or change a particular habitat depends on the desired vegetation composition. The Service, at this time, does not have objectives for habitat conditions that can be created by livestock grazing. Thus, sustaining habitat conditions created by livestock grazing would not be desirable at this time. We do not agree that we "can provide a better and a more sustainable wildlife habitat on Hart Mountain Refuge if [we] use the benefits of vegetation manipulation by cattle than if [we] exclude cattle from the area."

Regarding the statement, "Much of the use of livestock should be to harvest forage that exceeds the needs of wildlife on the Refuge," we do not have enough information available at this time to determine how much forage is required by Refuge wildlife. Not only would we have to estimate the number of AUMs required by pronghorn, mule deer, and bighorn sheep for particular areas, we also would have to factor in the number of AUMs required by rabbits and hares, herbivorous small mammals, herbivorous and granivorous birds, and herbivorous insects and other invertebrates. Also, forage is only one of the many uses of herbaceous vegetation. As such, we would have to be very carefull to subtract herbaceous vegetation needed for non-consumptive uses by wildlife and for soil protection and formation from that which could be safely provided to cattle. Non-consumptive uses include hiding, nesting, and thermal cover for rabbits, hares, small mammals, small mamalian predators, birds, insects, and spiders. It also provides perching structure for some of these wildlife. Again, native wildlife communities did not evolve under conditions created by grazing of large herbivores (above and beyond that which is already produced by pronghorn, bighorn sheep, and mule deer). As such, these conditions are not necessary and they may adversely affect some wildlife species.

Comment

478 "Technical reports within Wildlife Habitats of Managed Rangeland - the Great Basin of Southeastern Oregon, which was written by Jack Ward Thomas, Chris Maser, and other people, substantiate the concerns of the ODF&W and recommends that cattle be used for forage management since it is the least expensive, can affect many acres, and is easily controlled. Whereas, management for wildlife habitat, in other words no grazing, is extremely expensive, affects relatively few acres, and has a relatively small influence on wildlife habitat." (795)

Response. The Service's primary mission on Hart Mountain NAR is "management for wildlife habitat." In addition, the Service, at this time, does not have specific objectives for managing forage. Reports within the document identified in the comment describe how to minimize adverse impacts of livestock grazing and point out some situations where livestock can benefit forage for mule deer.

Comment

479 "Ecologist Frederick C. Hall, in the subchapter "Management Practices and Options" of the book that I just told you about [see above comment], concluded that moderate cattle grazing seems complimentary to pronghorns. He further states that even if livestock grazing were excluded from public lands in the Great Basin, the resulting circumstances would not provide optimum habitat conditions for featured species or ideal conditions for species richness. Which is Alternative D, the Fish and Wildlife Service's preferred alternative.

Alternative B is basically designed for featured species. So, in other words, we have somebody here that is saying that without cattle we're not going to get ideal conditions for either featured species management, nor will we get species richness." (795)

Response. We agree with the interpretation that "moderate cattle grazing seems complimentary to pronghorns," but only when forage and water are abundant (Kinschy et al. 1982). We agree to some extent with interpretation of the second statement, as it applies to Hart Mountain NAR in particular, but we feel that it was taken out of context. If cattle were taken off the Refuge, and no actions were taken to address the problem of excessive shrub cover, then, yes, "the resulting circumstances would not provide optimum habitat conditions for featured species or ideal conditions for species richness," but only as it applies to uplands (underlined portion is Service's addition). We believe that Hall (1985) clarified his intentions with the next sentence -- "For example, very large tracts of climax sagebrush is not optimum habitat for most wildlife species in the Great Basin of southeastern Oregon (Maser et al. 1984)." In other words, if livestock were removed without any other vegetation treatment aimed at reducing shrub cover, resulting conditions would not enhance favorable conditions for wildlife diversity. This is a major assumption upon which we based Alternative D -- without reducing shrub cover, restoration of Refuge uplands would not proceed. The mere elimination of livestock grazing would do little to restore most upland habitats on the Refuge. However, elimination of livestock from riparian habitats would result in increased wildlife species richness due to restoration of the riparian habitat (Table 3-15). Hall's discussion was within the framework of how managers can manage for livestock production while minimizing impacts to wildlife or, if possible, enhance wildlife habitat.

Comment
480 "In the subchapter "Pronghorns", which was written by Kindschy, Sundstrom and Yoakum, concurred that pronghorns consume less than one percent of the available forage and that pronghorns do not compete with cattle when forage and water are abundant and that pronghorns thrive best on ranges with subclimax vegetative composition. These structural and vegetal conditions are created by fire and by the foraging of wild and domestic herbivores. In other words, cattle. They further state that the forbs, grasses, and shrubs desired by pronghorn is typically higher in plant communities in midsuccession. I may not know much about land management, but I do know that cattle can be used as a vital tool to sustain an area in midsuccessional stages. Cattle are by far the best alternative in maintaining such conditions." (795)

Response. We agree with the assessment that pronghorn do not compete with cattle [or visa versa] when forage and water are abundant. Regarding the second half of the comment, cattle, in general, tend to speed-up succession, and thus push plant communities toward late succession (domination by shrubs in shrubland vegetation types). The Service has no intention of attempting to arrest succession in a mid-stage. Using prescribed burning, an early stage of succession (grassland-like habitat) would be created with the understanding that it will progress through mid stages of succession on its way to a late succession stage. Thus, periodic treatment is necessary.

Comment
481 "Appendix I quotes some of my published ([Anderson] 1975) observations on pre-conditioning forage by controlled cattle grazing. This thesis has been verified under practical conditions on numerous ranches and public-land areas, and by research. On page 2, Appendix I first paragraph, the Team says that Dr Mike Pitt, who is at the U.B.C and scientifically tested my thesis (1986), "found that growth was delayed in experimentally raised plants that were subject to moderate defoliation for two consecutive years during spring. Subsequent spring regrowth had higher protein, digestibility, calcium and phosphorus contents compared to contents of unclipped plants" (underlining is mine).

What Mike actually reported, in part, was "These delays in plant phenology altered (increased) forage quality on 26 October compared to non-defoliated plants"--the same autumn as the clippings were made. Since my thesis was to improve the nutritional values of winter forage, the Team's misquote changed the entire point.

What the team did not quote Dr Pitt as saying was "These (nutritional) values exceed maintenance requirements of cattle and elk, indicating that judicious grazing management can improve nutritive values of bunchgrass vegetation."

Scientists at O.S.U. also tested my pre-conditioning thesis using sheep in coastal clearcuts to improve forage for deer and elk. (1990) The conclusion was "These data suggest that sheep grazing can improve big game forage supply in Oregon's Coast Range by improving forage quality in the fall and by high quality forage in the spring". This was not cited by the Team, probably because it contradicted their bias against livestock.

It is quite apparent the Team did not accurately quote nor thoroughly cite literature appropriate to the issue of livestock as a tool for improving wildlife habitat. Very unprofessional and biased." (807)

Response. Thank you for pointing out an important oversight. Appendix I of the FEIS has been revised based on this comment. Pitt (1986), in his discussion stated that "[T]wo years of clipping at boot, emergence, flowering, and seed formation produced significant reductions in ADF, plus increases in CP, Ca, and P on 26 October compared to nondefoliated plants." Early clippings in the first year of study did not increases nutritional quality of plants later in the season. However, after the plants had been clipped a second spring, digestibity, crude protein, calcium, and phosphorous, on 26 October, were higher than that of plants that had not been clipped. This suggests that it may take two successive spring grazings to precondition autumn/winter forage, or that spring grazing may not consistently enhance nutritional quality of autumn/winter forage. Another possibility is that nutritional quality was enhanced by clipping in the first year, but that changes were not detected.

We agree that Pitt (1986) provides evidence that the concept of preconditioning of forage by livestock has potential. Based on Pitt's (1986) results, his statement that "[t]hese values exceed maintenance requirements of cattle and elk, indicating that judicious grazing management can improve nutritive values of bunchgrass vegetation" seems plausible. As yet, however, there is no indication that forage used by pronghorn and mule deer on the Refuge currently is below maintenance requirements of these animals.

Sheep grazing in coastal clearcuts (Rhodes and Sharrow 1983, 1990) provides additional evidence that livestock can be used to enhance autumn/winter forage for ungulates in some areas. Pitt (1986) pointed out that his results (summarized above) should be extrapolated to other areas with caution. This can also be said of Rhodes and Sharrow (1990) in regard to its applicability to Hart Mountain NAR. Pitt (1986) went on to specify that "the extent of regrowth depends upon availability of moisture, with response becoming less pronounced as soil moisture declines." In Pitt's clipping study, nutritive quality of autumn/winter forage was enhanced by clipping during only one of two years in an area receiving about 40 inches of precipitation per year. In Rhodes and Sharrow (1990), nutritive quality of forage was enhanced in both years in an area receiving nearly 100 inches of precipitation per year on average. Most of Hart Mountain NAR receives less than 12 inches of precipitation per year on average. Hedrick (1969), as cited by Pitt (1986), found that regrowth of vegetation following cattle grazing occurred only in two of five years under variable precipitation in eastern Oregon [Fort Rock, Lake County]. As yet, there is no indication that early season cattle grazing would increase the nutritional value of grasses used by pronghorn and mule deer on Hart Mountain NAR during the fall and winter. The primary grass used by pronghorn during the fall and winter is Sandberg's bluegrass, which generally is less than 4 inches tall. Please refer to Appendix I for further detail.

Three papers that address the subject of preconditioning (Anderson and Scherzinger 1975, Anderson et al. 1990a, Anderson et al. 1990b) were submitted with letter 807. These are reviewed in Appendix I of the FEIS.

Cheatgrass / Weed Control

Comment

482 "As one understands the relationship between herbivory and plant growth and development, livestock-as-a-tool begins to make sense. For example, on rangelands heavily infested with cheatgrass, early season grazing can be used to biologically control cheatgrass, with the management objective of enhancing native, perennial bunchgrasses. If the grazing is done early in the season when cheatgrass is rapidly growing, but before the native perennial grasses have begun exponential growth, the cheatgrass will be disproportionately used. If the herbivore is then removed while soil moisture is still present, the native grasses can take advantage of the resulting relief in competition and the vegetation stand will change from one dominated by an introduced, annual grass toward a native, perennial grassland." (205)

483 "I have already suggested that one might use a cow to ___?___ in cheatgrass and perennial grass relationships. There's a number of other relationships, weed relationships, that would fit into this as well. This strikes me as particularly apropos if one is involved in the burning program because, as you are all aware, there is a window of opportunity following fire for the establishment of invading species. While fire is a natural part of the ecosystem and probably a very positive one, there is some concern, at least early on, with weed invasion. An integrated pest management approach would suggest that you use every tool in your arsenal to maintain and to strive for the goals that you have got in mind. So, I'm suggesting, that if it makes good sense to have the use of fire, the use of herbicides, the use of various kinds of mechanical

means, as well as the use of livestock as a tool to maintain the kind of desired plant community that one was aiming to go after." (787)

Response. Conceptually, the use of cattle to reduce cheatgrass and increase native bunch grasses seems plausible. Hindering of cheatgrass growth in clipping studies and under livestock grazing programs has been demonstrated (Valentine and Stevens 1992, for review). However, under actual field conditions, cheatgrass either was not controlled or it was controlled at the expense of adverse side-effects to perennial grasses and soil. Valentine and Stevens (1992), in their review of the literature, concluded that grazing is not an effective method of controlling cheatgrass. Sanders (1992), in assessing its practicality, found that the preponderant evidence indicates little chance of conversion from annual to perennial grassland communities through grazing management in areas receiving less than 12 inches of precipitation per year. Potential problem areas for cheatgrass invasion on the Refuge receive 6-12 inches per year on average. We requested information from OSU's Department of Rangeland Resources that would provide supportive evidence that cattle can be used to reduce cheatgrass and increase native perennial bunchgrasses (Refuge files). The Service has not received any information as yet. Please refer to Appendix I for further discussion.

Comment
484 "Weed encroachment will be one of the most serious problems facing the western rangelands in the next decades. Domestic animals can be used to control weeds if they are grazed in relation to plant physiology. While most references quote research using goats or sheep to control weeds, bovines and equines can be used under certain conditions. Weeds are a huge problem on Hart Mountain. To holistically control them one must be prepared to use all the tools in his or her arsenal. While livestock grazing alone will probably not control such extremely aggressive weeds as white top, it can be especially effective against annual grasses, and even white top can be more effectively controlled if grazing is part of the integrated pest management program. The following citations are several examples where livestock grazing changed plant species composition to favor shrubs: Brock 1988; Parman 1986; Wood 1987; Lacey 1987." (205)

Response. Although we recognize that weeds are a problem on the Refuge, as we continue to combat the problem, we disagree with the assertion that they are a huge problem. Weeds are a problem in several isolated areas on Hart Mountain NAR. Literature cited in the last sentence of the comment, as they apply to weed control, indicate that cattle would offer limited potential for controlling broad-leaved weeds (please refer to Appendix I for further discussion).

Brock (1988) provides two examples where cattle successfully had been used to control particular plant species: (1) cattle effectively controlled aspen suckering, and (2) cattle controlled leafy spurge through repeated trampling. The second example was based on an observation (not a study) made by Gene Foss, a rancher, as reported by Parman (1986), which Lacey (1987) pointed out has not been quantified by research. Lacey went on to discuss at length a study that documents the avoidance of leafy spurge by cattle. As for the first example, it is not likely that the Refuge will be in need of aspen control any time in the near future.

Wood (1987) did not study the use of livestock in controlling weeds.

Lacey (1987) provides 6 examples where cattle were used to control weeds: (1) the Parman (1986) example was discussed previously, (2) as was the study that contradicted his observation; (3) cattle effectively controlled aspen suckering (same reference used in Brock 1988); (4) cattle were not effective at decreasing the cover of clubmoss (Selaginella densa); (5) cattle have been reported to use prickly pear (Opuntia polycantha) after spines have been burned off (however, no mention was made in regard to control of prickly pear); (6) cattle were not effective in attempts to control spotted knapweed (Centaurea maculosa).

In the following discussion, we evaluate the extent to which the citations support the statement for which they were provided (i.e., that livestock grazing can be used to change plant species composition to favor shrubs).

The citations provided for the statement do not provide any evidence that livestock can be used to favor shrubs, except that Lacey (1987) cited Norton (1981) as reporting that "excessive grazing on arid and semiarid shrub-grass range can accelerate a change to shrub dominance". Three of the references provide evidence indicating that livestock (primarily goats) can be used to control (not foster) shrubs. For instance, Wood (1987) studied the effectiveness of using cattle, sheep, and goats to control shrubs in abandoned farmland in Vermont. Although goats were by far the best animal for the task, cattle eventually lowered shrub cover, but they also increased Canada thistle and bull thistle. The other paper, Parman (1986), did not mention shrubs or their enhancement.

Creation of Fire Breaks

Comment

485 "Carefully prescribed cattle grazing can be used as an excellent management implement for controlling fires on the Refuge. Fire is a normal and necessary natural phenomenon, however we don't need to burn the whole Refuge down at once." (798)

486 "We have done alot of burning on our ranch (alot of controlled burning), and if you are going to do controlled burning, you better have some cows graze some big fire breaks, because you aren't going to stop fire in that kind of country that has the fuel loads that will build up without grazing." (799)

Response. The use of cattle for improvement of prescribed fire breaks is not feasible for Hart Mountain NAR. The objective of burning on the Refuge is to generate as much interspersion as possible through mosaic, patchy burns. A clearly defined fireline, such as found along fencelines, is not desired. In addition, fences (temporary or otherwise) would be required for each burn project, not only to keep cattle in a "firebreak" area, but to ensure that the target area for the burn project is rested sufficiently to contain enough grasses and forbs to promote fire spread. Use of cooler and more moist burning conditions rather than extensive firelines will promote desireable burn patterns. In addition, the target vegetation for treatment by fire is late succession sage, which is not productive for forage production in its current state. A number of successful management ignited prescribed fires have been executed on the Refuge over the past five years, even during the absence of grazing. Less severe burning conditions during spring and fall and avoiding burns during higher levels of fire danger will lessen the opportunities for fires to escape. It is unfortunate that the public is aware of only the ones that got away. It is anticipated that an average of 3,000 acres (approximately 1% of the total Refuge) per year will be treated over the 15 year treatment period. Please refer to Appendix I for further discussion.

Riparian Areas

General Comments

487 "It is not feasible to fence the streams as I have seen other areas that tried to do that. The fences were knocked down by the cows and they did not protect the streams. Please keep the cows out of the refuge. They do not belong in desert riparian zones." (204)

488 "In 1981 I participated in a field study with Duke University Forestry School in Coyote Gulch Canyon in Escalante, Utah. At the time cows were doing their usual damage in the fragile desert riparian areas. For three weeks we documented the flora and visual effects of cows in coyote gulch. Then we fenced the canyon (with Glen Canyon National Recreation Department officials) to prevent cows access. Two years later (2 cow-free years) Duke University returned with another class and noted a 400% increase in the number of floral species in the absence of cows." (551)

Response. Comments noted.

Comment

489 "Riparian research indicates similar things. Managed grazing, particularly early season grazing - if one wishes to foster shrubby vegetation - promotes riparian recovery at rates similar to grazing exclusion. (Buckhouse and Elmore 1993). The concept of early growth season grazing in riparian zones is as follows: Given green grass and green willows present in the early season, livestock will preferentially choose the grass. If the animals are removed prior to depletion of soil moisture the grass will regrow and reproduce while the willow grows unmolested and with the additional benefit of an early season decrease in competition. In this strategy, both the herbaceous and woody vegetation flourish. Platts 1989; Buckhouse and Elmore 1993; and Anderson 1993 report on a variety of strategies and their predicted outcomes as they are affected by climate and site." (205)

490 "We have a lot of evidence throughout the Great Basin that early season grazing can be used to foster woody vegetation along riparian stream courses. Basically, it works like this: Given a choice of green grass or green willows, the cow will take the green grass. If you graze early in the year and get out again while there is still soil moisture, then the grass can grow and go through it's reproductive stage and essentially complete the season with about the same sort of status as if it had not been grazed at all. In the meantime, the willow has been growing unmolested, and so you can encourage will growth or woodies. Conversely, if

you hate willows, or hate woodies, then you can go with a late season type of grazing and what will happen there, given green dry grass, the animals will take the green willows. You see, understanding something about plant growth development and how these plants are spawned is very crucial to this whole concept. I have a series of references again listed here [refering to those in last sentence of the above comment and others in the letter] that show that if one does this, you can not only change the plant mix, like I just described, but you can also change the palatability of the species." (787)

Response. We agree that recovery of many riparian areas can proceed while under a cattle grazing program if the program is properly managed. However, the preponderant evidence indicates that (1) recovery would occur at a faster rate if cattle are excluded from riparian areas, and (2) providing the conditions under which native riparian-wildlife communities evolved would not be fully possible if riparian areas are grazed by cattle. Recovery of the hydrologic functioning of a riparian area is critical to the success of a recovery effort (in reference to (1) above). To reach Refuge goals and long-range objectives, the Service must go beyond restoring hydrologic functioning of riparian areas. In addition to the restoration of hydrologic functioning, we also must restore and maintain the species composition and structure of plant and animal communities in riparian areas (in reference to (2) above). For instance, year-round, dense, tall herbaceous vegetation and accumulation of fallen plant material are natural components of many riparian meadows, and thus is important to native wildlife communities. Attempting to graze cattle to enhance willow growth (to promote riparian recovery) would necessitate negative impacts to the herbaceous understory of willow habitat, according to the concept outlined in the above comments.

We were unable to locate any studies or other reports that document instances where cattle grazing has enhanced willow growth. We did, however, locate references that recommend early-season grazing of cattle (relative to other strategies) to minimize impacts on willow plants (Roath and Krueger 1982b, Kovalchik and Elmore 1992, Buckhouse and Elmore 1993). Buckhouse and Elmore (1993) do not provide any evidence to indicate that cattle grazing promotes riparian recovery at rates similar to grazing exclosures. They do, however, point out that "[g]razing in the early part of the growing season doesn't appear to harm woody production, as long as herbaceous plants are abundant and growing actively." Buckhouse and Elmore's (1993) statement that herbaceous vigor can be promoted by appropriate grazing management importantly was qualified with the phrase, "when you compare it with season long grazing," not grazing exclusion.

We are unaware of any studies demonstrating that well-managed cattle grazing in riparian areas can allow recovery to occur at similar rates as recovery in non-grazed riparian areas. Upon the request of Oregon State University's Department of Rangeland Resources (letter dated January 5, 1994), W. Elmore (BLM riparian specialist for Oregon) was contacted regarding his study on Bear Creek, Crook County, Oregon. Elmore stated that there does not seem to be any difference in recovery between grazed and ungrazed areas on Bear Creek; he was not asked about recovery of native plant communities. Elmore went on to explain that one must consider, in interpretting the results of the comparison, that the grazed area has more potential for sediment building, and that a thunderstorm that resulted in substantial deposition in the grazed area apparently did not influence the ungrazed area (refer to DeLong 1994b for more details of the conversation). This illustrates the importance of replication in these types of comparisons. Without replication, effects of a great many factors (cattle grazing, land-use history, vegetation characteristics, soil characteristics, slope, bank stability, extent of terracing, sediment loading, etc.) cannot be distinguished.

Oregon State University's Department of Rangeland Resources was contacted to clarify a statement in their letter regarding recovery rates of grazed and ungrazed riparian areas. In the response, it was stated that "research, demonstration, and experience of fisheries scientists like Chaney, Elmore and Platts, and range managers has amply demonstrated that given proper, intensive management of livestock, riparian recovery from historic abuse can occur at rates similar to, and in certain instances, more rapidly, than ungrazed watersheds." E. Chaney (Northwest Resource Information Center, Idaho), W. Platts (Don Chapman Consultants, Idaho), and W. Elmore were contacted regarding the statement. Chaney and Platts did not think that a riparian area grazed by cattle could equal the recovery of a riparian area excluded of cattle. Platts added that nothing can beat complete rest, and Chaney added that proper management would be practically impossible to get under normal circumstances. They agreed with the Service that recovery can proceed in a grazed riparian area if cattle are adequately managed. Although Elmore felt that similar rates of recovery can occur, he went on to state that the only true and tried system that works in all situations is rest from livestock. None of the persons contacted knew of any instances where cattle grazing has accelerated riparian recovery (refer to DeLong 1994b for more details of the conversations).

Review of cited material:

According to Platts (1989), the only cattle grazing strategy that would be completely compatible with fishery resources is rest from livestock grazing (score = 10 of 10). The highest rated cattle grazing strategy involved one termed "riparian pasture". It received a rating of 8 (of 10), indicating that at least some impacts to fishery resources would be expected. Assessments made in the paper were supported by references to relevant research. Platts (1989) does not predict outcomes of various grazing strategies based on site and climate.

According to Buckhouse and Elmore (1993), low "management stress" (i.e., livestock grazing) during the dormant season or early growing season would result in restoration rates not substantially different from restoration rates resulting from rest from livestock grazing. However, references in support of this assessment were not provided. While Buckhouse and Elmore (1993) predict outcomes of various strategies based on some general site characteristics, climate is not used in predicting outcomes.

Anderson (1993) provided an informative discussion on the role of vegetation and soil surface structure in capturing, storing, and safely releasing water on watersheds. Although many of the concepts discussed by Anderson apply to riparian areas, the paper apparently focused on upland portions of watersheds (it did not include discussions on the storage and release of water as it pertains specifically to riparian areas). Anderson (1993) does not predict outcomes of livestock grazing strategies as they are affected by climate and site.

Comment

491 "...the herbivore, properly used, can foster shade for cover or thermal protection of waterways..." (205)

Response. We disagree with this assessment. We requested information from OSU's Department of Rangeland Resources that would provide supportive evidence for this premise (e.g., studies that document significant reductions in stream-water temperatures by means of livestock grazing) (Refuge files). The Service has not received any information as yet. Please refer to Appendix I for further discussion on this topic.

Comment

492 "Discussion of the negative impact of livestock on riparian areas and hydrology needs to be given in greater detail in the FEIS, as well as predictions on how elimination of grazing will change the landscape." (519)

Response. Negative impacts of cattle grazing to riparian areas, including hydrology, are discussed in Chapter 4 of the FEIS under Sections I, D, 5-8 of alternatives A, B, and C. The same sections for alternatives D and E discuss the effects of non-use of riparian areas by cattle (note that cattle grazing under Alternative C would be minimal). Appendix J provides a more detailed examination of these impacts. Effects of historical livestock grazing on riparian areas is discussed in Section Two of Chapter 1, in the Basis for Long-range Objectives section.

Comment

493 "The spectacular results of excluding livestock from segments of Willow and Guano Creeks thirty years ago were not discussed in the DEIS. This information and photos showing grazed and protected segments of these creeks should be added; they best illustrate why livestock should be removed from the Refuge." (519)

Response. We agree that dramatic changes have occurred inside the two exclosures on Willow and Guano creeks. Cattle have been excluded from the Buck Pasture (Willow Creek) for over 40 years, and from the Demming exclosure (Guano Creek) for over 30 years. Use of these two exclosures as examples of what can occur with removal of cattle from riparian areas has been controversial. Some people feel that we use these sites at the exclusion of others to exemplify differences between grazed and ungrazed riparian areas. Unfortunately, these fenceline contrasts are the only two areas on the Refuge where the consequences of grazing exclusion can effectively be compared to consequences of continued livestock grazing. The very apparent differences between inside and outside the exclosures are consistent with results of other livestock exclosures.

Comments

494 "One possible solution would be to have a co-op fencing project with the USFWS and permittee's. Fence off the major riparian areas and develop a series of water troughs that could be filled and drained when needed outside of the fenced riparian areas. Require permittee's to use more riders to keep stock out of riparian areas." (25)

495 "The last thing that I would like to mention is an article that I recently took out of the Capital Press and it has to do with new technology that I think is being ignored as a way to manage cattle. The new technology is an eartag, electronic ear tag that is being developed and tested now. There are some bugs to be worked

out of it. They find that you can manage a herd of cows, totally keep them out of an exclusion area, by use of a small electronic ear tag which gives an electric shock to that animal when he gets to an area that we want to be excluded. Whether it be pasture or a riparian area. So, I understand 2% of the mountain is riparian zone. It's very critical to the rest of that mountain. Therefore that's one of the areas that U.S. Fish and Wildlife is hanging their hat on. They want to protect that. I'm suggesting that it can be protected. It doesn't have to be fenced. They just have to be open to the new technology and ways to control the cows." (792)

496 Couldn't riparian areas be fenced off? (749)

Response. Riparian areas agreeably are critical to the rest of the Refuge. Equally important are uplands to riparian areas (watersheds), and to native wildlife communities (uplands comprise 94% of the Refuge). Using fences or other devices to keep cattle out of riparian areas merely would transfer impacts from riparian areas to adjacent uplands. Remember that standing dead grass and accumulation of dead plant material are important components of upland habitats, especially during the recovery process. Additionally, if cattle are excluded only from riparian areas, water would have to be piped into the uplands or water gaps would have to be created. Concentrations of cattle in water gap areas would create adverse impacts to riparian areas in these locations. Alternative D proposes the exclusion of livestock from riparian habitats as well as from upland habitats. OSU's Department of Rangeland Resources (Krueger and Buckhouse 1993) and the Hart Mountain Liaison Committee (LCCC 1992) advocated several strategies for using cattle to improve wildlife habitat in riparian areas. Bailey (1991) and Krueger (1991, 1992a,b) also discussed strategies for using cattle to enhance wildlife habitat in riparian areas. These strategies are included in Alternative B; excluding cattle from riparian areas, in this alternative, would not be desirable.

Other Uses

Comment

497 "Cattle can also be used as a instrument to disseminate seeds of desirable species. Small, hard-coated seeds pass through the rumen undigested and are deposited in a natural growth media (feces) in places that would be hard to plant mechanically. The following citations quote studies using cattle to disseminate desirable plant species. It obviously seems that in spots that are too steep, or too rocky for machinery, that this would be an exceptionally promising way to disseminate seeds from Stipas, Oryzopsis, and certain native forbs and shrubs with hard seed coats and small seed sizes. (Barrow 1988; Barrow and Havstad 1992; Ocumpaugh, Stuth, and Archer 1991; [Gardener], McIvor, and Jansen 1993)." (205)

Response. Reseeding of native herbaceous vegetation would not be needed in areas too steep or too rocky for machinery because these areas on the Refuge generally have sufficient seed sources. Reseeding will likely be required in the Wyoming big sagebrush vegetation type in the northern and eastern portions of the Refuge (Semi-desert Terrace, Loamy Terrace, and Droughty Bottomland Fan range sites). Terrain in this area is nearly level to gently sloping and where surface soils generally are not rocky (Anderson 1978).

The statement that "the following citations quote studies using cattle to disseminate desirable plant species" is misleading. Three of the 4 studies examine only the viability of seeds after they have passed through the digestive tract of cows. Seeds were removed from cow "patties" and were germinated under laboratory conditions. The other study (Ocumpaugh, et al. 1991), which focused primarily on the same subject as the other studies, presented preliminary findings on the field establishment of seeds that were placed in "artificial cow pats" placed in a field after it had been sprayed with Glysophate to kill competing plants. The studies definitely warrant further research into the use of cattle for disseminating seeds, but findings are preliminary in nature.

Barrow (1988) and Barrow and Havstad (1988) reported that seeds of five plant species of New Mexico can remain viable after passing through the digestive tract of cattle. This makes the use of cattle for disseminating seeds a possibility.

Ocumpaugh et al. (1991) found that a high proportion of seeds from legumes that have small, hard seeds remained viable after passing through the digestive tract of a cow. Good survival also was obtained for 3 grass species; however, there was essentially no survival with 3 other grass species. Ocumpaugh et al. (1991) estimated that it would take about 500 viable Alamo switchgrass seeds per cow pat to get a 70 percent chance of producing 1 plant per cow pat. It takes nearly 2,000 viable seeds before feeding to produce 500 seeds that remain viable after passing through a cows digestive tract. They estimated that it would take approximately 3,000 viable seeds to successfully produce 1 plant using this method, assuming that the high rate (70%) of seedling survival per cow pat can be achieved under an actual management scenario.

Gardener et al. (1993) concluded that only pasture legumes producing hard seed have much potential for successful dissemination by cattle. None of the bunchgrass species that they tested showed much potential for being successfully disseminated by cattle. They tested 10 species of legumes and 8 species of grasses.

Lacey (1987), a paper cited in another comment of the same letter, cited several studies that reported on the passage of viable seeds of noxious weeds through the digestive tract of cows, horses, and sheep. Appearantly, livestock are major dispersers of weed seeds. Lacey cited one study that found seeds can be retained in the digestive tract of cattle for 7 to 10 days. In addition to highlighting concerns regarding cattle grazing, this information provides additional support for the use of cattle for disseminating seeds of plant species that are adapted to such dispersal mechanisms.

J. Young (Research Leader, Agriculture Research Service, Reno, Nevada, personal communication) pointed out that few species of plants native to the Wyoming big sagebrush vegetation type would be ammenable to dispersal by cattle. He said that, although indian ricegrass (Oryzopsis) will pass through the digestive system of a cow, he has never seen one to germinate in a cow patty. He saw little potential for using cattle to disseminate seeds of native plants in the Wyoming big sagebrush vegetation type (Refuge files). D. Pyke (National Biological Survey) also was asked to recommend techniques for seeding areas within the Wyoming big sagebrush vegetation type with native herbaceous plants. In his response letter, he did not list the use of cattle as a potential option (Refuge files).

There are at least 9 limitations for initiating a program on Hart Mountain NAR for disseminating seeds using cattle (in addition to adverse environmental impacts): (1) herbaceous vegetation is scarce in areas where seed sources are scant (i.e., forage for cattle is scarce); (2) water distribution is low in areas where seeds need to be distributed in the Wyoming big sagebrush vegetation type; (3) viability of grass seeds, after passing through the digestive tract of cattle, is low for most species tested; (4) viability of seeds after passage is highly variable from species to species and no work has been conducted on species native to Wyoming big sagebrush areas; (5) a tremendous amount of seed would be required to produce a small number of plants; (6) coordination of such a program would be resource intensive; (7) application of native seeds by other means would be more economical and efficient, (8) cattle could potentially disseminate noxious weed seeds (which are highly adapted to such a dispersal mechanism), and (9) cattle grazing could adversely impact already degraded habitats. Please refer to Appendix I for further discussion.

Competition

Comment

498 "The DEIS states cows would compete with antelope for forage. Antelope often utilize only 1% of the available forage. At a grazing level of 12,000 AUMs cattle were using less than 50% of the available forage on the portions of the refuge that was grazed that year. To say that at a level of 4,300 AUMs annually cattle would compete with antelope, an animal whose diet rarely overlaps with cattle, is ridiculous." (206)

Response. Although competition between pronghorn and cattle does not appear to be problem when forage is abundant, it can be a problem during critical periods when ecological conditions are low as they are on the Refuge. For instance, competition for nutritious forage during late spring and early summer can result in lower pronghorn fawn survival (Ellis 1970).

Comment

499 "The DEIS states that Bighorn Sheep would benefit from the removal of cattle. Yet even when grazing was at the 12,000 AUM level, Bighorn experts were worried that there were too many Bighorns and conditions were right for epidemic diseases. Livestock was not considered a problem. How the Bighorn are to benefit from total removal of cattle is unclear." (206)

Response. Bighorn sheep would benefit from eliminating cattle from areas within the distribution of bighorn sheep because cattle and bighorn sheep directly compete for forage.

PRESCRIBED BURNING VERSUS CATTLE GRAZING

Comment

500 "Grass that is harvested by cattle and sheep is turned into food [as opposed to burning]." (29)

Response. The objective of turning grass into food for human consumption does not fit within Refuge goals or long-range objectives. Livestock grazing does not produce equivalent habitat conditions as does prescribed burning.

Comment

501 "The several alternatives discussed in the DEIS lack a coordinated or integrated approach to restoration ecology. If grazing prescriptions have value and prescription burning also have value, why set up alternatives which essentially allow only one of these management tools to be used. Limited use of fire in conjunction with any of the grazing alternatives seems short sighted since shrub control has been identified as a major problem. Conversely, why eliminate grazing (which may be the best tool on hand to control the noxious weed and invading annual grass problems) in the intensively managed prescription fire areas? With fire to control undesirable shrub and woodland species and prescription grazing to control invading weeds, one can begin to make positive management steps toward the diverse, high seral ecological communities which existed prior to settlement." (205)

Response. The Service does not foresee any potential for using cattle on Hart Mountain NAR in the next 15 years to resolve core problems facing the Refuge, and has identified adverse impacts of their continued use. Therefore, it would not make sense to include cattle grazing in a comprehensive management plan aimed at restoring native habitats of the Refuge. Maintaining the potential for using cattle solely to control noxious weeds and cheatgrass would be misdirected because of the low probability of success, the large amount of control that would be needed, and adverse side effects.

Comment

502 "According to the work exemplified by Alan Savory at the Center for Holistic Resource [also called ecosystem] Management, Albuquerque N.M. and by others including Stan Parsons, the conclusions presented in the Draft EIS, Alternative D, the preferred alternative, are erroneous. Hart Mountain National Antelope Refuge is located geographically in the Great Basin in the Basin and Range Zone. The Great Basin is largely a brittle environment typified by vegetation that decomposes by oxidation rather than decay, seasonal precipitation and capped soils. Therefore, attempts to maintain mid-succession habitats by fire will have the following results:

1. Soils: Burned over, undisturbed soils will produce early succession growth (mosses, lichen, weeds aka forbs). The plant component will be mostly annuals with very shallow roots leaving vast interstices of bare ground. Contrary to the statement that vegetation evolved separate from fauna evolution, the dominant disturbance factors historically in the Great Basin were ungulates and humans. The total elimination of disturbance from the Hart Mountain environment will result in capped soils, sheet erosion accompanying precipitation and snow melt, limited litter production by the fine grasses and broadleaf weeds, and almost total removal of available litter during windy periods.

2. Water Quality: The effect of exposing vast burned over acreages of upland soils to water and wind erosion will lower water quality. Great Basin soils are susceptible to cutting during high water flows. The potential sedimentation resulting from the plan in Alternative D could overwhelm the riparian restoration accomplished during the past two decades.

3. Air Quality: Air quality in the area surrounding Hart Mountain, particularly in Warner Valley will decrease as the U.S. Fish and Wildlife Service burns 1,000 to 2,000 acres of brushlands per year as anticipated in Alternative D. The preferred alternative projects improvement to approximately 180,000 acres of refuge, that is 3/4 of the refuge proper. This assertion is just not truthful." (600)

Response. We agree that prescribed burning could potentially result in short-term reductions in herbaceous vegetation, and short-term increases in soil erosion, sedimentation in streams, and particulates in the air. We do not agree with other assessments made in the comment.

Comments

503 "Regarding the brush densities, I feel to graze the areas first and then do the burning would be more suitable. With more grazing there could be less burning." (9)

"The work on-going at Austin, Nevada by Tony and Jerry Tipton demonstrates the efficient and inexpensive manipulation of resources that occurs when livestock are used to maintain diversity of landscape. While burning may be a complementary manipulation tool, brittle environments prosper when domestic livestock are prudently applied to management objectives, particularly preparing a seed bed and implanting naturally occurring seeds and incorporating litter and biomass into the soil thereby encouraging microbial activity and nutrient cycling. Widely dispersed and occasional prescribed burns are an essential component of excellent pronghorn habitat. The basic amount of burning recommended in the preferred alternative is an irresponsible application of the tool by exposing brittle soils to wind and snow melt without effective means to accelerate vegetative recovery." (600)

Response. Burning is not complementary to (i.e., equivalent with) livestock grazing. What can be done with prescribed burning in uplands and woody-riparian areas (where most of the burning would occur), cannot be accomplished with cattle. On the other hand, some of the conditions created by burning in meadows (e.g., reduced herbage) can be accomplished with cattle grazing, but effects on ecological components and processes would differ between the two methods. At this time, cattle would not contribute to resolving core problems or reaching long-range objectives. Cattle grazing would reduce, not increase, the amount of litter cover. J. Yoakum (an authority on pronghorn ecology) was extensively involved with the development of Alternative D, and feels that the burning program would benefit pronghorn on the Refuge.

Comment

504 "Why do the authors think livestock and burning are not compatible? As they go from alternative to alternative, there is progressively more burning and progressively less grazing. Why? On page 26 of Appendix J, it is specifically stated that: "Prescribed burning, mechanical treatments, and herbicides would temporarily reduce herbaceous vegetation. However, over the long term, forb and grass cover would increase, benefiting the livestock program". Thus, if brush control was implemented, and AUM's stayed at current levels, the degree of utilization would decline." (730)

Response. Livestock grazing and prescribed burning are not compatible under the framework of what the Service would like to accomplish on the Refuge, as outlined in the Refuge goals and long-range objectives. We agree that it would be possible to have a livestock grazing program and a prescribed burning program; an example of this is Alternative B. As the amount of prescribed burning and cattle grazing increase simultaneously, management becomes more complex and conflicts increase (assuming that wildlife management is an overriding objective, in contrast to cattle production). With an intensive prescribed burning program, inclusion of cattle grazing would be difficult because burned areas should not be grazed for several years, and it would be desirable to leave some burns ungrazed. As more burning is done in more grazing units, there would be less opportunity for cattle grazing throughout the Refuge.

The writer is correct in the assessment that increased herbaceous vegetation through reduced shrub cover would result in a decline in the degree of utilization, assuming that AUM's removed by cattle remained constant (Refuge-wide). However, based on Refuge goals, the increased herbage would be reserved for wildlife -- for forage as well as cover for hiding, nesting, shade, thermal protection in winter, and perching. It also would be important for protecting and building soils which in the long-term would benefit wildlife. There is no indication that any herbaceous vegetation would be produced that is above and beyond the needs of wildlife.

SEEDING/PLANTING

Comment

505 "Seeding and planting should not be limited to just the herbs, shrubs, and hardwoods. It should include seed collection and plantings to sustain the stand of Ponderosa pine." (670)

Response. Juniper reduction and underburning would be conducted in the Blue Sky ponderosa pine stand during this planning period. These activities would improve the chances for establishment and survival of natural ponderosa pine regeneration. Ponderosa pine seed collection and planting is a viable alternative which would be considered when evaluating specific management decisions for that area.

INTERIOR FENCING

Comments

506 "interior fencing should be removed since it will not be needed for 15 years. If livestock grazing is re-introduced at some point in the future, new fencing will be needed anyway, and likely not in the same places. In the meantime, wildlife habitat and primitive recreational opportunities, as well as scenic values, will be enhanced." (47)

507 "Reduction of fences is also preferable. Wide open, unfenced areas are vital to this area." (52)

508 "Internal fences are unsightly and impair wildlife travel within the refuge. We urge you to remove fences and other livestock grazing facilities throughout the refuge." (74)

509 "Range Developments - Interior fencing, corrals, and water developments should be removed." (655)

Response. As proposed in the Proposed Action (Alternative D) of the FEIS, efforts would begin during this planning period to remove livestock grazing facilities (fences, cattleguards, etc.) inside the Refuge.

Comment

510 "A few suggestions: Would it be possible to plan for the removal of all interior fences not needed to control vehicles, manage campground, and protect private property?" (555)

Response. The amount of fence removal accomplished would depend on Refuge budgets and labor availability. Refuge staff and volunteer labor would be used. Priority would be given to areas where impacts to wildlife are highest.

Comments

511 "Is residual interior fencing consistent with goals of the CMP? Fence removal needs to be much more extensive. In fact, all interior fencing should be removed except as necessary to control vehicles, manage campgrounds, and protect private property. Metal fence posts and even barbwire (except where rusted and spliced) could be redistributed free on a case-by-case basis to support riparian exclosure projects taking place throughout eastern Oregon. This could all be implemented by volunteers. Not doing this (the proposed action) deserves economic and environmental impact analysis. As noted in many places in the DEIS, the impacts of fencing on wildlife, including all of the featured species (except trout), are deleterious and well-documented in rangeland literature. Alternative D should move beyond C to provide a better range in the Alternatives. There is every reason to doubt that the same pasture areas would be wanted if grazing is re-introduced in 2008. Moveable electric fences would be much more likely. In the meantime, these fences interfere with every major goal of the CMP. Any rancher will tell you a fence not maintained for fifteen years of Hart Mt. winters is less than worthless. In fact, this July, a local rancher attributed cattle trespass in Robinson Draw to the impact of just one winter's snow on the well-maintained Refuge boundary fence. Fences are still attached to junipers and wooden posts in many areas such as west Warner Canyon and Post Meadows. Fence maintenance as a DEIS objective thus interferes with the burning needed for habitat improvement. Fences should at least be dropped. A management plan that anticipates cattle re-introduction (maintains fences) doesn't give itself a fair chance for success." (521)

512 "Since the preferred alternative includes rest from livestock grazing for the entire planning period, there appears to be no justification for retaining any interior fences on the Refuge, except those necessary to control vehicles or visitor access, or to protect private property. Reasons to remove all fences include well-known and serious hazards that fences pose for wildlife and visitors and the fact that even if fences are necessary for livestock management at some time beyond the planning horizon, the locations may be very different. Also, if the fences are not removed, they must be maintained regularly each spring (at significant expense to the Refuge) if they are to retain any potential usefulness at the end of the planning period, and to minimize hazards." (745)

Response. We agree that fences will deteriorate over the next 15 years if left unmaintained. We are also aware of the expense of fence maintenance and the fact that many of the Refuge fences do not meet published wildlife specifications and therefore have a negative impact on some wildlife species (Refuge files). Maintenance of interior fencing is not an EIS objective. In fact, long-range habitat objective (3) for all habitats is to "minimize man-made structures that degrade wildlife habitat, hinder animal movements, cause injuries or death, or otherwise negatively impact wildlife". Unnecessary interior fencing would be removed as budget and labor availability allow. The fence removal strategy of Alternative D was revised (Chapter 2, FEIS). The idea of redistributing fence posts and possibly barbed wire is a good one, and has been relayed to the Refuge Manager.

Comment

513 "Why take fences down in NE corner and SE when most complaints are around the mountain?" (766)

Response. Based on this and other comments and a reevaluation by Refuge staff, the fence removal strategy of Alternative D has been revised in the FEIS to give priority of fence removal to areas of the Refuge where impacts to wildlife are highest. Using this criteria, fences in the NE and SE areas of the Refuge would be lower on the priority list than those on and around the mountain (please refer to the Livestock Grazing section of Section 1 under Alternative D of Chapter 2, FEIS).

Comment

514 "The DEIS raises the issue that one year 2 antelope were killed in a fence, this is unfortunate, yet that same year, tags were issued for the outright killing of over 200 big game animals. I am in no way against hunting but a double standard should not be applied to a grazing program." (206)

Response. We do not feel that a double standard has been applied to the Proposed Action. The impact of fences on pronghorn was not the primary reason for proposing the elimination of livestock grazing during this planning period. However, fences can impact pronghorn and other wildlife, and these impacts were disclosed. As noted above, areas where impacts to wildlife are highest would receive priority for fence removal.

BOUNDARY FENCING

Comments

515 "The refuge boundary fence should be repaired and maintained. This will prevent livestock from wandering onto the refuge from surrounding lands." (74)

516 "During a recent trip to NAR, I saw nine cows in the middle of the Refuge, an occurrence which I understand is not unusual. Boundary fences and gates should be repaired to prevent such incursions." (519)

Response. The boundary fence is and would continue to be checked and maintained every year by Refuge employees.

Comment

517 "Cattle and feral horse immigration into the refuge are continuing threats to the Refuge environment. Some people are asking the Service to construct or improve fencing around the Refuge's perimeter. OWF opposes the Service's construction or improvement of a perimeter fence. OWF understands that materials and labor for fence installation cost nearly $4,000 per mile. Besides installation costs, high fence maintenance costs will also saddle the Service. These costs are too high to justify. The Service would be better off spending its money on ecological monitoring programs and not on expensive fencing.

A perimeter fence will have non-monetary costs as well. It will isolate the Refuge from surrounding areas. For example, pronghorn which intend to move between the Refuge and other locations might not be able to do so. Animals which attempt to cross over or under the fence may get injured or even killed in the process. Perimeter fencing will also increase predation on juvenile ungulates.

In Phase II of the planning period, OWF suggests that the Service begin removing any fences, gates, or cattleguards which may exist on the Refuge's perimeter if those fences are not also fences for neighboring grazing allotments. Without fences, Refuge wildlife species will be able to roam throughout more of their original range. As the Service acquires more land for a wildlife corridor, it could remove or direct volunteers to remove more fences." (695)

Response. Hart Mountain NAR is surrounded by both public grazing allotments and private grazing areas. Removal of perimeter fencing would allow for unimpeded cattle and feral horse immigration onto the Refuge which could result in detrimental impacts to wildlife and habitat. Currently there are approximately 59 miles of boundary fence on the Refuge. We do not foresee any large blocks of new fencing needs, although several areas do need replacement or repair. All new Refuge fences would be built to published specifications (Kindschy et al. 1982, Van Dyke et al. 1983) to allow for the least impact to wildlife while maintaining the necessary barrier to livestock and horses. In 1993, materials and labor for a boundary fence on the Sheldon National Wildlife Refuge were approximately $2,700/mile (Refuge files).

WATER MANAGEMENT

Water Developments

General Comment

518 Pardue - Gary, since you are out there and you know the country and you see it every day, if the grazing is totally eliminated on the mountain, where are the antelope going to go?

Miller - Where they have already started to go. The fence just divides us. The antelope are all over with the cows. They are right in the middle of them. We hauled thousands of gallons of water last year and that is where the antelope come. They are not afraid to drink out of a trough. The first year, they told us we couldn't haul water. One of the reasons was they were afraid that the antelope wouldn't drink out of the trough. That's not true. A lot of them left and never came back because of that...

Bill Barry - I can back up Gary. This goes clear back to 1936. I was a little kid with my dad and my uncle was pumping water out of a well in Guano Valley. There was no water within 20 miles. So I asked him 'Why are you pumping water for. You don't have any sheep around there.' There were at least 300 head of antelope out on the edge of that lake. He said 'Those little fellows over there will die, if I don't do this every week. You watch, when we leave, they'll come in and they will help themselves.' They did, right out of the trough." (781)

Response. Comment noted.

Comments

519 "The Final EIS needs to address in more detail the issue of waterhole maintenance by identifying those waterholes that are not essential. Perhaps it is not intended that we maximize the number of any particular game species to the detriment of naturally functioning hydrological processes, which benefit the entire ecosystem." (47)

520 "Water management was not addressed in the plan. Proper water distribution is essential to optimum wildlife populations. Water availability has been altered heavily over the years through homesteading and livestock management activities. It would seem restoring the natural distribution and adding new water where necessary will be a major job over the years and funding must be obtained. Please include a discussion of and an outline of water management projects in the final." (736)

Response. It is agreed that the FEIS provides a limited amount of detail on the issue of Water Development. However, a comprehensive water management plan is not entirely necessary given the brevity of water development on Hart. The simple adoption of a Refuge policy pertaining to water development should suffice.

The history of waterholes on Hart Mountain NAR evolved primarily from the need of water for domestic livestock. Strategically locating waterholes in areas which exhibited a potential to collect run-off aided in the geographic distribution of livestock and facilitated grazing in areas once void of water and reduced overgrazing in areas distant from other water sources (Refuge files).

Implementation of Alternative D would eliminate the use of cattle and therefore leaves only wildlife (primarily pronghorn) to be considered in the way of water development. Drought can reduce the vitality and fertility of pronghorn (Hailey and others 1966,Jones 1949). Pronghorn have killed themselves trying to get through fences to reach water (Baker 1967). It is well known that pronghorn require water, the only question is how much and how often. (Sundstrom 1968b) reported that optimum rangeland habitat has drinking water available at intervals of less than 8 kilometers (5 miles). Some animals may be found further than 8 kilometers from water, but Sundstrom (1968b) observed that 95 percent of over 12,000 pronghorns were within 4.8 to 6.4 kilometers (3 to 4 mi) of water. Water consumption by pronghorn varies inversely with the quality and succulence of available forage. When succulent forage is available, one liter (.25 gal U.S.) of water per animal per day is sufficient. When succulence exceeded 75 percent, animal did not drink (Beale and Smith 1970). During dry summers, 4.2-5.7 (1.1-1.5 gal U.S.) liters per day may be needed (Beale 1966).

Present management recognizes the over abundance of waterholes on Hart and the high cost of maintenance. As of 1993 the unwritten policy of the Refuge has been to maintain no more than one waterhole at radial intervals of two miles. All other waterholes within two radial miles will not be maintained, bulldozed or otherwise refilled with soil. As stated in the DEIS (pg. 69 Water Management, second sentence) maintenance of waterholes (waterholes have a tendency of silting in) will occur on 5-15 year cycles and impoundments located in drainages will be evaluated as to their environmental impacts. This strategy eliminates the need for creating new waterholes as we presently have an over abundance.

Comments

521 "Will stock ponds be restored under Ecosystem Management? Waterhole developments considered in the DEIS are unneeded attractive nuisances encouraging trespass cattle and feral horses, concentrating use in fragile freshwater playa areas. Since better habitat on the Refuge will intensify livestock pressure on boundary fences, the proximity of water is a significant issue. In wet or average years, the antelope -- the most aerobically fit of all terrestrial vertebrates -- hardly need them; in dry years, more water will be available because of riparian restoration; in prolonged droughts, the artificial waterholes are all dry in any event. I am providing a map showing an example in the Alger Lake area of five stock ponds (one of which entirely destroyed a small playa) excavated within two miles [four antelope-minutes] of a natural semi-permanent waterhole [not shown on USGS quad map !]." (521)

522 "FWS' own consultant [Van der Schaaf] wrote about the Spanish-Mound-Long Lake area in 1991 that bunch grasses are "mostly absent [around freshwater playas] due to livestock grazing pressure. This is especially true on playas which have dugout ponds in the center of them, thus acting as concentration areas for cows for miles around." I found this to be the case in 1993 for trespass cattle and feral horses in the Alger-Desert-Nora-Dobyn Lake area as well. The cattle trough occupying the mouth of Mound Creek is a particular eyesore, as is the unsightly and dysfunctional berm parallel to and east of Rock Creek. The 1992 excavations in Paiute Reservoir needs remediation. Spanish Lake waterholes were a non-use area for antelopes again in 1993, as judged by tracks in September. Irrigation structures at Big Flat is another problematic subject. Waterholes further attract and sustain coyote in antelope fawning areas. Exotic weed seed beds become established on sidecast material." (521)

523 "Wetland fill and removal may require a permit for activity exceeding fifty cubic yards retroactive to 1 July 1977, the onset of the Clean Water Act. Playas and seasonal wetlands are certainly jurisdictional wetlands and will continue to be so under the August, 1993 White House policy paper. The readily available NWI maps described excavated wetlands existing in 1983. Aerial photos can easily distinguish maintenance of existing facilities from new developments. Neither COE nor DSL is aware of any permit applications from the Refuge. This is not surprising because waterhole designs fail to meet basic permit issuance criteria such as need for the action, availability of less destructive alternatives, avoidance of unnecessary impacts (sidecasting fill adjacent wetlands), and no-net-loss mitigation (impractical in the desert). Permit issuance [like herbicide use]would likely be contested by major environmental groups." (521)

524 "The CMP does not systematically discuss plans for these stock ponds. Philosophically, maintaining stock ponds, internal fences, and irrigation ditches (Big Flat) anticipates a cattle re-introduction in 2008. These structures diminish the prospects for success of the CMP and are certainly not a component of ecosystem management. Additionally, they represent a schizophrenic management seen throughout the DEIS: habitat restoration and natural populations of wildlife alternates with commodity maximization [guzzler mentality] favoring artificial habitat if it generates a few more hunting tags or duck stamps [e.g.,Malheur]. The FEIS needs a consistent management philosophy throughout." (521)

Response. The most recent documented record of new waterhole construction dates back to October 20, thru December 3, 1980. It was within that time frame that 17 new waterholes were excavated by C.I.C. Construction from Sparks, Nevada under BLHP contract (Al, Decision, Riffle, East 44 Lake, East Reservoir Lake, Lower Bitterbrush, Green Lakes, Mound Lake, Juniper, Little Buck, Middle Cat Lakes, Tony Lake, Fred Pond, Nora Pond, Roadside, South Boundary, and Alger Lake (Refuge Narrative 1980). There has been no recent excavation within Paiute Reservoir, although rehabilitation of waterholes within the general area occurred in September and October of 1992 (Refuge Narrative 1992). Establishment of exotic weeds on sidecast material does not appear to be a problem on the Refuge.

The Refuge appreciates your heart felt concern regarding our compliance with federal wetland regulation. As you are aware, numerous changes in wetland regulations and policy have recently occurred and the Refuge has every intention of complying, when and if our activities warrant.

The trespass of cattle onto the Refuge is not caused by the proximity of waterholes to the boundary fence. The problem emanates from broken fences and visitors who fail to close gates they have traveled through. The boundary fence to the Refuge is inspected in the spring of each year and maintained and repaired throughout the year.

The irrigation canals at Big Flat were constructed to provide maximum forage production for cattle grazing. We no longer have a need for such canals and therefore they will be allowed to fill with sediment and vegetation. Internal fence removal is addressed in Alternative D of the FEIS.

We are sorry you feel that the DEIS represents schizophrenic management but, perhaps some of the changes in the FEIS will be of some consolation. Please also refer to the response to the above comments.

Comment

525 "[page] 69 I don't understand the second sentence in the paragraph "Water Management". Should the word "maintained" be replaced by "reviewed"? (555)

Response. The word maintained defines the action which is necessary to keep the waterhole functional. Waterholes require maintenance as they slowly accumulate large amounts of silt which reduces water holding capacity.

Comment

526 "I believe that the opportunity to create new waterholes should be left open. There may be some natural changes take place that make this necessary." (670)

Response. Thank you for your comment regarding waterholes. We agree that we should allow ourselves the opportunity to create new waterholes if needed. Although, the likelihood of the Refuge creating any new waterholes is slim. This is due to the over abundance of waterholes which presently exist.

Water Quality

Comment

527 "The final EIS should list the designated uses of any affected waters, and it should fully disclose all water quality impacts on these waters." (32)

Response. Designated uses of all waters on the Refuge are for wildlife purposes with the exception of domestic use for water originating at Valet Spring.

Water quality impacts may initially occur on 2 sections of the Barnhardi Road (Guano and Rock Creeks) that would be rerouted under Alternative D. At these sites, upland vegetation would be disturbed and erosion could occur. To minimize erosion, roads would be placed along contour lines and designed with switch-backs in areas of moderate slopes. The road from Post Meadow to Big Flat would also be rerouted around meadows where possible. Currently, portions of the Barnhardi Road travel through riparian areas causing stream sedimentation, soil compaction, and wildlife disturbance. The Service has not conducted a sediment assessment. However, upon evaluation of the best available information, the Service has determined that rerouting these road segments would be of net benefit to water quality and wildlife.

The Service also proposes to reroute the road that currently runs through the Refuge headquarters. This road initially would negatively impact the vegetation and would potentially impact water quality. Mitigation measures would include rehabilitating the existing road, installing a bridge where the bypass road would cross Rock Creek, and installing a longer bridge to allow floodwaters to pass beneath the bridge. A longer bridge would allow flood waters to disperse to a greater degree than possible with the current bridge. Long-term effects of the rerouted road would be no different than the existing road.

Impacts on water quality by mechanical treatments of Wyoming big sagebrush or low sagebrush communities would depend on precipitation patterns, slopes, and response of herbaceous vegetation to the treatment as well as method of mechanical treatment (USBLM 1991). The majority of precipitation generally falls on the Refuge in the winter as snow or gentle rains that would not greatly erode exposed soils. However, infrequent, intensive summer thundershowers could erode disturbed soils. Treatment sites would only occur on gentle slopes thereby minimizing soil erosion. Although reducing woody vegetation and increasing herbaceous cover is an aim to mechanical treatments, a viable seed source of herbaceous species may be a limiting factor in some sagebrush communities. If herbaceous cover does not increase and stabilize the soil after shrub removal, some soil erosion may occur. Seeding of native grasses and forbs following mechanical treatments would be implemented where native herbaceous vegetation are insufficient.

Impacts on water quality by prescribed burning would also depend on precipitation patterns, slopes and response of herbaceous vegetation to the treatment. Prescribed burning in the spring would have a lower potential for soil erosion than fall burning, because of the shorter duration until herbaceous regrowth. However, burning in the spring is often hampered by high moisture conditions.

For information on the effects of herbicides on water quality see comment 388.

Comment

528 "The final EIS should provide a detailed description of the existing physical, chemical, and biological characteristics of streams, lakes, and other water bodies in the planning area. Identification of the affected watersheds on alternative and other maps clarifies the relationships between local waters and proposed project activities." (32)

Response. Information on physical, chemical, and biological characteristics of streams, lakes and other water bodies on the Refuge is limited. However, Table 3-7 provides a summary of resource condition of Hart Mountain NAR streams, by gradient class. Table 3-8 provides stream characteristics of Rock Creek (ODFW Aquatic Inventories Project, 1991). Map 1-4 illustrates vegetation types of Refuge wetlands. Chemical analyses of water are few. On Nov. 24, 1985, a water sample collected at the headquarters was tested by Neilson Research Corporation. The water source for the headquarters is Valet Springs and may provide some indication of water quality on the Refuge. Test results are listed below. "None detected" is abbreviated as "ND".

Arsenic, As	ND @ 0.005	pH	7.34
Barium, Ba	ND @ 0.1	Specific Conductance	630
Cadmium, Cd	ND @ 0.001	Turbidity	0.2
Chromium, Cr	ND @ 0.005	Corrosivity	-0.65
Fluoride, F	1.64	Alkalinity	221
Lead, Pb	ND @ 0.005	Calcium	16.74
Mercury, Hg	ND @ 0.0005	Total Dissolved Solids	503
Nitrate, NO_3 as N	ND @ 0.05		
Selenium, Se	ND @ 0.002		
Silver, Ag	ND @ 0.005		
Sodium, Na	122		

Maps are included in Appendix N of the FEIS that identifies proposed project areas and affected waters.

Comment

529 "Will Refuge activities comply with the Clean Water Act, Section 401? Section 401 of the federal Clean Water Act is not cited by the DEIS in Appendix A. A new bypass road at the headquarters is discussed but not analyzed for possible environmental impacts. Underground storage tanks (USTs) at the Headquarters maintenance area are not identified by location, construction material, or status (leakage). There is no discussion of possible soil contamination, no plan to construct above-ground moated tanks, and no talk of compliance with new DEQ regulations. These tanks are unfortunately located where a spill would discharge directly into Rock Creek. The proposed action (the CMP itself) lets USTs "rest 'til they rust," despite the emphasis on riparian habitat and water quality goals. It is very expensive to remove contaminated soil to a certified hazardous waste landfill. Section 401 compliance should have a higher budgetary priority than new tourism facilities." (521)

Response. The Refuge intends to comply with the Clean Water Act, Section 401, and this legislation was added to Appendix A. In compliance with DEQ regulations, the Refuge plans to replace all underground storage tanks at the headquarters area with above ground, metal tanks placed on concrete. In addition, the generators will be relocated to the southeast corner of the headquarters yard in an effort to reduce any potential impacts to Rock Creek. Replacement of storage tanks and relocation of generators are scheduled to be completed during the summer of 1994.

Please refer to comment 527 for an analysis of possible environmental impacts of the proposed reroute.

Comment

530 "Will Refuge activities comply with the Clean Water Act, Section 404? Section 404 of the federal Clean Water Act is not cited by the DEIS in Appendix A. There is no mention of the 1987 Federal Manual official definition of wetland. The inter-agency scientific and legal consensus is to use this definition until the National Academy of Science revision is available in early 1994. There is no map of hydric soils. Jurisdictional wetlands on the refuge have certainly not been delineated. (Neither map 1-4 nor the National Wetland Inventory maps are acceptable to wetland regulatory agencies as delineations.) The Refuge should be aware that riparian-associated wetlands are regulated quite distinctly from riparian zones. Riparian vegetation is improperly not distinguished from lacustran, palustran, and vernal pool habitat in the glossary. Consequently, proposed actions cannot be analyzed for compliance with this major federal legislation. There

is no acknowledgment of the need to obtain 404 permits from the Corps of Engineers and the Division of State Lands for the numerous wetland fill/removal activities proposed by the CMP that do not qualify for a "nationwide" (categorical) exemption. Prior unpermitted fills are not identified and the need for after-the-fact permits and compensatory mitigation is not discussed. Heavy equipment in wetlands (e.g., trucks in Flook Lake) requires a permit because of compaction, vegetation damage, and water quality concerns. Neither DSL nor COE can recall prior wetland permit applications from the Refuge. Land management agencies often exhibit the attitude that they are somehow "above the law" on wetlands (because of noble intentions). However, "improvements" are often in the eye of the beholder." (521)

Response. The Refuge will comply with the Clean Water Act, Section 404 and this legislation was added to Appendix A. We acknowledge that 404 permits from the Corps of Engineers and the Division of State Lands are required for wetland fill/removal activities that do not qualify for a "nationwide" exemption. A map of soil types was developed but is not presented in the EIS. The definition for riparian vegetation was revised in the glossary.

Comment

531 I have a question on water temperatures - is it above 68 °F? (777)

Response. Little standardized information is available on Refuge water temperatures. Based on information provided in section on streams in Chapter 3 of the FEIS, maximum summer-time temperatures in Rock Creek above the Hot Springs Campground seem to not exceed 61 °F, while below the campground, they approach 80 °F in places. These temperatures reflect only portions of the creek in which trout are known to occur. Guano Creek shows similar patterns for comparable elevations (please refer to Chapter 3 of the FEIS for further detail). As pointed out by Bowers et al. (1979), temperatures should not exceed 70 °F in trout streams of southeasern Oregon. Certain strains of native trout, however, can withstand water temperatures of 80 °F for short periods during the day (Bowers et al. 1979).

Water Rights

Comment

532 "The water rights issue has not been addressed. There are many problems and potential problems that the refuge staff have overlooked. We believe this to be a critical part of the management of the refuge and any planning that is, or may be done. It is imperative that all current water rights and any violation or abandonment should be addressed." (731)

Response. We agree that the water rights issue is important to the management of the Refuge; however, it is beyond the scope of this EIS/CMP.

REINTRODUCTIONS

General Comments

533 "Oregon Wildlife Federation supports the Service's attempts to reintroduce native plant or animal species, including attempts to reintroduce the Sharptail Grouse." (695)

534 "The FEIS should consider reintroduction of all extirpated species into Hart Mt. NAR, including wolf and grizzly (if they were, in fact, components of the original ecosystem)."

Response. Comment noted.

Comment

535 "It (Alternative D) makes possible the reintroduction of sharptail grouse." (358)

Response. The reintroduction of sharptail grouse is being considered. ODFW and OSU are attempting to reintroduce sharptail grouse to northeast Oregon at this time. If they are successful, the Service may pursue reintroductions.

Comment

536 "Have gray wolves, like sharp-tailed grouse, been extirpated from the Refuge? The DEIS to quick to dismiss wolf reintroduction under alternatives not developed, page 87, saying "information was not found that wolves were resident in the area of Hart Mt." Are wolves "resident" anywhere? The last gray wolf was

killed in 1931 around Summer Lake. The Service could probably find record for wolves at the Refuge if it tried a little harder. Perhaps there is some reason for embarrassment: Merle Jacobs, a trapper for Fish and Wildlife Service, dba Bureau of Biological Survey, trapped predators around Long Lake, Jack Lake and Guano Creek in the late 1920's; surely his bounty records include wolves and denning results. [Sheep predominated in this era, not cattle.] Vernon Bailey, again of Bureau of Biological Survey, also dealt with Canis lycaon nubilis in the Malheur area in 1936. The Refuge may well not be four-season habitat suitable for wolf reintroduction, but the DEIS should establish the facts separately from any analysis and policy." (521)

Response. The Service has not found any evidence of wolves being anymore than transitory visitors of the Hart Mountain area. Even if the Service were to consider reintroduction of wolves it would entail extensive studies on the suitability of habitat and the impacts to the surrounding areas far beyond the Refuge boundaries. This is beyond the scope of the EIS.

Comment

537 "Reintroduction of wildlife should be limited to those that are common or were common in the area." (670)

Response. Under the Proposed Action (Alternative D), only wildlife species formerly known to occur in the area would be reintroduced.

PREDATOR CONTROL

General Comment

538 "We [ODFW] agree with your assessment. Predator control is certainly not needed on Hart Mountain for pronghorn, mule deer, or sage grouse at this time, particularly with the extremely low hunting mortality due to the conservative seasons used there." (7)

539 "I do not support predator control activities..." (45)

540 "(page) 71, last par. I'm very skeptical of predator control Usually its need (?) arises because human activities are not properly controlled or directed. I suppose it might be needed when certain species are reintroduced and aren't used to predators. It might also be applied to certain herbivores when certain plant species are reintroduced. In general, regulating human activities is preferable." (555)

Response. Comment noted.

Comment

541 "I hope that trapping of animals is prohibited (I really mean steel-jaw or leghold trapping)." (27)

Response. Trapping for fur-bearing animals is not allowed on the Refuge at this time and there are no plans to start.

Comments

542 "Recently, I traveled through Montana, Idaho, Wyoming and Colorado. Those states seem to have a lot of game. In talking to their State Game people, they are not letting predators wipe out the game. Perhaps we have too many cougars and coyotes without proper controls. It seems to me that all species need to be better managed. Then there just might be enough for cattle grazing on Hart Mountain, sportsmen to harvest the game and yes, the looker with camera." (44)

543 "I would also suggest that some sort of predator control be implemented to keep the coyote population down, this would be beneficial to all game animals. The deer population seemed depressingly low to me." (533)

544 I would like to see a much more aggressive control program, especially on coyotes and ravens. (755)

545 "..But in those days, they had a lot of sheep on the mountain. They had a lot of cattle. More probably in those days, than they'll ever see again. You know, since the sheep left, they don't have the trapper up there taking care of the coyotes or the predators, so they don't have the animals for the coyote to eat, so he's

killing more antelope and more deer, more sage chicken. He don't have the sheep to eat on. He don't have the calves to eat on, or an old dead cow. So there is no predator control. I've been up on that mountain with the Order of the Antelope for 30 years and I've been on that mountain several times a year when I lived underneath the base of it. This year, I never seen one deer or one antelope. Last year I see one, or the year before I seen one. I don't know what they are trying to prove. They don't want the horses. They don't want people. They don't want...It don't seem like they want anything except a place for themselves. It isn't for the people by the people. It's for the Fish and Wildlife by the Fish and Wildlife." (789)

Response. The Service agrees that predators can affect populations of mule deer and pronghorn. However, on Hart Mountain, degraded habitat is likely the primary limiting factor. Degraded habitat can impact fawning cover and hiding cover for fawns, which can elevate predation rates. Other problems caused by degraded habitat are availability and quality of forage, quality of thermal cover and availability of water. A predator control program on the Refuge during the 1950s and 1960s resulted in increased fawn survival (McNary 1980, Refuge files). However, only slight increases in pronghorn populations were noted between 1955 and 1969 (Refuge files). Apparently, fawns that survived because of predator control died of other causes. Udy (1953) investigated the results of predator control on pronghorn fawns and concluded that rangeland conditions affected pronghorn populations more than predation in the Great Basin of Utah. Connelly (1981) evaluated many mule deer/predator cases and concluded that "In no case has predation by coyotes or mountain lions been documented as the principal cause of mule deer population decline." Connelly also stated "Mule deer numbers ultimately are limited by quality and quantity of habitat." Beale and Smith (1973), Yoakum (1980), and O'Gar and Yoakum (1992) also found that the cumulative effects of predation ultimately appear to be regulated by habitat quality. Changes in vegetative succession brought about by the livestock grazing towards the turn of the twentieth century greatly stimulated the increase in numbers of deer in the Great Basin (Urness 1976, Longhurst et al. 1982, 1983). However, this same factor of heavy livestock grazing use of vegetation in deer habitats during the mid-twentieth century, led to deterioration of preferred forage which in turn seems to have contributed to the decline of mule deer herds in the latter half of the century (Dasmann 1949, Peterson 1970, Tueller and Monroe 1975, Spalinger 1980, Longhurst et al. 1983). Please also refer to comments 538, 547, and 548 and their responses.

Comment

546 "In the past few years, A.D.C. (Animal Damage Control) have conducted control measures from the South Boundary of Hart Mt. to Hwy 140 East for Deer Enhancement. This area is a wintering area for mule deer, along with other species such as sagegrouse and antelope.

During A.D.C.'s work in the area, O.D.F.W.'s deer counts have showed a definite improvement in the doe to fawn ratios.

During A.D.C.'s activities in this area I witnessed a very high percentage of predators (coyotes) with the various sized groups of sagegrouse.

I have been informed due to budgets, O.D.F.W. will no longer be able to do this Deer Enhancement work. I also feel that many of the deer, antelope, and sagegrouse in this Beatty's Butte Management area came from Hart Mt.

I don't feel enough emphasis was placed on predator control in your report. I think more emphasis should have been placed on the Lemas report as well as the report by C. Trainer. The reports show a very high percentage of antelope kids and deer fawns were lost to predation. I also feel that without any predator control being done on the refuge as well as off the refuge, but in the area. That many species such as deer, antelope, and especially the sagegrouse will suffer large losses in total numbers." (809)

Response. We agree that an effective predator control program can positively influence populations of pronghorn, mule deer, and sage grouse. Trainer et al. (1978), Lemos et al. (1978), and others support this assessment. However, as discussed in the response to the previous comments and in the Featured Species section of Chapter 3, sufficient evidence indicates that the influence of predation would have less impacts on these species if their habitat is in a healthy condition. The Service, under Alternative D, would not attempt to maximize populations of game species of wildlife and would recognize predators as part of the ecological system of the Refuge.

Comments

547 "I support your low emphasis on predator control. If you are managing for natural ecosystem processes, you will need a full complement of native species, including coyotes, cougars - maybe someday wolves." (48)

548 "Predators should be considered functional components of ecosystems rather than obstacles to producing wildlife." (540)

Response. The Service agrees with these comments with the possible exception of wolves for which we have found no evidence of them occupying the Refuge on a permanent basis, although it is believed they occasionally wandered through.

Comment

549 "Predator control may be appropriate if habitat conditions are improved but predators are limiting recruitment." (540)

Response. Predator control may be appropriate if a certain species is especially vulnerable while habitat is improving. The cumulative effects of predation ultimately appears regulated by habitat quality (Beale and Smith 1973, Yoakum 1980, O'Grar and Yoakum 1992).

Comment

550 "P. 71. We generally prefer that there be no predator control on the Refuge, but if the Service believes that predator control must remain an option, we ask that the Plan be more specific about when predator control can be used (e.g., only to protect T & E species? Which species may be controlled?), and the means of predator control that can be considered. Again, the Plan does not measure the environmental impacts of predator control." (622)

Response. The only legitimate reason for initiating a predator control program would be if the Refuge was in jeopardy of losing a certain species and could prove that predation was the cause. If the Service determined that predator control was needed for their continued existence, the environmental impacts would be studied in accordance with the National Environmental Policy Act before any action was taken. At this time, the only threatened and endangered species that use the Refuge are transitory (bald eagle, peregrine falcon) and do not breed on the Refuge.

Comment

551 "Predator control should be used very little, if at all. The best way to reduce predator influence on animals is to increase the habitat cover. Predator control is a waste of money and time. Better cover and habitat is the only way to reduce predator impacts. As a rancher in western South Dakota who runs 300 cows, I have seen where ranches with overgrazed land had a lot more predator problems than on ranches with good cover and habitat." (628)

Response. The Service agrees with this comment. Although predator control can be useful in some situations, habitat management would be a more effective strategy on Hart Mountain NWR. In good quality habitat, prey species are more successful at avoiding predation and at reproduction. Also see comments 210, 225, and 538.

Comment

552 Without predator control, Hart Mountain will be a magnet for predators. (766)

Response. Although information is limited, there is a possibility that the Refuge may act as a magnet for some predatory wildlife. However, as explained elsewhere, the Service believes that restoring habitats to healthy condition would reduce high predation rates on some wildlife species such as sage grouse.

Comment

553 Government land managers should not be affected by political ups and downs of public opinion. (in reference to predator control). (768)

Response. The Service agrees with this statement and believes that the Proposed Action is based on the best scientific data we have available at this time.

FEERAL HORSES

General Comment

554 "An aside--thank you for honesty in language. It is most refreshing to read of "feral horses" rather than "wild horses." BLM gathered several hundred horses from the Willow/Whitehorse Creek basins of the Trout Creek Mountains--but did not reduce cattle numbers significantly--with predictable results. When 3000 cows, calves and bulls are grazing an unprotected desert riparian/riverine wetland area, removing 300 mares, foals, and stallions, but keeping more than 9,000 cattle AUMs doesn't make much sense. But it does make one appreciate a management plan which addresses fish and wildlife needs first!" (732)

Response. Comment noted.

Comment

555 "You may have to control the herd, but don't kill it off... I'm sure there's room for a few." (2)

Response. Elimination of the horse herd on the Refuge would allow for the greatest amount of habitat recovery, would eliminate (reduce) competition with native wildlife (feral horses are a non-native species) for forage and water, and would benefit Refuge goals and objectives. (see page 72 vol. 1.)

Comment

556 "I oppose any inhumane extermination of the horses." (27)

Response. No extermination of horses is planned.

Comment

557 "Page 72, Vol. 1, under Feral Horses, top of page: Wild horses exist on adjacent BLM public lands and will possibly wander onto Refuge lands - how will you deal with wild horse herds re-establishing themselves back on Refuge lands?" (531)

Response. Feral horses now inhabiting the Refuge will be gathered by the Service and given to a private organization which will adopt them out. Any horses re-entering the Refuge would be gathered by the BLM to be adopted out or relocated.

Comment

558 "Volume I, page 72, Feral Horses: Refer to the first statement, "...horses that subsequently move on to the Refuge would be periodically removed...". We suggest that you plan to maintain existing periphery fences to exclude wild horses and cattle grazing on adjacent BLM lands. Should horse removal prove necessary, you should coordinate with the BLM, as we have legal responsibility for managing an adjacent Wild Horse Herd Management Area. Wild horses moving onto the Refuge may include animals we have intentionally relocated to improve adoptability of the future herd, or may include animals under research." (541)

Response. The Service would maintain the exterior fence and BLM would be contacted before any feral horse capture takes place.

Comment

559 "Oregon Wildlife Federation understands that a native equine species existed in the western interior until approximately 3,000 - 7,000 years ago. Is it possible that animal's range could have included the Refuge? OWF suggests the Service search intensively for an answer to this question. If the Service finds that no native horse species ever lived on the refuge, the Service should adopt a no horse policy and remove all horses from the Refuge soon. If the Service finds that there were horses on the Refuge, then OWF suggests that the Service continue its present policy of periodically thinning horse herds." (695)

Response. Equines became extinct in North America 8,000-11,000 years ago. Equines were reintroduced with the arrival of European settlers, and are no longer part of the native wildlife community. With the help of the American Indian, horses spread throughout the western United States during the 17th and 18th centuries, and they persist in many areas as feral populations (Berger 1986, as cited by Garrott et al. 1991). The horses now residing on the Refuge are direct descendants of domesticated stock and not the original equine species that evolved in North America. Therefore, they are considered feral.

WEED MANAGEMENT

Comment

560 "I urge you to adopt an explicit policy of preventing introduction of exotic species and managing for the elimination over the long term of those that already exist on the Refuge. Unfortunately, many refuges permit continued expansion of introduced species or even promote them. Thus, for example, Russian olive, Eleagnus, is expanding at Malheur and is present and expanding at refuges all over the West." (504)

Response. Hart Mountain NAR has a long history of implementing numerous methods of weed control. We have utilized herbicides, fire, and mechanical methods. We have no intention of allowing potentially noxious vegetation to go unaddressed. We are aware of the location of these plant communities and are currently implementing mechanical means for controlling them (e.g. white top, Canadian thistle, and Mediterranean Sage). All refuges are prohibited from introducing exotic plant and animal species as per the Code of Federal Regulations (CFR) Title 50 Part 27.52.

We appreciate your comments regarding weed control as it has prompted us to include in the FEIS a section on weed control.

Comment

561 "How do exotic plant species become established at the Refuge? Table E-3 lists 25 species of exotic, non-native plants which are properly considered undesirable . To a very large extent, these plants seem to become established along roadsides because of Refuge activities. The DEIS does not discuss ways of mitigating impacts of road maintenance (e.g., by not grading road margins so excessively). Proposed new roads and relocated roads would create fresh and permanent areas (not quantified) of disturbance that may more than offset proposed benefits. The road-to-trails alternative is not considered. Discing, chaining, and railing are considered as vegetation management options for sagebrush. These will result in severe soil disturbance and invasion by cheat grass. Discing will be an unmitigatable disaster. Roto-flailing (hydraulic weed-wacking) is preferable because it minimizes ground compaction and soil erosion. The sagebrush just needs to be set back, not obliterated." (521)

Response. Exotic plant species become established through introduction of plant or seeds. Most of the exotic plants on the Refuge today were introduced by cattle and horses. These exotic plants thrive on disturbed sites and are considered invader species. The presence of these species along the roadside is not due to Refuge activities, but due to their introduction and nature.

The construction and maintenance of roads is a much needed necessity which grants mobility. The fundamentals of gravel road construction require the road to consist of ditches free of vegetation, and a crowned road surface to facilitate draining and the recovery of gravel to be placed back on the road when grading. The width of a ditch is no greater than the width of the standard grader blade (8 feet). The establishment of exotic weeds on the roadside is not a problem, is easily controlled, and does not warrant modification to road construction techniques. Whenever possible, the least soil disturbing mechanical method will be implemented in managing vegetation.

Comment

562 "Shrub Removal and Cheatgrass: The Wyoming big sagebrush habitat-type is an area of concern due to the potential for cheat grass invasion in these areas. Although the plan calls for treatments to reduce cheatgrass invasion, it is not clear what these would be or the level of success that might be anticipated in preventing domination by cheatgrass. For this reason it might be prudent to follow a conservative, experimental approach prior to making any large burns where cheatgrass invasion is possible. In areas where fires will not carry, herbicide treatment would seem preferable to mechanical disturbance as it would not disturb soil structure." (540)

Response. We agree with your comment and a conservative, experimental approach will be taken in shrub removal and cheatgrass control. Whenever possible the least soil disturbing vegetation controlling technique will be implemented.

Comments

563 "The EIS omitted an analysis of noxious weed control as an issue if this foolhardy scheme, Alternative D is adopted." (600)

564 "The noxious weed or undesirable plant community control has not been discussed in the plan. The negative effect of irresponsible spread of identified noxious plants directly affects adjoining land owners, and can destroy an ecosystem if left unmanaged. We believe Hart Mountain National Antelope Refuge to have communities of identified noxious weeds." (730)

Response. We appreciate your comment regarding weed control as it has prompted us to include in the Final Environmental Impact Statement/Comprehensive Management Plan a section on weed control.

MONITORING

General Comments

565 "We only urge you to use this opportunity to extract the maximum amount of biological data possible. This information may someday be critically important to the U.S. Fish and Wildlife Service and to other state and federal agencies in restoring and managing their lands and in developing ways to manage with as little intrusion on natural processes as possible." (519)

566 "Evaluating Management Objectives: From the perspective of future conservation efforts, the collection of quantifiable information documenting base-line information and the effects of treatments on plant and animal communities will be extremely important. Detailed descriptions of how data would be collected (except for annual and periodic survey data described in Table 2-1) were not clearly described. It is assumed that detailed monitoring methods would be included in the Final DEIS. There was concern voiced whether sufficient base-line and subsequent monitoring data would be collected to ascertain whether the prescribed treatments actually achieved the objectives of restoring native habitats and increasing biological diversity. For this reason, the monitoring of existing treatments should be a very high priority and monitoring protocol should be developed prior to the addition of new treatment areas." (540)

567 "TWS (The Wildlife Society) encourages well-designed monitoring efforts to determine effects of treatments and to provide feedback for adaptive management approaches." (540)

Response. Comments noted. Please refer to responses to comments 568-572, and expanded description under Chapter 2, Alternative D and Appendix N for more information on monitoring.

Comment

568 "We saw no plan to monitor wildlife species as a result of this management plan. We believe a wildlife monitoring plan should be part of the management plan. It would be a great opportunity to develop a number of studies to determine the effect of such large changes in habitat on big game, sage grouse, small mammals, reptiles, song birds, and raptors." (7)

Response. Wildlife monitoring objectives were listed in Table 2-1 of the DEIS. Please refer to Appendix N for a general description of procedures, objectives, and priorities of wildlife monitoring. Because of limitations in funding, time, and knowledge, procedures described in Table 2-1 do not address monitoring of small mammals, reptiles, and raptors. Individuals and organizations interested in an expanded program of inventory and monitoring efforts should contact the Refuge Manager to discuss potential cooperative arrangements.

Comment

569 "The final EIS should include a discussion of monitoring for each resource category in the draft EIS including fisheries and water quality. A properly designed monitoring plan will demonstrate how well the preferred alternative resolves the identified issues and concerns by measuring the effectiveness of the mitigation measures in controlling or minimizing adverse effects.

The monitoring plan should include types of surveys, location and frequency of sampling, parameters to be monitored, indicator species, budget, procedures for using data or results in project implementation, and availability of results to interested and affected groups.

The final EIS should describe the feedback mechanism which can compare baseline data with monitoring results to adjust standard operating procedures, monitoring intensity, and protocol at first detection of adverse effects. Provision of such an adjustment process ensures that mitigation strategies will improve in the future and that unforeseen adverse effects are identified and minimized.

This feedback seems particularly relevant in the Hart Mountain area because the 1969 Hart Mountain NAR Resource Management Plan proved to be a plan that eventually led to the present undesirable management conditions. The monitoring and feedback plans for the proposed Management Plan should be designed around a 15 year period of adjustment to optimize the success of the management process. by making small adjustments, where analysis of monitoring has indicated a need for change, the Hart Mountain NAR can perhaps better meet its long-term goals and objectives." (32)

Response. Please refer to Table 2-1 and Appendix N for a list and discussion of wildlife inventory and habitat monitoring activities, which would include periodic survey of trout and stream habitat done in contracts involving Service fisheries experts or ODFW. Refer to the expanded description of habitat monitoring activities in Chapter 2 for description of proposed monitoring actions under Alternative D. Monitoring of vegetation and certain geomorphic characteristics such as stream channels are emphasized, since core resource problems emphasize these components of riparian habitats. Aside from monitoring stream water temperatures, water quality monitoring is not included as a proposed monitoring action. More specific documentation of inventorying and monitoring procedures will be described in the wildlife inventory plan and habitat management plans, which will adhere to development and usage guidelines prescribed in the Service's Refuge Manual (USFWS 1982). Wildlife inventory and habitat management plans are being developed or will be revised after completion of the EIS process.

After implementation of the Proposed Action (pending approval), wildlife, habitat, and management actions would be monitored, results from monitoring would be summarized in official memorandum, managers would review memorandum, and they would determine whether operational management plans would require amendment based on monitoring results and discussion with staff. Any major decision made by managers to amend management plans based on results of monitoring would be recorded in official memorandum, operational management plans, and annual narrative reports. These documents are retained in permanent files in the Complex Office in Lakeview and Headquarters of Hart Mountain NAR. Information yielded by inventory and monitoring efforts is public information and is made available to interested individuals and organizations upon request to the Refuge Manager.

Comment

570 "I also would urge the Fish and Wildlife Service to significantly expand their monitoring programs for vegetation, streamside, and aquatic habitats. This effort should be complimented by a thorough review and compilation of historic information (reports, cultural records, etc.) that help establish conditions of the refuge prior to human-induced disturbance." (314)

Response. Refer to the expanded description of wetland monitoring in Chapter 2 under Alternative D and Appendix N. The Service has researched the historic literature; it will continue to compile historic information for comparative purposes in the future.

Comment

571 "We would like to see a greater emphasis being placed on statistically valid, comprehensive monitoring of prescribed burning activities and other treatments, including the passive restoration of sites without the presence of livestock. This statistical data is sorely lacking in a number of the natural communities that are being targeted by the Refuge. Data collection will not only benefit the Refuge but could have dramatic implications far beyond the Refuge boundaries on other public lands as well as private ownerships as well." (359)

Response. Prescribed burns and riparian restoration would be systematically monitored to describe change over time (see expanded discussion of monitoring in Appendix N). The monitoring strategy entails systematic collection of data for key parameters over an extensive range of sites where management will be focused in the next 15 years (e.g., prescribed burns, riparian areas).

Although a variety of sites would be monitored, objectives for monitoring would be limited to describe response of key variables subject to management over a range of sites and vegetation types (e.g., change in density and size classes of aspen before and after prescribed burning in the aspen vegetation type). In the case of stream-based riparian areas, monitoring sites would be allocated in proportion to representation of valley types of the Refuge. The extent of monitoring on any given site would be limited given the size of the Refuge, the scope of management actions, and limits to funding available for monitoring. As a guideline, the intensity of monitoring on any given site would be determined mainly by the certainty of response of the key variables described in project objectives for a given vegetation type (uplands) or valley unit (riparian). In the case of prescribed burning, monitoring objectives will be based on evaluation of the certainty of trend in response of key variables, response trends reported in technical information, and professional judgement.

Assumptions of statistical validity would be accounted for in the planning of monitoring actions. Most of the information that would be collected would not meet the statistical standards conventionally used by the research community (e.g., 90% or better chance that the estimate is within 10% of the mean value). However, it is assumed that our approach would successfully reveal large scale trend in response of key variables, which may be attributable to the management action should this response be consistently observed on similar sites subject to similar management methods.

Researchers should contact the Refuge Manager if they are interested in developing cooperative arrangements geared to monitor change in wildlife populations and habitats that meet conventional criteria of statistical validity.

The relevance of biological monitoring activities to off-Refuge activities is beyond the scope of this EIS.

Comment

572 "Any intervention inside a national refuge carries the imperative of monitoring the results over a long period. Your intention of establishing permanent vegetation plots is a first step, but limiting surveys to once every 5-10 years is too infrequent. When the frequency of personnel turnover is higher than that of plot monitoring, plots become lost or forgotten, survey methods change, and data are buried and forgotten. Because of the critical need for information about recovery of damaged Great Basin ecosystems, the monitoring program needs to be expanded to wildlife, including invertebrates, to surface and ground water and quality, and to soils; and the techniques need to be improved. We recommend that you initiate a nested approach to landscape and vegetation monitoring, starting with whole-refuge monitoring utilizing twice-yearly fixed-wing or satellite photography. Satellite imagery is available from LANDSAT or the military and would allow NAR to obtain vegetation, stream and landscape data, starting from the period prior to the elimination of livestock from the Refuge (baseline data) and continuing into the future. This should be accompanied by course-grained community monitoring for biodiversity and ground cover, and fine-grained monitoring for community dynamics. The Refuge should obtain a modern geographic information system (GIS) for recording and analyzing changes. Such careful and well designed experimentation and monitoring could make NAR one of the most important long-term research sites in the arid west and potentially save the public money by providing well researched and documented results that will be useful to USFWS, Bureau of Land Management (BLM), and other federal and state agencies." (519)

Response. Please note the expanded discussion of monitoring under Chapter 2, Alternative D and Appendix N. Also, refer to responses to comments 568-571 for discussion of monitoring. In our judgement, the monitoring program as described will provide managers with the information they need to evaluate the success or failure of management actions to achieve management objectives on a project-by-project and collective basis. Other comments were noted.

Comment

573 "Are time-critical monitoring priorities recognized? Initial conditions on the Refuge should be intensively documented continuing with the 1994 field season. If we don't document how the refuge is now, how will we know fifteen years from now whether the experiment is a success. Ranchers will say that the Refuge was better off when it had cows. Aerial photos especially need a grain-scale interpretive effort immediately on sample frames or they lose their value quickly. Juniper, mountain mahogany, and sage should all be dated prior to burning. Is the Cat Lake Butte experimental burn site suitability for intense interpretive and monitoring? Annual oblique photos could provide record of change at fraction of airplane fly-over in many areas or alternately, one could shoot a hand-held camera satisfactorily from an airplane while doing wildlife inventories." (521)

Response. The objective of 1992-94 inventory and monitoring efforts was to develop the baseline information against which future conditions would be compared. Yes, the Cat Butte burn site is suitable for monitoring. A total of 10 monitoring plots were established to assess vegetation response after burning in the low sagebrush site and 5 plots were established to assess vegetation response after burning in the mountain shrub site. Photos were taken of each plot from a permanent stakes. Additionally, permanent stakes were placed at 2 locations on the ridge that comprises "Cat Butte" and panoramic photos were taken of the project area before burning.

Comment

574 "Will prescribed burns and accidental and natural fires be adequately monitored? The DEIS does not summarize the known fire history of the Refuge nor describe planned burns such as the October 1993 Cat Buttes test burn [that took place without a T&E survey]. There is no map of recent burns and their origins,

displaying areas burned, date, acreage, vegetation type, intensity, and origin (accidental, cultural, prescribed, or lightning)[but see the attached hypothetical map]. An accompanying table could have summarized vegetational response. It would be useful to provide a schematic map to help visualize how the proposed 40,000 acres of burn might create a mosaic in various habitat units. Pyle's 1991a fire history in the Bibliography cites little data that is site-specific. Data on key community types fires at Hart is lacking. Non-vegetated rock zones are correctly recognized as significant fire-breaks. However these are not talus but mainly tensional fault lines. Fire crew data is poor -- only to 1985. It seems that fire suppression resources were limited into effectiveness until fairly recently. Surely 100-year old juniper did not invade directly because of fire suppression, but rather from fine-fuel load removal by cattle or palatability of competing vegetation." (521)

Response. Pyle (1991a) reviewed fire history of vegetation at Hart Mountain NAR. He found few site-specific data for vegetation types in the northwestern Great Basin, in general, and Refuge, specifically. Because of this lack of site-specific data, the fire management officer is reviewing all station files to compile and document prescribed fires and wildfires that have occurred since Refuge establishment. Additionally, a fire ecologist was contracted in 1994 to examine fire history in vegetation types of the Refuge. Refer to discussion of budget under alternative D, chapter 2, for discussion of resources planned for the fire management program.

Detailed description of individual burn projects is beyond the scope of this EIS. The fire management officer is required to develop a site-specific plan for every prescribed burn. This plan includes burn objectives, personnel required, safety considerations, and monitoring protocol. Each plan requires authorization by officials at the level of station, complex, and regional office before it may be implemented. Such was the case for the plan developed to prescribe burn vegetation in the vicinity of Cat Butte. Please refer to the discussion of monitoring under alternative D, Chapter 2 and section 1, Chapter 3, for discussion of fire history.

Before 1992, vegetation response was not systematically monitored on prescribed burns; data is not available from management-level prescribed burns that summarizes vegetation response. Refer to Pyle (1993) for an analysis of the response of brood-rearing habitat of sage grouse to prescribed burning at Hart Mountain NAR. Pyle (1991a) reviewed the literature on historical occurrence of fire. His summary was based on exhaustive review of technical information that reported fire regimes and fire history for vegetation types that occur on the Refuge.

Comment

575 "Recent burn boundaries can be identified on aerials and entered into a GIS layer. The FEIS should at least get a start on this process. Fires are mentioned 1972 at Deer Creek and from August 1985 (11,500 acres). Prescribed burns took place on South Mt. and Bond Creek in 1992-92. Lightning fires are seen on upper Stockade Creek, upper Guano, and east of the Gap. The road to Big Flat, which should be closed, had chest-high tinder-dry grass this summer right in the roadbed. Could not a1500° catalytic converter start an awkwardly timed fire here and elsewhere, defeating an orderly prescribed burn program? Natural fires may be less frequent, larger in extent, and more of community-replacement type. Paiute cultural fires (to manage food resources) and escaped fires may not have mimicked the natural fire regime in frequency, intensity or location. There may be a need for prescribed burns in perpetuity, unlike what is said in the DEIS. Since the CMP will be a closely-followed experiment, there needs to be a policy commitment to T&E inventory (e.g., pygmy rabbit) and initial condition documentation prior to burns and subsequent multi-year measurement of response. The DEIS leaves this unclear." (521)

Response. The fire management officer has identified documentation of fire occurrence on the Complex as a priority. Compilation of this information is currently underway. Files are maintained for each prescribed burn and wildfire. Maps describing burn perimeters and interspersion are included in the file.

Alternative D proposes to move the road that accesses Big Flat from the meadow to the adjacent upland to minimize the possibility of wildfire in the Warner Creek vicinity. We concur that Native Americans extensively influenced fire regimes during the pre-historic and early historic periods in the intermountain west. See Gruell (1985a, 1985b) for discussion of the historic influence of cultural broadcast burning.

Please refer to expanded discussion under Alternative D, Chapter 4, for discussion of monitoring protocol to be used to assess wildlife and habitat before and after prescribed burns are done.

Comment

576 "The Wildlife Society recommends that monitoring is not directed only toward species of current concern, or only toward high-profile species." (540)

Response. Wildlife inventory activities proposed for all alternatives are designed to account for all featured species and specific wildlife assemblages (species richness). Please refer to responses to comments 7, 32, 314, 359, 519, and 521, and Chapter 4, Alternative D, for discussion of monitoring of wildlife and habitat.

Comment

577 "Biological monitoring should take place whenever "unnatural" changes are effected on the land. High levels of monitoring of livestock to assure appropriate levels of use. Intensive monitoring in the riparian areas to assure animals are not using those areas." (670)

Response. We agree that monitoring is of critical importance for tracking the influence of management actions. Alternative D, the Proposed Action, would eliminate livestock grazing on the Refuge for the next 15 years. Monitoring standards identified under Alternative D, Chapter 4, for prescribed burning also would be applied in the case of mechanical and herbicide applications.

Comments

578 "The Service has de-emphasized a critical component of Alternative D. This is a tremendous mistake. Never before in Eastern Oregon's history have cattle been removed from such a large tract of land. As a result, no one has ever documented such a large land area's recovery from livestock grazing. The Service has a unique opportunity to document the Refuge's recovery from consumptive abuse. OWF strongly urges the Service to develop a comprehensive monitoring plan (MP) and publish details of the plan in its Final EIS." (695)

579 "The draft plan should provide more detail on long-term monitoring and research. The need for monitoring a recovering landscape is critical not only to the Hart-Sheldon Complex, but to the entire National Wildlife Refuge System and other public lands. We would like to see how and when the Refuge plans to accomplish this goal and what it will cost. Our fear, of course, is that upon completion of the Plan, other priorities on the Refuge or within the Fish and Wildlife Service will dictate that research and monitoring be relegated to a lower priority. While that may be acceptable in other situations, Hart Mountain provides a unique situation not available anywhere else in the western United States. The goal to implement an intensive monitoring and research program is imperative." (702)

580 "With regard to monitoring--a critical aspect of the proposed valuable fifteen years without cattle on the Refuge--I would like to see the U.S. Fish and Wildlife Service (FWS) commit to a more definite, more thorough (spelled out) monitoring program." (732)

Response. The monitoring program that would occur under Alternative D would deal with management objectives of the Refuge. The scope of monitoring and management does not pertain to management of land owned by other agencies, organizations, and individuals. Please refer to the expanded discussion of monitoring in Chapter 4, Alternative D. Discussion of budgets associated with implementation of Alternatives can be found in Chapter 2 for Alternative D.

Comment

581 "I understand the threat of budget constraints on staffing and programs. However, I would encourage the staff to link up with reliable volunteer programs for stream monitoring and other field inventories, as well as encouraging additional college and university research projects. The August 1993 American Fisheries Society Watershed and Stream Restoration Workshop in Portland included sections on involving the public and on data needs and management. This could be an opportunity to involve area high school youth in mutually beneficial field work." (732)

Response. We concur that the scope of the monitoring program is determined mainly by short and long-term federal funding. Monitoring activities described under Alternative D, Chapter 2, were based on assumptions of positions and budgets described for implementation of each alternative. Individuals and organizations interested in cooperative volunteer arrangements, including biological inventories and monitoring, should contact the Refuge Manager.

Comment

582 "Even if budget limitations do occur, I believe it would be advisable to include a more specific, clearly stated monitoring and evaluation schedule. My prior experiences with government agencies, including the FWS, have indicated to me the wisdom of putting in writing hoped for standards and guidelines for monitoring,

evaluation, and other actions. Such written intentions can save a great deal of regret in the event of changes within agencies, and in affected interests." (732)

Response. Standards and guidelines for monitoring are generally described under Alternative D, Chapter 2. Also, refer to the list of habitat objectives in Chapter 1 for overall management objectives used for standards. Additionally, operational plans for habitat management will address objectives to be used as standards of evaluation on a site-specific basis.

RESEARCH POTENTIAL

Comment

583 "I feel that it is imperative to have an area in the Great Basin to study where livestock have been removed." (51)

Response. This topic is beyond the scope of the goals and objectives of Hart Mountain NAR and the management planning process.

Comment:

584 "I'm excited by the potential of using Hart Mtn. as a data base for "management" in other areas of the intermountain west." (52)

Response. This topic is beyond the scope of goals and objectives of the Refuge, which are primarily concerned with management of land within the Refuge boundary.

Comments

585 "By implementing the management strategies in Alternative D, the USFWS will create an unprecedented opportunity for research about restoring degraded Great Basin ecosystems. Further, it will protect and restore wildlands habitat, which will in turn benefit the wildlife populations that depend on that habitat." (74)

586 "The Hart Mountain National Antelope Refuge is one of the first intensively grazed public lands to be reclaimed from livestock grazing and trampling. Because NAR contains of a wide variety of vegetation and ecosystem types, the elimination of livestock provides a unique opportunity for environmental scientists to carry out important research on recovery of the shrub/steppe ecosystem both **with** (treated) and **without** (untreated controls) human intervention. Little is presently known about vegetation and wildlife recovery after livestock removal from Great Basin environments; any information that can be obtained about this process at NAR will be invaluable for future restoration efforts throughout the region." (519)

587 "In fact, I support Alternative D precisely because it offers an unprecedented opportunity to test the "grazing improves the range" hypothesis on a large scale. I urge you to pursue Alternative D and to pair the findings with the best of traditional management practices on BLM rangeland elsewhere in Oregon." (640)

588 "Hart NAR will be the first possibility for a landscape scale research project on juniper where cattle grazing is halted for more than just a season or year or so. Juniper research with respect to watershed functioning and health has been done on a very small scale, with few if any true control sites. Hart could provide unique insights in the nature of juniper uncomplicated by livestock grazing. Where some first to third order stream watersheds have been free from livestock impacts for over twenty years, native grasses, forbs, and shrubs appear to be out-competing juniper even though young juniper are present and seed-producing trees beat abundant fruit. Some researchers concede that region-wide atmospheric carbon level increases associated with human populations and livestock populations may be directly responsible for increased populations of such dryland woody species as juniper. I wonder why on my property and on Crooked River Ranch some of the greatest vegetative abundance diversity is found under and among the protective brittle branches of juniper. I support a cautious approach to "controlling" or managing juniper. We know too little." (732)

589 "I believe a study building on Tiedemann's fecal coliform (FC) studies in northeast Oregon would be valuable. FC counts taken now and FC counts taken after 15 years of rest with no cows could provide extremely interesting data for comparison and analysis, particularly with the increased recreational use at Hart. It would be interesting to check on Giardia spp. populations as well. Tiedemann's 1987 article references the Oregon standards for water quality, and notes that the presence of Escherichia coli in streamwater indicates contamination by warm-blooded animals, and the potential that pathogens may also be present.

Research on the presence, abundance and diversity of small mammals, particularly with respect to predator species and populations (coyotes, eagles, other raptors, etc.) as the vegetation at Hart responds to the absence of domestic livestock grazing would be another valuable research possibility.

Water monitoring (stream flow highs and lows seasonally, quality factors--temperature, pathogens, FC, etc.) and studies monitoring/analyzing the growth response of aspen, willow, mountain mahogany and other shrubs (recruitment of young, stem height/length, seed or sucker abundance) would also be valuable research project to pursue. Where else in Oregon is such a large land area which such native species and habitat diversity now free from the impacts of domestic livestock grazing? What an opportunity to document changes in the absence of cattle!" (732)

Response. We agree that implementation of Alternative D would provide potential opportunities for study of restoration of habitats degraded by historic livestock grazing. Although the Service encourages independent research to foster interpretive, educational, and recreational objectives of National Wildlife Refuges, such a cooperative association is subject to policies stipulated in the Refuge Manual (USFWS 1985:8 RM 12.1-12.17). Management actions that influence habitat conditions and wildlife populations will be monitored (see wildlife/habitat monitoring) by Refuge personnel to foster evaluation of progress being made towards achieving goals and objectives. Please also see response to the following comment.

Comment

590 "I would also encourage you to consider dedicating a part of the Refuge to ecosystem research possibilities as a funding source. (This may not be feasible or desirable to your goals, but perhaps it would be)." (642)

Response. The opportunity for research would be maintained at Hart Mountain NAR regardless of which alternative is selected. Additionally, a Research Natural Area (RNA) exists and more are proposed for designation to facilitate research in particular geographic locations (USFWS 1982). Individual proposals for research in the Refuge or RNA would be evaluated pursuant to the policy guidelines described in the Refuge Manual (USFWS 1982). It is beyond the scope of the EIS process to determine specific objectives of future research efforts.

Comment

591 "TWS also encourages long-term programs of resource-free monitoring, these being programs designed to assess changes in basic ecological components in unmanipulated systems. Information from these types of programs (e.g., vegetative species structure and composition) can be used as the foundation for monitoring habitat for key species and guilds of wildlife." (540)

Response. We agree with this assessment. Please refer to Vol. I for description of what habitat monitoring efforts would occur with implementation of the Proposed Action. The goal of this monitoring program would be to examine the status and trend of a range of physical and biological parameters likely to be influenced by management actions. The scope of this program would be determined by short and long-term funding of biological and fire management personnel.

MANAGEMENT OF SPECIFIC AREAS

Big Flat

Comment

592 "Will Big Flat be restored under the CMP? This area is the most important and diverse freshwater palustrine habitat on the Refuge and can contain deep-water habitat, year-round water. It has a long history of disturbances, largely water diversions to sub-irrigate pastures, oriented to livestock forage production. Recently cleaning of canals has left miles of weedy berms. If the Refuge would actively restore this area, there would be more deep water in more years, due to less loss to evaporation, transpiration, and percolation on mesic sites. Wetlands are capable of remarkable recovery. The Refuge has been intensively managing the area in advance of the FEIS, clear-cutting undated juniper near the springs. Evidently, this is for aspen aesthetics, since Liverman cites five studies stating no additional surface water will result. It seems very risky to conduct prescribed burns in this area even with the juniper gone because it could jeopardize the unique mountain mahogany old-growth resource above. There can not have been fire suppression here historically because of inaccessibility to equipment. Grazing adjacent to the lake may have reduced competition for the juniper and justify removal. The FEIS should describe the intended management program at Big Flat and whether artificial conditions are an objective." (521)

Response. We agree that wetlands are capable of remarkable recovery. Therefore, Big Flat would be permitted to restore on its own to a more native condition. The Service would not clean out canals; rather, vegetation and sediment would be allowed to accumulate in and fill canals.

Periodic fires are an important component of healthy aspen stands and for sucker regeneration. Fire also effectively kills junipers less than 1.2 meters tall. However, with the lack of periodic fires, many junipers currently are too large to kill by fire and must be removed mechanically in order to prevent a stand conversion. We propose cutting junipers that threaten quaking aspen stands. This management action is in agreement with Liverman (ODFW) as stated in letter 745 that "protection of quaking aspen groves, wetland and aquatic features, and key watershed locations, should be identified in the Final Plan and EIS as the top priority for juniper manipulation. Although protection of resource values on those sites will depend on the health of the entire watershed in the long-run, they also are at greater risk in the short-run than values present in most upland areas."

Shirk Ranch

Comment

593 "Will Refuge manage Exchange of Use lands consistently with the CMP? Currently, FWS manages 2000 acres of BLM land above the mouth of Guano Creek (just above Shirk Ranch) under a Cooperative Agreement dated 12 January 1978 (attached) and still in effect. The Refuge now licenses winter grazing (January to April) in this severely degraded riparian zone, though this treatment would seem to maximize streambank trampling as cows search for palatable dormant forage. The area is a critical corridor link for Sheldon tui chub connecting Shirk Lake to 35 miles of desert riparian zone. Because of trespass, this area was already severely over-grazed in September 1993 before cattle from the Cove Pasture of the MC Beaty Butte 600 Allotment (no AMP, Harrington) could be turned out. An unmaintained fence allows cattle trespassing on Shirk Ranch to also trespass on this pasture and vice versa.

This same 2000 acres encompasses a 1991 proposed BLM Research Natural Area (Guano Creek pRNA, map enclosed) as well as distinct sites on for two endangered species, Eriogonum crosbyae and Ivesia rhypara rhypara. The latter species is subject to an ODA monitoring program and a Conservation Agreement between national FWS and BLM described in the April 25, 1993 Federal Register that was to pre-empt the listing litigation. [Precise T&E maps enclosed for convenience should not be re-printed in the FEIS under any circumstances.] Lastly, the area is totally within the final BLM wilderness proposal for Guano Creek Wilderness. The DEIS does not speak to this area at all: how will it be managed over the next fifteen years?" (521)

Response. Yes, the Service, pending approval of the FEIS, would manage Exchange of use lands in accordance with the strategies outlined under the Proposed Action (please refer to Chapter 2 of the FEIS).

594 "How are Shirk Lake and North Lake to be managed? The DEIS indicates that Shirk Lake will not be grazed under any alternative. Management at North Lake is nowhere specified, though grazing was intense in September, 1993. The Refuge was constructing a confusing new fence along the south boundary in late September that would seem to change the lands manageable under the CMP. The 1991 EA provides a map that definitely needs to be included in the FEIS (enclosed). A complex and maintenance-intensive system of nine dikes is envisioned, resulting in a classical FWS waterfowl production facility. Water is to be diverted away from two miles of Guano Creek's historic channel (to Guano Lake) to fill artificial Shirk Lake pools, the excess being shunted off to Guano Slough. (Guano Valley had water from 1870 to 1907 but was dry through 1934 to a well depth of 900 feet. This indicates that the proposed Shirk Ranch development may be largely futile.) Although the land may have been purchased [at negligible cost compared to subsequent management expenses] with Duck Stamp monies in 1938, this should be the only management consideration in perpetuity. The area is evidently to be permanently managed outside the goals and parameters of Ecosystem Management (Alternative D). Willow grow prolifically in the waters here and natural pool maintenance by beaver may be a viable and cost-effective option. Ecosystem Management for this area seems to require analysis under NEPA. Neither the DEIS nor the cited EA analyses impacts to the Sheldon tui chub, a federal candidate species known to inhabit the area under construction. The dikes would seem to create numerous physical barriers for the fish and increase future genetic isolation of fragmented populations. What mitigation for wetland fill is being proposed under the terms the 404 permit application?" (521)

Response. The Shirk Ranch area would be managed according to the strategies outlined under Alternative D (Proposed Action), Chapter 2 of the FEIS. Further detail is provided in the Shirk Lake Wetland Development Environmental Assessment, which is available from the Sheldon-Hart Mountain Refuge Complex office.

Crump Lake

595 "How is the Crump Lake area to be managed? The DEIS does not adequately discuss Refuge policy in the Crump Lake area under the preferred alternative. This is area of complex and changing ownership patterns. For example, the Executive Boundary of the Refuge includes land to the west of the lake in sections 30 and 31 of T.37S R.25E. Map1-2 incorrectly shows the irregular parcel of Refuge land above the NE shore as private. SLB ownership here is largely a meander line (a shoreline of the 1880's) at approximately the 4480' level. This SLB land, as waters of the state, was not included in the recent sale. BLM completed the 2,451 acres Kiely acquisition in December 1992 and terminated the allotment. The Nature Conservancy has purchased 540 acres of private land immediately south of the Refuge base property for the 4,670 acre 217 Cox Allotment, which contains Wool Lake, partly in the Refuge. There is no current AMP on 216. Cooperative agreements with TNC, BLM, SLB, and private owners should be considered. The FEIS should include a full-page quad corner nap showing ownership and allotment boundaries and should describe management plans and goals for the area under the CMP. A quality corridor to low-elevation habitat in the Warner Potholes ACEC should be a central defined objective for the CMP planning cycle, even if opportunities are limited today by circumstances beyond the control of the Refuge." (521)

Response. As with other areas on the Refuge, strategies for managing of the Crump Lake area are outlined in the Upland Habitat Management and Wetland Habitat Management sections of each alternative in Chapter 2, as they apply to specific habitats in the Crump Lake area. Long-range objectives address vegetation types found in this area and Table 2-2 identifies targeted rates for these vegetation types. A more detailed habitat management plan is forth-coming. Cooperative agreements with land-owners is an excellent idea.

Outholdings

Comments

596 "Will livestock be used as a management tool at Jacob's Reservoir? Lower Guano Creek, sixteen miles of classically abused riparian zone, links the south Refuge to Jacob's Lake to Shirk Lake to North Lake to Guano Slough. Sheldon tui chub have been documented here regularly in the past despite poor conditions. The fish was known from 1934 to be in Guano Creek, in 1955 from 13 frozen dead fish in the creekbed, from Jack Danielson's work in the 1970's, and from Shirk Lake itself from 1985. A 1993 BLM study by Mark Stern did not find chub in a partial survey below Jacob's Reservoir. These fish could survive drought cycles, like they do at nearby Sheldon, if Guano Creek were in better condition. Since health of riparian communities is a crucial objective in the DEIS, improved conditions on lower Guano Creek should be a defined objective for the CMP planning cycle, even if opportunities are limited today by circumstances beyond the control of the Refuge. At Jacob's Reservoir, the Refuge owns 360 acres, the Cox estate [non-permittee private] has 120 acres, and the rest is BLM.

The area above the dam is called the Jacob's Reservoir Pasture of the 216 Allotment (O'Keeffe) (fencing map enclosed). The new draft AMP (enclosed) calls for treating (grazing) of the entire area (BLM, Refuge, and non-permittee private) in alternate years, from April 15 to June 15. In "rest" years, Refuge land could be used as a "gathering pasture" for an unspecified period in the spring for the permittee's 1400 head of livestock. As of September 1993, Refuge land was not fenced off at all within this Pasture. A decrepit juniper fence on the east boundary has clearly not been maintained for decades, allowing cattle from the O'Keeffe Allotment to graze the riparian area below the dam as well. The Refuge owns over a mile of creek downstream from the dam that has never had fencing. Note that cattle on the Jack Lake/Guano Creek Pasture of the MC Beaty Butte 600 Allotment (no AMP) also have access to riparian areas above and below the dam. The BLM is certain that no Memorandum of Understanding, Exchange of Use, or Cooperative Agreement exists between the Refuge and BLM (see attached letter). The DEIS speaks of maintaining a 15 acre pool, but does not analyze the impact of this action or maintenance of the barrier (dam) on the Sheldon tui chub. Is the CMP applicable to Refuge land here?

Is the CMP applicable to Refuge land near School Section Lake? The Refuge owns 200 acres SW of Jacob's Reservoir in two fragments within the May Lake Pasture of the 216 Allotment. It is apparently currently unfenced and so would be subjected to the grazing terms of the new AMP (flip-flop growing season deferment: 5/20 to 7/1 in year one; 7/15 to 9/15 in year two). Is the Refuge planning an exchange of use for these parcels, further acquisition that would block up manageable wetlands at School Section Lake, or will they be managed under Ecosystem Management?" (521)

597 "How are the fragments to the east to be managed? Refuge boundary maps in the DEIS show two scattered parcels east of the Refuge totaling 400 acres that including wetlands of Guano Slough. There is no discussion of these lands, which are surrounded by private land. How were these lands acquired and what was the intent for management at the time of acquisition? What is the condition of these lands and how will they be managed under the CMP over the next fifteen years?" (521)

Response. Refuge lands that currently are administered by the BLM as described by the 1979 MOU for the southern end of Shirk Ranch, Jacobs Reservoir, and other Refuge lands to the south and east of the Refuge proper would continue to be managed as such. Management of Refuge lands currently administered by the BLM is beyond the scope of this EIS. Please also refer to comment 191.

RESEARCH NATURAL AREAS

General Comment

598 "The existing Poker Jim RNA was sensibly enlarged to a manageable size and mostly freed from its artificial section-line definition, which corresponded poorly to natural boundaries and is unnecessary in the days of hand-held GPS. The original Poker Jim was too small to offer natural fire breaks or control areas to balance prescribed burns of junipers. However, the RNA could be improved by slightly enlarging it on the west (5600 foot contour to include the upper perched wetland (palustrine emergent temporarily flooded)." [A map was included in the letter] (521)

Response. Comment noted.

Comment

599 "The proposed Research Natural Areas (RNAs) meet the identified natural area needs as described in the Oregon Natural Heritage Plan (1993) for the Great Basin Physiographic Province. The Conservancy provided a number of recommendations for potential RNAs at Hart Mountain and the proposed alternative has met our expectations through both adopting our recommendations in many cases or by recommending more suitable sites. We commend the Refuge for its commitment to the RNA program and stand ready to assist the Refuge in designating the proposed RNAs.

We have a few minor, specific comments regarding RNAs that require clarification in the final EIS and management plan. First, the text of the Special Areas Management section (p.75) does not note that the existing Poker Jim Ridge RNA is proposed for expansion but the accompanying map (Map 2-14) does show this proposed and necessary expansion. The expansion will provide for better representation of the target element at the RNA, namely the western juniper/low sagebrush community, and will give the RNA more identifiable and protectable boundaries.

A second comment is with regards to the proposed Cooper RNA on the western escarpment of Hart Mountain. The site selected clearly meets the identified natural area need for a high gradient, first order stream system but the proposed name of the site does not fit with the name of the canyon on the U.S.G.S. topographic map of the site. RNAs are usually named for readily identifiable geographic features and we would recommend that this proposed RNA be named Juniper Canyon RNA in keeping with this tradition.

A third comment is with regards to the Warner Creek proposed RNA, where the Conservancy's own inventories are incomplete in terms of community-types represented. We are aware of the mountain mahogany communities present at the site but we need better information about the Wyoming big sagebrush communities and the potential for low sagebrush communities there as well. Also there should be some mention of the inclusion of Warner Creek within the proposed RNA, making the site a watershed designation that includes a stream that is in quite good condition. There is no question about the quality of this site or that it is an excellent choice for an RNA.

Finally, we are interested in seeing more information in the final EIS on the Water Canyon proposed RNA. The specific low sagebrush types present at the site, more exact boundaries for the RNA (on topographic base maps), and other pertinent information would be welcome. With regards to having pronghorn as a target element of the RNA, there is no stated need for these animals in the Oregon Natural Heritage Plan as they are not classified as Threatened, Endangered or Sensitive by the State of Oregon. Nevertheless, we still believe that the site is worthwhile for the playa lake communities present as well as the unique riparian zone within Water Canyon." (359)

Response. Thank you for your suggestions, and for pointing out inconsistencies in the DEIS. Corrections to text were made to indicate the proposed expansion of the Poker Jim Ridge RNA. The name for the proposed Cooper Canyon RNA was selected because the proposed RNA is located in what the Service recognizes as Cooper Canyon. The canyon that we call Cooper Canyon is not labelled on any U.S.G.S. maps. Juniper Canyon, which is labelled, is located to the immediate south of Cooper Canyon. The name of the proposed Pronghorn RNA was changed to the Desert Lake RNA in compliance with convention used to name RNAs after a prominent, known topographical feature where those features are referred to on maps. See Appendix E for a description of purpose for RNAs and partial listing of plant communities and cell elements known to occur in existing and proposed RNAs, including the Desert Lake RNA. The process of RNA designation described in the Refuge Manual (USFWS 1982) will be used for modification and designation of existing and proposed RNAs.

Comment

600 "We are a bit unclear as to why the Refuge management plan will only be recommending the proposed RNAs for study instead of proposing them for designation. This is likely a procedural question but it seems that the plan could and should propose these areas for designation, even though the final decision to designate resides with the regional office (or higher) of the U.S. Fish & Wildlife Service." (359)

Response. The basis for proposal versus designation was to increase time available to objectively review and evaluate the proposal to establish RNAs. First, a reconnaissance of biological resources needs to be conducted. This job is partially complete based on inventories done by Refuge staff and The Nature Conservancy during 1991-92. Resource values need to be reviewed, purposes specifically identified, and benefits and costs of designation need to be evaluated in compliance with Service guidelines (USFWS 1982). Third, time constraints imposed by EIS development prevented intensive evaluation of proposed RNA sites, and based on this evaluation, development of memorandum to submit to the Service's Regional Director for review and authorization.

Comment

601 "The final issue that concerns the Conservancy is the proposed management of Blue Sky. In our analysis of natural area needs for Hart Mountain we proposed that Blue Sky be afforded "Natural Area" status because of its ecological importance. This is one of the largest stands of ponderosa pines in the northern Great Basin and has considerable regional significance, both from an historical perspective as well as from an ecological perspective. Historically the site of the former Camp Warner would have been a national treasure in many states. The pre-history of the site can only be guessed at but we can assume that the Native Americans made considerable use of the area.

Ecologically the site has considerable regional importance because of its contribution to regional biodiversity. Both floristically and because of the documented avifauna diversity at the site (Dobkin and Herman both note the area as being rich in bird species numbers because of the unique ponderosa pine habitat), the site contains a considerable amount of the biodiversity present on the Refuge.

For these reasons the Conservancy feels that the area requires special attention and protection in the Refuge management plan. This attention was not apparent and should be added to the final plan. Some comments regarding additional protection for the area are summarized below.

1) The proposal of a small campground at Stockade Creek and a horse camp in Post Meadows will potentially put too much pressure on the Blue Sky area and should be re-evaluated.
2) Likewise the road to Blue Sky should be closed short of the pine stand to prevent additional compaction of the tree roots, a leading killer of trees, to reduce the risk of fires started by vehicle catalytic converters, and to reduce pollution of the creeks and springs that flow through the site.
3) Post Meadows represents one of the largest meadows at the Refuge and needs intensive work to restore its species composition as well as Guano Creek which flows through it. A horse camp is inappropriate at this site.
4) Finally, there may need to be additional seasonal closure of the area for birds and other wildlife species needs." (359)

Response. We concur that the Blue Sky site is of special cultural and ecological importance. There is no special category such as "natural area", other than research natural area, described in the Refuge Manual (USFWS 1982). The Conservancy's concerns regarding the potential impacts associated with campground development, public use, and vehicle traffic have been noted and will be considered in development of operational plans that deal with site-specific management of cultural resources, wildlife habitats, public use, and prescribed burning at the Blue Sky and Post Meadow sites.

The proposed campground at Stockade Creek was dropped from consideration. A new site, Barry Spring, was selected (see description under Alternative D, Chapter 2). Impacts to Blue Sky would be reduced at the new site compared to the site proposed at Stockade Creek.

We are uncertain what "intensive work" the writer was referring to with respect to restoring Post Meadows and Guano Creek in Post Meadows. Rest from livestock use and willow planting would be the 2 methods we would use to influence condition of the stream channel and associated floodplain vegetation. Under Alternative D, the obligate wetland species of plants would be expected to increase as the width/depth ratio of the stream channel declined and the floodable area (the wettest zone of the floodplain) increased. It is uncertain whether introduced grasses such as timothy, would decline in abundance above the floodable area.

We appreciate the concern about possible impacts of designation of the Post Meadows Corral Area as a horse camp, which is proposed under Alternative D. However, the proposed campground for horse users was retained under Alternative D and will be developed upon its implementation. Impact of horses will be minimized by restricting horses to the corral area.

Implementation of Alternative D would lift the seasonal closure of the road to Blue Sky. This decision was based on an effort to maintain opportunities for public use of Refuge roads that cause minimal damage to habitats or disturbance to wildlife. Despite the fact that visitors would be afforded year-round use of the Blue Sky Road, low visitation and excessive snow and mud would limit use of the road and access to the Blue Sky vicinity between fall and spring.

Comment

602 "Are all potential RNAs recognized and will they receive adequate monitoring resources? The proposed RNAs are excellent and one of the strongest components of the DEIS. The Refuge certainly needs to do its share in this large multi-agency cooperative endeavor. None of these proposed RNAs are represented by existing cells and few alternatives remain for consideration." (521)

Response. The Nature Conservancy surveyed the Refuge for potential RNA sites in 1991. Two areas that they recommended for RNA designation were not included in the list of proposed RNAs in the EIS. They were not included because: (1) one site included an unmanageable mix of private, state, and federal land; and (2) another site harbored natural elements adequately represented in the proposed Warner Creek RNA. Please refer to response to comment 521 under funding/staff for discussion of inventories and monitoring activities in existing and proposed RNAs.

Comment

603 "Warner Creek is an inspired recommendation containing an excellent high elevation swale, the sub-alpine brushy cinquefoil, and the fascinating Slump Meadows geomorphological area. RNA boundaries should have a geomorphological aspect at Hart, given the immaturity of hydrological development, rather than just taking the usual drainage boundary approach." (521)

Response. Boundaries of proposed RNAs at Desert Lake, Warner Creek, and Cooper Canyon were based on geomorphic criteria. The perimeter of each area conforms to watershed boundaries. Other comments were noted.

Comment

604 "Cooper Canyon is reportedly a pristine area of high biodiversity and representative of Basin and Range escarpment country. Does the attached map show the correct proposed boundaries? A proposed Hart Canyon pRNA was rejected, even though it contained the remarkable relic white pine community and is much larger than the Cooper Canyon proposal. Exactly such a cell is needed. in view of the SLB sale of inholdings, shouldn't this be reconsidered?" (521)

Response. The attached map, [sent by the person who submitted the comment], though limited in detail, accurately shows the boundary of the proposed Cooper RNA. The recommendation of The Nature Conservancy for designation of an RNA at Hart Creek was considered, but dropped (memorandum on file 22 January 1992). This decision was based on the fact that most of the white fir occurs on private land.

Comment

605 "Can Pronghorn RNA be enlarged to include the Mound and Long Lake areas, which are in far better condition than the heavily trespassed and monotonous low sage north of Desert Lake? Note Map 2-14 is

improperly cross-hatched on the east and ambiguous in the north. Since RNA is a more restrictive designation than wilderness, the RNA could be included in the recommended south WSA." (521)

Response. The proposed Pronghorn (now Desert Lake) RNA includes Desert Lake and the watershed to the east and south, not north. The RNA includes a wide range of wetland plant communities found at Desert Lake, a spring, a unique intermittent stream (Water Canyon), and a broad diversity of low sagebrush communities. We do not agree with the writer's contention that the communities found in the proposed Desert Lake RNA are any more impacted than those found in the vicinities of Mound Lake and Long Lake. If the writer has data to substantiate their claim of differential habitat conditions between areas, please provide the information to the Refuge Manager. Refer to Appendix E for a partial listing of plant communities known to occur in existing and proposed RNAs.

Comment

606 "The ponderosa area, headwater slopes, and Post Meadows areas have received such heavy impacts that they might not qualify as an RNA. Still, they possess remarkable natural qualities deserving of recognition. Does FWS have an internal special management designation, such as Natural Area, analogous to Special Interest Area (FS) or Area of Critical Environmental Concern (BLM)? Possible boundaries are shown on the attached map." (521)

Response. The Service has no categorical equivalent to the types of special management designations referred to, other than Research Natural Areas. Please refer to response to comment 359 for discussion of management status of the Blue Sky site.

WILDERNESS

Larger, More Connective Wilderness

Comments

607 "While I support your wilderness recommendations, I would like to see more connectivity in these areas." (33)

608 "Ways should be identified as such and the resulting roadless areas analyzed for wilderness values. I believe your proposed Wilderness Study Areas are bounded by ways, and not by roads, and are therefore not properly evaluated." (47)

609 "I would like to see the Wilderness areas in the refuge connected by closing the roads that would separate them under the DEIS." (53)

610 "Why are the proposed wilderness areas so fragmented? Wilderness areas potentially suitable for WSA recommendation may have been improperly disqualified by the DEIS, which does not distinguish between roads and ways. There is no entry for 'way' in the Glossary. Map 2-13 does not distinguish roads from obvious ways. Ways are not shown in map legends. A way is defined as a route established and maintained exclusively by vehicle passage, i.e., not maintained by highway equipment such as graders. Lake County does not maintain the main road to Frenchglen, much less internal Refuge roads and ways. There is an observation in the DEIS narrative that many tracks in the Refuge were haphazardly created by vehicles--these would likely be ways. In the analysis of areas suitable for WSA designation, the distinction is critical: WSAs are allowed to contain ways (but not roads) by the Wilderness Act of 1964 (cited in Appendix A). Surely the Refuge records can clarify this issue and change DEIS maps and WSA proposals accordingly. It is well-known that fragmented wilderness areas are dysfunctional." (521)

Response. Potential WSAs were evaluated based on the basic criteria in the Wilderness Act. These areas may change once the WSA process begins. Areas were delineated based on the large, roadless tracts of land under the Proposed Action. We are not proposing to close roads to connect WSAs under the Proposed Action, because we have already closed over half of the Refuge roads. The Wilderness Act does not distinguish between roads and ways. This is a policy that has been well used by the BLM.

Comments

611 "Could these study areas be connected to BLM WSAs?" (528)

612 Regarding the Guano Creek WSA [BLM], could the Refuge include the middle area to combine the three areas into one proposal? (773)

613 "Boundaries of the South WSA fragment need to be re-evaluated with a view to linking up with the East WSA parcel. Poker Jim could join up with Transition Ridge and Orejana Canyon as considered by BLM and OHDPA in a 1989 proposal. A specific recommendation to de-fragment the WSAs is shown Map W (enclosed)." (521)

Response. Yes, connecting the South and Poker Jim potential WSAs with the BLM WSAs is a possibility, and this would be further studied when the Wilderness Study Process begins.

Comments

614 "Move boundaries up to the roads, but leave about a 100 foot right-a-way from the center line of the road. Roads and/or natural features like creeks or rims provide a definable boundary, which will make management easier." (531)

615 "Wilderness Study Areas boundaries should be brought up to the edge of necessary roads, the result would be larger more manageable wilderness boundaries." (202)

Response. We agree with the comment and, as such, have moved the boundaries up to the edge of roads. These boundaries may be re-evaluated when the actual study process begins and the Wilderness Study Reports are written.

Comment

616 "The potential WSA boundaries seem to be drawn so as to leave large non-federal land inholding out of the areas. Because an active land-acquisition program is already underway on the Refuge and is expected to continue, it is probable that the state inholdings will be acquired in the near future. The wilderness consideration should take into account these probable acquisitions, or the new management plan should mandate a timely process to revise wilderness recommendations based on a consolidating land base." (519)

Response. The proposed WSA boundaries were not drawn with consideration to private lands. This consideration would become an issue once the study reports are undertaken.

Comment

617 "I was intrigued with Alternative E. I liked the additional wilderness..." (49)

Response. While Alternative E does provide for extensive wilderness areas, it does not provide for many other management options. This alternative was not chosen because of its extremely limited access and virtually no management of the Refuge.

Support WSAs

Comment

618 "All areas meeting wilderness criteria and not already studied should be studied for wilderness potential..." (14)

Response. We agree. This would be done under the Proposed Action. Please refer to Chapter 2, Section Two, Alternative D of the FEIS.

Comment

619 "The 55,000 acres proposed for special protection as a wilderness is essential..." (263)

Response. This would remain essentially the same in the FEIS. A few additional acres were added when the boundaries are adjusted to the edge of roads.

Comment
620 "The plan would be better if it incorporated the wilderness recommendations of the Oregon High Desert Protection Act." (161)

Response. This Act is beyond the scope of the EIS. When the actual study process begins, then there will be time for a more detailed study and report.

Against More WSAs

Comment
621 "Most of Hart Mountain is a Wilderness experience in it's present condition and does not need further WSA or RNA studies, and bureaucratic cost and manipulation, to be enjoyed by all." (730)

Response. It is Service policy to 'review units of the NWRS, including new acquisitions and expansions of existing units, for lands and waters that qualify for wilderness study, consistent with provisions of the Wilderness Act and subsequent legislation. The periodic reviews will occur through the comprehensive management planning process as required by FWM 602.' (610 FW 2.1, Draft).

Comment
622 "The existing Lake County plan is completely ignored and some management considerations are in violation, i.e., wilderness study areas." (66)

Response. Please refer to comment 98 for a response.

Comment
623 Alternative D proposes a wilderness area of some 44,000 acres. Land and wildlife management opportunities within wilderness areas are nonexistent. Refuges are created for a specific purpose. Land managers must be allowed to use every management tool available to them. Wilderness prohibits that. Refuges should be exempt from wilderness legislation. (795)

Response. Designating an area as wilderness does not mean that land and wildlife management opportunities are non-existent. Refuges are not exempt from wilderness legislation, so we will continue with our wilderness study process.

General

Comment
624 "...Rock and Guano Creeks should be studied for Wild and Scenic River potential." (14)

Response. This is beyond the scope of this EIS.

Comment
625 "Further, I support...management of the area to retain wilderness character until Congress can decide how much should be designated as such." (34)

Response. When we delineate the final wilderness study areas (following completion of wilderness studies) then these areas would be managed to retain their wilderness character. These areas would be roadless under the Proposed Action, so monitoring the effects of visitor use would be the primary concern in these areas.

Comment
626 "Hart Mountain National Antelope Refuge Wilderness of 265,000 acres." (649)

Response. This is essentially what Alternative E offers. It was not chosen because wildlife and habitat objectives would not be met and recreation opportunities are extremely limited (other than hiking).

Comment
627 Wilderness brings more money to a community than ATVs, hunting, etc. (773)

Response. We appreciate your comment. However this statement varies greatly depending on the area/region in question.

RECREATION

Low Impact Recreation/Education

Comment

628 "As far as recreation goes I advocate efforts to encourage only low-impact, no trace, non-motorized recreation." (49)

Response. The Service does encourage low-impact recreation on the Refuge. We propose to eliminate motorized recreation in several key wildlife areas, and where damage to the natural resources has occurred. In future literature and other interpretive efforts we plan to explain to visitors how their actions affect wildlife and other natural resources of the Refuge.

Comment

629 "Hart Mt. Refuge is a beautiful area and certain recreation activities would seem compatible with its [the Service's] mission: wildlife viewing, photography, and hiking, to name a few." (58)

Response. Yes, the Refuge encourages those uses which are compatible with wildlife.

Comment

630 "I will personally miss the ability to mountain bike on the back country Refuge roads which are beyond compare in the rest of the public lands in south-central Oregon. Nevertheless I feel that strictly controlling public use of Refuges that are dedicated to wildlife and natural ecosystem protection should be the primary goal of refuge management and I support the Refuge's decision as such." (359)

Response. Thank you for you comment. A substantial amount of backcountry roads would remain open under Alternative D.

Comments

631 "Implement a land ethics education program that emphasizes 'Leave no Trace' principles." (531)

632 "TWS...encourages every effort to maximize learning opportunities on the manner in which Great Basin ecosystems (including plant, animal, soil, and water resources) respond in the absence of livestock." (540)

Response. This is a good idea and will be considered in developing interpretive and educational materials.

Comment

633 "Place an Information sign with a pull out area to give visitors a better idea of what to expect and things to see-an entrance info sign can help you educate people before they enter the refuge even though the eastern entrance has few people." (531)

Response. Thank you for your comment. These are good ideas. The Refuge plans to improve signing on the Refuge, both interpretive and directional as funding permits.

Comment

634 "Also, a mandatory education toward your camping and recreating public could certainly improve their environmental sensitivity." (642)

Response. We will make an effort to educate Refuge visitors concerning wildlife mostly through brochures, interpretive signs, and other literature. However, we would not make education mandatory.

NON MOTORIZED AND MOTORIZED USE

Comments

635 "Please do everything you can to prevent the introduction of all ORVs and ATVs." (90)

636 "There should not be any motorized off-road use allowed." (723)

Response. We do not encourage the use of ORVs and ATVs. Off-road use is not currently allowed nor is it proposed in Alternative D.

Comment
637 "Recreation Opportunity Spectrum should be balanced between motorized and non motorized. I like the balance in the preferred alternative." (670)

Response. Comment noted.

Comment
638 "The EIS makes the point strongly that SPNM recreation opportunity is a scarce resource and demand for it is expected to increase. This seems to be a recreation opportunity which is compatible with wildland wildlife. We urge you to close at least 30% more roads than the draft proposes." (736)

Response. Demand for SPNM recreation opportunity is expected to increase. However, this increase would not be as predominate in Lake and Harney Counties as it is in the rest of Oregon. Yes, this is a form of recreation which is compatible with wildlife. However, there is already 67% less open roads in the Proposed Action than current management, and we feel this is a significant reduction in road miles on the Refuge (81 additional miles closed).

Comment
639 "Can Alternative D accommodate some primitive recreation? Primitive recreation is nowhere defined, though it seems to be a step up in quality from that afforded by wilderness areas. Only alternative E offers any. (Alternative D is the same as C: none) It seems that a 277,000 acre refuge could offer a full spectrum of recreation alternatives. Can South Mt. be designated as primitive in the FEIS?" (521)

Response. According to the standards set forth in the ROS User's Guide, Hart Mountain NAR does not offer any primitive recreation opportunities, nor would it offer any under the Proposed Action. Some of the criteria for primitive classification are: 5,000 acres in size, at least three miles from roads with motorized use, and evidence of humans un-noticed, However, the Refuge would, under Alternative D, provide number opportunities for primitive camping.

General

Comment
640 "All recreation, Hikers, campers, should pay for privilege of using Federal lands, same as grazing cattle." (29)

Response. While recreationists do pay for camping and recreation on some federal lands, it is economically unfeasible for the Service to collect user fees on Hart Mountain NAR. As far as comparing this to cattle grazing, grazing is a direct benefit to a rancher's business. As an example, people who guide for hunters and subsequently profit from this 'recreation' are required to complete a special use permit and pay a fee.

Comment
641 "I do not support...favoritism granted to the Order of the Antelope to conduct their celebrations within the Refuge..." (37)

Response. This is not within the scope of the EIS. The Order of the Antelope no longer holds its meetings on Refuge lands.

Comment
642 "It [Alternative E] provides no recreation and limited wildlife viewing for the public, a stated use of refuges." (254)

Response. It is true that Alternative E provides limited wildlife related recreation opportunities (provides many opportunities for primitive recreation, but no range of opportunities), and is one of the reasons this alternative was not selected as the Proposed Action.

Comment
643 "We also hope that the local people will understand the economic value of the recreational and restorative aspects of the Preferred Alternative compared to the limited value of continued grazing." (254)

Response. The economic value of recreation would most likely continue to cause disagreement among some Lake County residents because it is often compared to ranching. Ranching is not only an economic value for Lake County, but also an established way of life. There is no doubt, however, that tourism brings in money to the local community.

Comment
644 "I agree that visitor facilities should be improved, while keeping the unique 'flavor' of the refuge as a remote wilderness." (379)

Response. Thank you for your comment.

Comment
645 "We believe that this plan to close some roads, move campsites from sensitive areas...will significantly enhance the beauty and recreational value of Hart Mountain." (452)

Response. Thank you for your comment. We certainly hope so.

Comment
646 "My only concern was the state of the ...bathrooms..." (522)

Response. The Proposed Action calls for new, accessible outhouses to replace all existing ones.

Comment
647 "Have you gave any thought to the Limits of Acceptable Change (LAC) system to be used on the Refuge?" (531)

Response. Thought has been given to using the LAC system on the Refuge. However, without a recreation planner to implement and monitor such a system, it would be too much of an extra responsibility for the Refuge Manager to undertake. If in the future, a recreation planner is hired, then the LAC would be a beneficial system to implement.

Comment
648 "...the presence of cattle and the systems necessary to contain them detract from my visual and aesthetic experience of being able to see pronghorn antelope and associate species in a natural setting." (564)

Response. Cattle would not be present on Refuge lands under the Proposed Action. Additionally, fence removal would be initiated in some areas of the Refuge.

Comment
649 "According to public comment, the presence of cattle can have a negative impact on visitors' experiences...Numerous people have stated that the cattle are historical and beneficial and should be used as a management tool...Where is the information that some people like cattle and enjoy seeing them and would encourage the management to keep them there?" (730)

Response. Yes, we have heard from people that support cattle as a management tool on the Refuge. However, the most common reasons are for managing wildlife habitat, and for preserving the local culture and economy, not for the enjoyment of seeing them on a wildlife refuge.

Comment
650 In 1936 there was an executive order mandating historical sites on the refuge for public use. In my opinion this has not been addressed in the EIS study. I would like to make a suggestion and go on record that the first Fort Warner which has buried soldiers and also Indians, should be an historical site and with a first rate campground established for Lake County and the public at the old Blue Sky and Fort Warner. (788)

Response. The Executive Order establishing the Refuge (E.O. 7523) does not mandate 'historical sites on the refuge for public use'. The scope of the E.O. 7523 is limited to wildlife management. We currently offer an interpretive sign at the Fort Warner site. A new campground would be designated near this site, however establishing a campground at an historic site is not the best way of interpreting the area. Camping would not be permitted in the ponderosa pine stand because of the stand's uniqueness.

Comment

651 I stand against allowing people to ride horses on parts of the Mountain where mountain bikes are prohibited. Bikes cause less damage and don't eat the government's precious grass, and leave nothing behind them to indicate their presence. I'm not against horse back riders, but the vast majority of the public can't afford to own one. Allowing horses, but not bikes, is creating another level of aristocracy. (795)

Response. Thank you for your comment.

Comment

652 Keep visitor room open and accessible. (759)

Response. The visitor room would remain open until the road is re-routed around Headquarters and an information station (kiosk, outhouse) is developed. A visitor center jointly administered by the BLM and Service is proposed for the base of Hart Mountain.

Comment

653 Make some overlooks accessible. (759)

Response. All future projects undertaken by the Refuge would be designed to be accessible to the physically impaired.

Comment

654 Increased use--What will happen? (759)

Response. We have added more information concerning how the Refuge would deal with increased visitor use. Please see Chapter 2, , Alternatives C and D, for this information.

Comment

655 It would be a good idea to sign of dangers such as the roads, weather, etc. (761)

Response. Thank you for your comment. It would be considered when developing a recreation plan (after finalization of EIS).

Comment

656 There are not a lot of parking areas on the Refuge. (766)

Response. Visitors may pull off any road (distance not to exceed length of vehicle) to park, and we propose additional parking areas at Barry Spring and Hot Springs Campground.

Comments

657 We will support Oregon Access Guide's toughest category. (779)

658 Reserve some sites for disabled users. (779)

659 Forget remodeling buildings. Use new structures. It is hard to remodel older buildings. (779)

660 Make use of the people from Klamath Falls as advisors regarding access issues. (779)

Response. Thank you for your comments. They will be considered when new structures are built, and in the recreation plan.

Comment
661 "Why not put video monitors in the Hot Springs bathhouse and visitor center for those who don't wish to walk? The National Park Service finds many visitors prefer virtual reality to nature. This would reduce the perceived need for roads and reduce wildlife disturbance. Dispersed vehicular use should be discouraged to spare staff resources better directed to habitat rehabilitation." (521)

Response. Hart Mountain NAR offers unique recreation opportunities based on the primitive, undeveloped nature of the area. Video monitors do not fall under the category of recreation based on the primitive, undeveloped character of the Refuge. We also do not believe that this would be an economically feasible activity for the Refuge to pursue.

Comment
662 "Recommendation: move forward with planning studies but build no new facilities over the fifteen-year life span of the CMP unless they result in net habitat improvement in proportion to their cost." (521)

Response. The only facilities that we propose are the new campgrounds which will include new outhouses and fence poles to prevent driving in sensitive areas.

Comment
663 "Can current visitation quality be improved? Hart Mt. cannot accommodate limitless demand for recreation in high quality habitat. The solution is to keep visitation at low levels and bring more Great Basin habitat into good condition." (521)

Response. We have addressed in greater detail (in FEIS) what would happen when recreation use of Hart Mountain increases. For more information on this topic, please see Chapter 2, Alternatives C and D.

Comment
664 "There is a safety need for designated giardia-free water, possibly at Barry Spring and at Guano Creek's headwaters. Barry Spring is currently in unsanitary condition due to back-filling and failed design." (521)

Response. Refuge staff are considering developing a water source at Barry Spring for visitors. This would be considered when the adjoining camping area is constructed.

Comment
665 "The street light at HQ is visible for hundreds of square miles and is an intrusion into the high desert reminiscent of the Kamper Corral lights near Page Springs: shield it for minimal directional safety needs only." (521)

Response. Thank you for your comment. It has been noted.

Comment
666 "Names such as Blue Sky Hotel (no facilities), Skyline Drive (usually closed), Black Canyon Road (barely a hiking trail) are misleading and set visitors off on excursions they regret." (521)

Response. Thank you for your comments. They will be considered when developing future maps, brochures, and other literature. Some names, such as Blue Sky Hotel, were taken from the most current U.S. Geological Survey maps. To maintain consistency, we have used their names when possible.

Comment
667 "Few out-of-country visitors are aware that a mid-day shower could leave them stranded on a remote clay road. The barn at Calderwood homestead seems to be in highly unsafe condition. Recommendation: a high quality visitor's map that provides recommended hikes and shows usable roads and destinations." (521)

Response. A high quality map is a great idea. In the future, as funding permits, a new brochure with a high quality map would be developed.

CAMPGROUNDS

Hot Springs

Comment
668 "Regarding the redesign of the Hot Springs Campground, it would seem reasonable to minimize the number of designated campgrounds if it is deemed essential to continue to allow camping in such an ecologically sensitive area (riparian)." (47)

Response. We agree, and propose in Alternative D to minimize the number of sites while still providing adequate camping opportunities for current use. There currently are approximately 30 sites and 10 tent-only sites. Camping adjacent to riparian areas would not occur under the Proposed Action. Better direction and control also would help lessen the impact to the habitat.

Comment
669 "I favor keeping it (Hot Springs Campground) as primitive as possible, but there should be more definition of where vehicles can and cannot go..." (86)

Response. Under the Proposed Action there would be more direction in the campground through the use of an information board with a map and camping areas and sites that are clearly designated. We also would install low lodgepole fence poles to prevent people from driving into sensitive areas.

Comment
670 "The only question we wish to raise is how the Refuge staff would control use when the existing Hot Springs Campground becomes enlarged to 30-45 campsites. This added management responsibility would necessitate staffing solely for recreation and may eventually result in law enforcement responsibilities as well." (359)

Response. The Hot Springs Campground would not be enlarged under Alternative D. It would be redesigned to provide more protection for riparian areas and more direction and control for visitors. This should not result in added management responsibilities. In fact, it should make it easier for Refuge staff to check the Campground and enforce regulations because people are either in a designated site or not. As the campground now exists, much of the damage occurs from people driving and camping anywhere.

Comment
671 "I would like to recommend that you move camping further out of the riparian areas at the Hot Springs Campground." (112)

Response. For the most part, we would move camping further away from riparian areas in the Hot Springs Campground. We also would reduce the amount of campground roads in riparian areas.

Comment
672 I would like to see Hot Springs as a day use area only. The Refuge could develop an alternative site, but not in a riparian area. (758)

Response. Under Alternative D, the Hot Springs Campground would remain open by designing sites so that camping would not greatly impact riparian areas. We would like to keep this site open because it is a popular year-round, established site, and it is located close to Headquarters which helps with law enforcement.

Comment
673 Discourage RV camping. (759)

Response. We do not discourage or encourage RV use. All camping is restricted to what is available in the existing campgrounds. We would recommend, under Alternative D, that RVs use certain areas of the Campground, however we would not offer any accommodations for them. The remoteness of the Refuge and the roughness of the roads limits current use and would continue to do so.

Comment
674 Charge fees at Hot Springs Campground. In central Oregon, when fees are charged, camp behavior improves. (772)

Response. Charging a fee at the Hot Springs Campground currently would cost the Service more than it would gain. The current problems at Hot Springs seem to be with the people that visit the Hot Springs Campground exclusively for the bathhouse, and not the average camper. See comments below concerning the bathhouse.

Comment
675 Restrict Hot Springs to 20 sites. (773)

Response. We feel that the Hot Springs can support more than 20 sites. Please see Chapter 2, Section Two, Alternatives C and D, for more information concerning the campground.

Comment
676 Get rid of outhouses in the Hot Springs Campground, replace with new ones. (773)

Response. We propose to remove the eight existing outhouses at the Campground and replace them with six new handicap accessible vault toilets.

Comment
677 "Something does need to be done at the Hot Springs to keep vehicles out of the wetlands, riparian zones and streams." (521)

Response. We agree. We propose to install two stream crossings, designate areas where people can and cannot camp, install low fence poles to prevent visitors from driving in sensitive areas, and to construct an information board to provide visitors with better direction and understanding.

Guano Creek

Comment
678 "...closure of the Guano Creek campground...is also a high priority in improving habitat on the Refuge." (47)

Response. We agree. Guano Creek Campground would be closed in order to protect this riparian habitat.

Comment
679 "The camps must be kept off of the area immediately to Guano Creek but the area should be left open to camping. There are areas that can be 'hardened' along the draw to allow some isolated vehicle camping experiences." (670)

Response. There would not be any camping in Guano Creek under Alternative D. Even if sites are 'hardened', the riparian habitat is too critical to allow any camping. Our objective is to provide campgrounds that are as primitive and basic as possible. We would do as little site hardening as possible.

New Campgrounds

Comment
680 "New campgrounds should be placed as to minimize damage to the ecosystem." (14)

Response. New campground sites have been selected as to provide limited dispersed camping while minimizing impacts to critical riparian habitats.

Comment
681 "I believe that it (Ponderosa Pine site) would make a good camp site if sites were carefully located and hardened. I realize there is prime riparian area located in this site but I believe with careful planning and development a nice camping area could be established. This camp site should only be open during hunting season and not all year long." (25)

Response. The Pine site (Blue Sky) is a very unique and critical habitat on the Refuge--the only one of its kind. It also is a popular day use area. Camping would be offered close to the area so that visitors may enjoy it without creating the impacts that camping would. Visitors would be able to camp near Blue Sky from June through November, not just during hunting season.

Comments

682 "I question...[a] campground in the Stockade Creek area. This would require road construction across two streams." (28)

683 "The proposed Stockade Creek campground unwisely disperses visitors to an area with little management oversight. These visitors would then disturb and litter a vast new area of wildlife refugia." (521)

Response. We reconsidered the Stockade site and decided not to propose a camping area there, mainly because of the two stream crossings, the slope of the area, closeness to meadow traffic through Blue Sky area, and it is a popular day hike area. The Barry Spring site would not disperse visitors to a new area (it would be located adjacent to Blue Sky Road), and would allow easier management and law enforcement of the area (please refer to Appendix N, Map N-1).

Comment

684 "A better place for a campground [compared to Stockade Creek site] might be south of the road between Guano Creek and Barry Spring, and it would be less impact on animals wanting to feed in Post Meadows." (28)

Response. Based on this comment, we evaluated the site and determined that it would have less adverse impact than the Stockade site. For more detail please see Chapter 2, Section Two, Alternatives C and D.

Comment

685 "Eliminate the development of new camping areas. These would encroach on critical wildlife habitat. Recreation is not the primary purpose of the refuge." (542)

Response. We agree that recreation is not the primary purpose of the Refuge. However, Refuge staff carefully selected sites that would have the least impact on wildlife, but that would have high recreational values.

Comment

686 "Overhauling the existing campground and development of new campgrounds is also important and will help keep the backcountry and uplands less impacted by off-road driving and will allow easier and, therefore, less expensive management of these areas. Where will the campgrounds be located, and how will the Hot Springs Campground be improved?" (182)

Response. The new campgrounds would be located near Flook Lake, and near Barry Spring (east of Blue Sky). A horse campground would be located at Post Meadow corrals. Please see Chapter 2, Section Two, Alternatives C and D, in the FEIS for more information concerning the new campgrounds. As far as off-road driving is concerned, it is not allowed on the Refuge currently nor would it be allowed under any Alternative (please see Appendix N, Map N-2).

Comment

687 "Are not the campground developments envisioned in the DEIS excessive? FWS' mandate is habitat, not eco-tourism, which in excess is incompatible with dominant use objectives. According to the DEIS, accidental fires already dominate the Refuge fire history. The Comprehensive Management Plan (CMP) has little chance of succeeding if accidental fires supplant (and preclude) prescribed burns. More (dispersed) recreation means more (dispersed) accidental fires." (521)

Response. We dropped one of the proposed dispersed sites called for in the DEIS (lower Guano Creek), changed the location of the Stockade Creek Campground to Barry Spring (see Chapter 2, Section Two, Alternatives C and D) (please see Maps N-1 and N-2 in Appendix N), and changed the location of the Flook Meadow Campground to just north of Flook Lake. These changes to Alternative D would lessen impacts to wildlife. As outlined in the DEIS, we propose to close the Guano Creek Campground and mitigate by establishing a campground near Barry Spring. The Barry Spring site would have fewer adverse impacts to wildlife than the Guano Creek Campground. As far as fire is concerned, the Refuge does not allow campfires when the fire danger level is high. We have not historically had a problem with campfires, and do not anticipate one.

Comment

688 "The Flook Meadows site only makes sense if it can distract RVs and Frenchglen traffic from the Hot Springs (most unlikely). Five or six sites just wreck a new area to no purpose." (521)

Response. Refuge staff designed the Flook site with travelers to and from Frenchglen in mind. The Campground has been changed from the Flook Meadows location to just north of Flook Lake. Please see Chapter 2, Section Two, Alternatives C and D, for more information about this site.

Horse Campground

Comment

689 "Post Meadows represents one of the largest meadows at the Refuge and needs intensive work to restore its species composition as well as Guano Creek which flows through it. A horse camp is inappropriate at this site." (359)

Response. The proposed horse campground is on the edge of the meadow. Use of horses is extremely low on the Refuge, and we do not anticipate any significant problems with horse camping in this area. We added more mitigation measures for this site in the FEIS, however, to ensure that if future problems do occur, they would be dealt with immediately. Please see Chapter 2, Section Two, Alternatives C and D, for more detail on the horse campground (see also Map N-1 in Appendix N).

Comment

690 "Horse corrals at Post Meadows will prove an attractive nuisance to commercial outfitters and Willamette Valley horse clubs." (521)

Response. Due to the remoteness and primitive condition of the horse camp, we do not feel that the campground would draw large numbers of groups. We have, however, rewritten the section pertaining to horse use on the Refuge. Please see above comment #359 and Chapter 2, Section Two, Alternatives C and D, for more detail.

General

Comment

691 "I would like to see 'soft' camping only allowed on the Refuge." (52)

Response. Our objective when it comes to camping is to provide primitive types of camping designed to minimize impacts to the environment.

Comment

692 "Although I have camped, hiked and birded on the refuge for over thirty years, I would prefer a permit system, if it became necessary, to attempt to accommodate all the present and yet to be invented ways to drag all the comforts of home into the wilderness." (90)

Response. Due to limited funds, staffing, and remoteness of the area, a permit system is not being considered at present. If use becomes too high for current campground capacity, people will have to go elsewhere to camp (possibly on adjacent BLM lands).

Comment

693 "...camping [should be] banned." (492)

Response. We do not propose to ban camping on the Refuge. We feel that camping, if carefully managed and planned for, is compatible with wildlife objectives and public use management.

Comment

694 "I propose not letting RVs onto the refuge. Tent camping only please." (52)

Response. For now, RVs do not present a problem in campground management. If, in the future, camping becomes crowded and the Refuge can no longer support the amount of vehicles and people, then camping would be more restrictive and people would have to camp off Refuge lands.

Comment

695 "Campgrounds need to be more carefully monitored." (642)

Response. We agree. With the redesign and new campgrounds, monitoring would be key in evaluating impacts. The new design should make monitoring easier. We have added more specifics on mitigation, please see Chapter 2, Section Two, Alternatives C and D.

Comment

696 "If need be, a developed overnight area should be developed outside of Refuge." (52)

697 "I like the location of a campground in the Warner Valley to help take the pressure off the refuge." (59)

Response. Much of the Refuge is surrounded by BLM lands. Camping is allowed on much of these lands, and the BLM currently has plans to place some sites near the Warner Wetlands. This would allow some Refuge visitors to camp at the base of the Mountain.

Comment

698 "Some specific options for dumping wash water." (86)

Response. Currently, the Refuge does not provide for dumping wash water on the Refuge. We provide unique camping opportunities centered around a primitive, minimal development theme. We stress a pack-it-in, pack-it-out theme on the Refuge.

Comment

699 "What does 'minimally developed' mean? In my opinion, development is necessary to prevent further resource damage from occurring but it should be in harmony with the environment as much as reasonably possible- the campground should be low key/low profile but also defined." (531)

Response. We agree. Minimally developed means to provide some direction and control of visitor use, without creating a lot of structures or impairing visual qualities of the Refuge. Our main objective of delineating camp sites and providing direction is to prevent people from driving through creeks and throughout riparian areas.

Comment

700 "And the letter [Sierra Club] mentions the removal of campsites. I ask you...what campsites? Are you speaking of the occasional ring of rocks from campfires of the past when people were allowed to enjoy the Mtn.?" (533)

Response. The removal of campsites refers to the closure of the Guano Creek Campground. The sites are areas that were established over repeated use, and they are located in a sensitive riparian area which offers critical wildlife habitat.

Comment

701 "I believe that the camping as described in alternative B is the most appropriate. This area is unique in that it can provide all levels and types of camping and should be continued to be managed for that to occur." (670)

Response. We feel that the camping in Alternative B allows too many camping opportunities to be compatible with wildlife objectives. Based on NWRS and Refuge goals, we would like to provide adequate camping opportunities with the least impact to wildlife habitat.

Comment

702 "Shade ramadas should be built for shade." (14)

Response. While some tree plantings may be necessary in the campgrounds, shade ramadas are not included in Alternative D. We have not considered this option as to keep the area as free from structures as possible in keeping with the primitive character of the Refuge.

Comment
703 The Refuge needs more campgrounds because visitor use will increase. Rail fences helped prevent driving in the meadow at Hot Springs Campground. (774)

Response. The new campgrounds proposed in Alternative D should help. When visitor use increases beyond the capacity of these campgrounds, then people would have to find alternative camping off the Refuge. We would not add new campgrounds other than what is proposed in Alternative D. We have added more information on planning for increased visitor use in the FEIS, please see Chapter 2, Section Two, Alternatives C and D.

HOT SPRINGS

Comment
704 "I support your proposal to redesign the bathhouse and to prohibit camping adjacent to it." (47)

Response. Comment noted.

Comment
705 "A walking trail to the Springs for soaking might very well cause people to treat it with more respect." (90)

Response. We agree that some problems could be alleviated if people had to walk to the bathhouse. This is a good suggestion. However, access to the camping sites on the west side of Rock Creek below the Hot Springs is needed. Unfortunately, the road that accesses this area passes right by the bathhouse.

Comment
706 Regarding the Hot Springs bathhouse, remove the cinder blocks and make something compatible with native stone (Headquarters buildings). I suggest an all-enclosed, high wall for skinny dippers and those who do not want to see skinny dippers. (774)

Response. We would, under the Proposed Action, redesign the bathhouse to make it blend better with the surrounding environment. We are, however, planning shorter walls for law enforcement reasons.

Comment
707 I support tearing down the Bathhouse. (773)

Response. Comment noted.

Comment
708 I would suggest no driving around Hot Springs (within 200'), because it is creating damage to the geothermal resource. I suggest parking above Hot Springs and creating walk in trail (accessible, less than 5%). (773)

Response. Driving currently is not affecting the geothermal resource of the Hot Springs. The Hot Springs area has been used extensively since the Refuge was established. There are no unique plants or animals dependant upon the Hot Springs area. (Dennis Simmontachi, Lakeview District BLM, personal communication)

Comment
709 I recommend replacing the footbridge. (779)

Response. We are planning on installing a bridge where people currently drive through the creek to prevent further damage to the creek. We would design this bridge to be accessible for physically disabled visitors so that we would not have to replace the footbridge.

ROADS MANAGEMENT

Barnhardi

Comment
710 "I suggest that Guano Creek Road be closed about half-way up the length of what is now designated as a campground." (723)

Response. The Guano Creek road would be closed at the beginning because the new reroute would be approximately 1/2 mile to the east of this road. For more detail on the proposed re-route, please see Chapter 2, Section Two, Alternative D (please see Map N-4 in Appendix N).

Comment
711 "The Barnhardi Road, if it is closed to the public, would not receive enough use from Refuge administration to warrant reconstruction or re-routing." (359)

Response. The part of the Barnhardi proposed for reconstruction would be open to the public. The main purpose of this reconstruction is to continue a loop road from Skyline Drive to the Blue Sky road without going through the riparian area along Guano Creek, which is a critical wildlife habitat area.

Comment
712 "I think you should leave the road between the Hot Springs and Guano Creek open." (2)

Response. The road between the Hot Springs and Guano Creek would be closed. This is critical wildlife habitat, and travel on this road is causing an unnecessary disturbance to wildlife. The road also is located in extremely rugged terrain, and is in very poor condition. We do not have the equipment or the staff to maintain these jeep trails, so some would have to be closed due to excessive environmental erosion. Please see Chapter 2, Section Two, Alternative D, for a complete discussion of this issue (see also Map N-4 in Appendix N).

Comment
713 "I believe Guano Creek road should be closed if camp sites are provided somewhere around Fort Warner site." (25)

Response. A campground would be provided just before the Fort Warner site (Map N-1 in Appendix N). This new camping area would accommodate approximately 20 sites. It would be located to the south of the Blue Sky Road after crossing Guano Creek and before Barry Spring. Please see Chapter 2, Section Two, Alternatives C and D, for more detail on this new site.

Comment
714 "In addition, I would like to see Barnhardi Road closed completely rather than going to the trouble of rerouting it." (47)

Response. Most of the Barnhardi Road would be closed under Alternative D. The rerouting would provide a road in a less sensitive area, so that visitors may still drive near the area without creating adverse impacts to the riparian habitat. This would allow people to drive the loop from Skyline down to Blue Sky Road.

Comment
715 "The Guano Creek road should be converted to a trail, with the few hunter camps closed and toilets moved out, as proposed in the DEIS, because of riparian objectives." (521)

Response. In the FEIS the road would remain closed, camping area closed, and outhouse removed as proposed in the DEIS. People would certainly be allowed to hike along the road.

Big Flat

Comment
716 "Also, the road to Big Flat should be closed rather than being reconstructed." (47)

Response. The road to Big Flat would not be closed because Refuge staff need to use this area for wildlife management activities, and it is a popular wildlife viewing area for Refuge visitors.

Comment
717 "Similarly for the issue of re-routing the road from Post Meadows to Big Flat to avoid the sensitive meadows. If the road is closed to public vehicles then there would be little use (other than occasional administrative use) such that re-routing does not seem warranted." (359)

Response. This road would not be closed to public use. The public would be allowed to access the area from June through November.

Main Road

Comment
718 "Don't make the main road over the refuge anything like a BLM Back Country Byway." (49)

Response. The main road over the Refuge has been a BLM Back Country Byway since 1989. There are no plans to improve the road.

Comment
719 "Will relocating the road away from the headquarters area benefit the ecosystem in the long run, or at least be neutral?" (555)

Response. Relocating the road away from Headquarters would be neutral in the long run. Please see Chapter 2, Section Two, Alternative D, for more detail on this proposed reroute.

Comment
720 "Two items I question are...2. Eliminating public traffic thru the headquarters compound. I know tourists are a pain sometimes, but the benefits of friends made by helping or giving direction, etc. might outweigh the problems." (28)

Response. Visitors would still be allowed to enter Headquarters area, and the visitor room would remain open until a public contact station is constructed. The main reason for doing this is to allow traffic to bypass headquarters. With all the permanent and seasonal employees on the Refuge during the summer months, the chances of encountering Refuge personnel would be relatively high.

Against Road Closures

Comment
721 "Roads are already closed most of the year! You can't really close any more roads without stopping all traffic everywhere the whole year around." (533)

Response. Under Alternative D, vehicle access would be maintained to most major areas on Hart Mountain. We propose to close repetitive roads, roads with excessive environmental damage (erosion), and roads in sensitive wildlife areas (riparian areas).

Comment
722 Under Alternative D, road closures would be extensive. It would allow for the designation of administrative roads...Administrative roads do nothing more than create a social distinction between the haves and have nots. It creates an aristocracy. If the public can't drive to it, government employees should not be allowed to drive to it either. They can walk like the rest of us peons. What's the rush? (795)

Response. The closed roads under Alternative D would be closed to the public and Refuge staff. We propose to retain approximately 20 miles of administrative roads for Refuge staff use (this is a 50% reduction in administrative roads from current Refuge management). These roads are necessary for work where walking is not feasible (e.g. the road to Warner Peak for maintenance of the radio repeater, prescribed burning, and biological surveys).

Support Road Closures

Comment
723 "There are currently 27 entrances by roads or ways to the park. Close many of them for better control and management of the refuge." (53)

Response. Approximately 1/3 of the entrances would be closed because Refuge roads accessing entrances would be closed under the Proposed Action.

Comment
724 "I support your proposal to close the road into Warner Pond...I would however, request that administrative approval be granted [to ODFW] to allow for access once each spring to stock trout." (75)

Response. Oregon Department of Fish and Wildlife would be allowed to access Warner Pond each spring to stock trout.

Comment
725 "I would suggest that you look at more road closures to protect habitat..." (243)

Response. We reevaluated the proposed road closures in Alternative D and feel that the proposed amount is adequate. If specific problems occur in the future, then the manager would evaluate these on an individual basis.

Comment
726 "We favor the closure of 181 miles of roads to further protect sensitive areas..." (263)

Response. This would remain the same in the FEIS.

Comment
727 "Will you rehabilitate the roads/jeep trails that are closed or will you allow nature to take care of that chore? Won't erosion still occur due to the existing tire ruts if no reclamation actions are taken?" (531)

Response. Rehabilitation of closed jeep trails would not take place under Alternative D. Without the pressure from driving, we feel that vegetation will reclaim the roads, and erosion will not be a severe problem.

Comment
728 "Relatively few roads on the Refuge are necessary to provide unique, vehicle-dependant recreational opportunities in the Refuges Recreation Opportunity Spectrum...Thus there appears to be little justification for the extensive road network currently in place in the northeast and southern portions of the Refuge." (745)

Response. Many roads would be left open to provide access to specific reservoirs, juniper areas, and creeks for Refuge staff and visitors. We feel that we have left roads open that are necessary to travel to specific locations. Vehicle-dependant recreational opportunities was not the only factor that we took into consideration.

Comment
729 "...one of us is disabled and uses a wheelchair, but neither of us feels that an argument that access would be too limited if all the miles of roadway were not left open is a valid one in this instance." (660)

Response. Thank you for your comment.

Comment
730 "OWF [Oregon Wildlife Federation] understands the Service wishes to let certain roads remain open for prescribed burning operations. We suggest that the Service expedite burning in areas accessed by roads which the Service would close if not kept open for prescribed burning. At Phase II or at a subsequent time, when burning in those areas is complete, OWF suggests the Service close those roads and allow natural fires to renew those areas in the future." (695)

Response. Areas to burn are selected by vegetation type. The objective of the burn program would be to create a mosaic of different habitats for wildlife; therefore, choosing areas to burn based on road closures is not feasible. If excessive erosion resulted from a burn, then the road may be closed temporarily or permanently to allow recovery; however, if no erosion occurs then the roads would be important to allow access for monitoring the results of the fires. Ecological prescription parameters must be satisfied to ensure resulting fire effects do not further degrade the condition of the Refuge. Those fires not meeting the ecological prescriptions must be suppressed, and access is necessary for suppression.

Comment

731 "Why are so many miles of ways and roads left open? Road closures need to be more extensive. A specific proposal is enclosed (Map R). Recreation must be subordinated to needs of wildlife. Visitors can easily day-hike to any part of the Refuge starting from a small, well-planned system of maintained access roads (see enclosed proposal)." (521)

Response. We agree that recreation must be secondary to wildlife. As such, we propose to close over twice the amount of existing roads. The entire mountain has been closed to vehicle access, most of Poker Jim Road is already closed, and the Barnhardi Road would be closed. These areas are key wildlife areas. All roads except Blue Sky Road would be closed during most of the pronghorn fawning season (Blue Sky would be open year-round, weather permitting). Alternative D offers many opportunities for day-hikes to much of the Refuge via closed roads.

Comment

732 "A roads-to-trails program would make sense. Most visitors stay at the centrally located Hot Springs which provides easy hiking access to Blue Sky (three hours), the west rim (two hours), the Willow Creek trail (one hour), and Rock and Bond Creeks (immediately adjacent)." (521)

Response. Closed roads would make excellent hiking areas, and we plan on using them for this purpose. We also plan on making hiking opportunities more known to visitors. However, we would not have any 'marked' trails.

Comment

733 "There is no documented need for the excessive road network in the NE and SE. Mule deer areas have ample access already; twenty archery tags for a pronghorn hunt do not justify an extra two hundred miles of roads. The DEIS describes extensive and significant unwanted disturbances to featured wildlife due to vehicles. Remote Refuge roads facilitate poaching; management presence is minimal. There is ample opportunity for visitors to enjoy a road-based outdoor experience on the adjacent 13,000,000 acres of BLM land. Slob hunting out of pickup windows is also available from extensive BLM and FS road systems. More roads means more visitors--build them and they will come." (521)

Response. The roads we have chosen to remain open were not selected with hunting being a primary reason. We looked carefully at erosion, location near riparian areas, wildlife disturbance, and redundant roads. We propose to close over half of the existing roads, and have no plans to build any new roads (aside from re-routing a few roads). Any reference to new roads means an old road that is being re-routed.

General

Comment

734 "...also the Spanish Lake and Caulderwood roads should be left open." (2)

Response. The roads to Spanish Lake and Calderwood would remain open under the Proposed Action.

Comment

735 "The road to the mouth of DeGarmo Canyon is getting very rough. It needs maintenance or simply to be closed." (544)

Response. Many roads on the Refuge are very rough; it is not possible for the Refuge staff to maintain all roads. Refuge visitors must use their own discretion when travelling on jeep trails, and we recommend high clearance and four-wheel drive vehicles for all roads except the Main road through headquarters and the Blue Sky Road.

Comment
736 "I would recommend that you seek public input as to which roads to designate for non motorized use. I would like you to consider such designation for the Blue Sky to Hot Springs (Skyline Drive), Black Canyon, part of the Old Military and all roads south of Blue Sky except the South Boundary Road." (483)

Response. Thank you for your suggestion. However, we have chosen to leave open Skyline Drive, Black Canyon, and some roads south of Blue Sky because they are only open during periods when impacts to wildlife would be lowest. We have offered many opportunities for public comments during this planning period (see Chapter 2, Section One, Public Involvement), and have considered and used many suggestions.

Comment
737 "I take exception to your interpretation of the Code of Federal Regulations (CFR 27031) which states that '...travel in or use of any motorized or other vehicles...is prohibited on national wildlife refuges except on designated routes of travel...'. Although I am not a lawyer, I have obtained legal opinion and have been assured that your interpretation is in error. Namely a designation of a route of travel does not automatically define what type of vehicles may or may not travel on a given route. Judgement of what type of vehicle may travel a route is left up to the refuge administration." (483)

Response. Yes, we agree that this statement is confusing and misleading. We have changed the wording in this section in the FEIS to clarify the message we were trying to convey. Please see Chapter 2, Section Two, Features Common to All Alternatives.

Comment
738 "Will the roads be closed to both motorized and mechanized travel--what about mt. bikes?" (531)

Response. Yes, closed roads would be closed to both motorized and mechanized travel. Mountain bikes would not be allowed on closed roads because we anticipate use of mountain bikes to continue to increase greatly. We are trying to prevent any future problems with high uses not directly oriented to wildlife.

Comment
739 "Alternative C looks the best to me for closing roads." (25)

Response. Comment noted.

Comment
740 Consider limiting use of some Alternative D roads to bikes, wheelchairs, walking, horse. (757)

Response. Hiking and horse use is allowed anywhere on the Refuge (please see Chapter 2, Section Two, Alternative D). Please see comment #531 above for more details on mountain bikes. Wheelchair users may travel on any roads that could accommodate them.

Comment
741 Close Poker Jim Spring road. (758)

Response. The Poker Jim Spring road would remain open because of proposed future burns in this area; and because we would close the Petroglyph Lake road (to the west) which is a popular wildlife viewing area, and would like one road to access this area (southern 1/2 of Poker Jim).

Comment
742 Don't improve roads, it limits traffic. (760)

Response. We do not propose improving any roads. We would maintain existing roads to the extent funding allows. The Main road through headquarters and the Blue Sky road are a higher priority due to the amount of traffic they receive in the summer months.

Comment
743 Don't open any roads to ATVs or ORVs. (760)

Response. Roads which are open to vehicular traffic are open to ATVs and ORVs. No vehicle of any type may travel off of open roads.

Comment

744 I don't have a problem with road closures, but don't close the old roads until new ones are built. (766)

Response. The road through Headquarters would not be closed until the re-route is built. The only road we may close before re-routing is the Barnhardi Road, due to soil erosion, wildlife disturbance, and because the road reduces the amount of riparian habitat available to wildlife.

Comment

745 Make closed signs more clear to people (for authorized vehicles). (766)

Response. We agree that there are places where we need to move the signs closer to the start of the road. It is Service policy to have standardized signs. We have found these signs are visible without being aesthetically unpleasant.

Comment

746 "Now is the time to pre-empt ORV/ATV abuse, not after a usage pattern has become entrenched (like at Oregon Dunes or Lost Forest). Visitor commonly drive through inappropriate places and damage sensitive habitat and wetlands (e.g., the July 1993 vehicle in Flook Lake). Serious thought should be given to closing all through roads to the south, to preclude development of a loop mentality." (521)

Response. Please see above Comment #760 concerning ATV use. We are not closing all through-roads to the south because these are not causing harm to wildlife and habitat. These roads are only open under the Proposed Action from June through November. They are closed during most of the pronghorn fawning season.

Comment

747 "The road through Flook and Dobyn Lakes are treacherous for inexperienced drivers (and need closure anyway because of their sensitive wetland nature)." (521)

Response. These roads basically limit vehicle passage when they contain water. We only allow access to the Dobyn Lake area during the summer months when there is likely to be less damage from driving.

Comment

748 "Road also cuts through wetland at Spanish Lake, despite some closures." (521)

Response. Refuge staff enforce road closures to the best of their capability, but there will undoubtedly be violations. These violations will be dealt with as they occur.

Comment

749 "Military Road doesn't really exist east of Shirk turnoff and Martin Creek road is shown as open from the south." (521)

Response. The Military Road is very rough but it does exist. We warn visitors of the nature of our roads and open many of them only in the summer months when there is less chance of muddy, snowy, wet conditions. The Martin Creek road is only open approximately 1/8 to 1/4 of a mile from the south. Although this short distance of open road is misleading, it was done this way because Refuge staff closed the road at the nearest fence line. In the future, a closed road sign can be placed at the entrance to be less confusing to Refuge visitors.

Comment

750 "Is the interim road management to be in the spirit of the preferred alternative? In September, 1993, Refuge staff graded a broad swath the entire length of the Blue Sky road on the far side of the ditches, knocking over established bitterbrush and sage and creating a 47 acre seedbed for cheat grass distributed along half the length of the Refuge. This could have nothing to do with drainage concerns. The Hot Springs road shows that healing could take decades. There was no T&E survey, no EA, even though this seems to be covered under NEPA as a significant federal action, especially given the Eriogonum procidium site." (521)

Response. Refuge staff cleaned out the existing ditches along the Blue Sky Road for drainage concerns. Road maintenance is not a significant federal action, and is not within the scope of this EIS.

HIKING

Comment
751 "Using old jeep roads for trails is a good idea." (14)

Response. We also believe that closed jeep trails would make excellent hiking trails.

Comment
752 "Short segments of trail bed should be allowed to be built, however, if it would allow a easy loop and would not greatly impact wildlife." (14)

Response. We appreciate your suggestion. However, because of limited funds, and maintaining the primitive, undeveloped character of the area, we do not plan to build any trail bed. The Refuge offers many hiking opportunities on closed roads and paths.

Comment
753 "Also, the plan should allow for one or two self-guided hiking trails to educate the public regarding the refuge ecosystem." (14)

Response. This is a good idea. It will be considered when brochures are developed for hiking on the Refuge.

Comment
754 "On page 199, Vol. 1, under the 'Hiking Opportunities' heading, First sentence, add the words 'a primitive and solitary' between the existing words 'few' and 'hiking'. Maybe will provide better clarity and definable statement! After the existing word 'hiking' add, 'experience'. As the sentence now reads and if no new trails are developed, how could additional hiking opportunities exist? Is it because people will be forced to hike instead of drive if they want to get to their desired destination?" (531)

Response. Additional hiking opportunities would be created through the closure of roads; not because people would be forced to hike instead of drive, but because these areas would create excellent hiking opportunities for people who chose to hike.

Comment
755 Planning for trail systems, encourage non-vehicular use. (773)

Response. By closing half of the roads to vehicle use we would, in effect, encourage non-vehicular use of the Refuge. A trail system would be too 'developed' for the primitive character of the Refuge. However, opportunities for hiking along closed roads and designated hiking areas would be increased under Alternative D.

HORSE USE

Comment
756 "Under the 'Hiking and Horseback Riding': 3rd line down-' greatly increase or becomes a problem' statement. Is there some kind of measurement or is it arbitrarily decided by someone when it or if becomes a problem? The LAC system would work well in this case!" (531)

Response. Certain indicators would signal if horse use was becoming a problem. Some of these would be overuse of camping area, erosion problems, and visitor complaints. The LAC system would work well for recreation on the Refuge, however if a recreation planner is not hired in the future the manager would not have the time to implement such a system.

Comment
757 "Excellent idea to develop additional horseback riding trails." (670)

Response. Although a couple comments were received suggesting the development of trails for horseback riding, this was not incorporated into the Proposed Action.

Comment
758 "Some areas should be off limits to horseback riding because of the terrain or because of sensitive environment. In particular I would propose that such activity be off limits to both the western escarpment and the Southern half of Hart Mountain. I am particularly opposed to any commercial or large group use of horses on the refuge. There must be careful regulation of all horseback riding on the refuge to prevent significant ecological harm. Conflict will occur between hikers and horseback riders." (483)

Response. The Proposed Action has been revised to provide more mitigation for horse use on the Refuge. Because horse use is currently low, a lot of restrictions are not necessary. If horse use does increase, mitigation measures to minimize impacts include closing of certain areas to horse use, restricting horse use to certain seasons, closing the horse campground during droughts, and possibly reevaluating horse use altogether.

HUNTING

Comment
759 "[I w]ant trophy hunting prohibited." (27)

Response. The Service's objective for hunting is not to provide trophy hunting, but rather to provide the general public with quality wildlife-oriented recreational experiences and an opportunity to utilize a renewable natural resource; and to maintain wildlife populations at levels compatible with the Refuge habitat.

Comment
760 "Consider restricting hunting on alternate years or alternate weekends." (48)

Response. Although we realize that there is some hunting almost every weekend from mid-August through mid-October, on many of these weekends there are very few hunters. We stagger our hunting seasons so that there won't be crowding on the Refuge.

Comment
761 "...Alternative B also contains some pretty cumbersome baggage, such as...undesirable hunting changes..." (206)

Response. The primary difference in the hunting program of Alternative B is the increase in pronghorn hunting tags. Refuge staff met with ODFW to decide what the Refuge could offer without adversely affecting big game populations or overcrowding hunters. This hunting program option was included in Alternative B because it is the alternative with the strongest emphasis on public use.

Comment
762 "...and we would prefer that hunting be prohibited, at least for a period of time." (263)

Response. Comment noted.

Comment
763 "I strongly support...continued limited hunting..." (267)

Response. Limited, quality hunts would continue under Alternative D.

Comment
764 "...Option D should be followed through with only one modification and that is extremely regulated hunting." (381)

Response. In 1993, the Refuge had approximately 200 total hunting tags for three species of animals (pronghorn, bighorn sheep, and mule deer) with nine different hunting seasons. We feel that this is a very regulated hunting program.

Comment

765 Maintain Hart Mountain NAR as a quality hunting area (current level satisfactory). Quality defined as opportunity to hunt area with limited number of people (low interaction). (760)

Response. We agree that one characteristic of quality hunting is the opportunity to hunt in an area with a limited number of people. This is one reason that most of our hunts have very few tags. This would remain the same in Alternative D in the FEIS.

Comment

766 "Under 'Hunting and Fishing Management" all comments are negative toward the subject. Where is the reference to comments as to the tens of thousands of people that have enjoyed the mountain for hunting and fishing, historically?" (730)

Response. Please see Appendix L and Chapter 3, Section Two, for a description of hunting and fishing opportunities on Hart Mountain NAR.

Comment

767 Put more hunting data in document. (755)

Response. We have more hunting data than most other types of recreation on the Refuge. While hunting is a very important recreational activity to some Refuge visitors, it is only one of the many activities which the Refuge offers.

Comment

768 I favor a two point limit for mule deer. (755)

Response. Comment noted.

Comment

769 I suggest auctioning two rifle (center fire rifle) tags--make it a late season hunt after deer season (over Thanksgiving). (766)

Response. Comment noted.

Comment

770 As far as hunting, rifle hunters should be allowed to hunt on the Refuge, even if it is 'once in a lifetime'. There's no reason why only bowhunters and black powder hunters should be allowed to hunt there. (770)

Response. Rifle hunts currently are provided for hunters wishing to hunt pronghorn and bighorn sheep. Hunting opportunities for mule deer are limited to primitive weapons.

FISHING

Comment

771 "Fishing should be banned from the refuge. Rock and Guano creeks are too small to sustain any amount of fishing pressure-especially if more people start to visit with campground improvements, trails, etc." (14)

Response. The fishing pressure in Rock and Guano Creeks is very low. The creeks are monitored, and fishing is closed if Refuge staff feels there is a problem with the fish populations. Currently, the two creeks are closed to fishing to allow populations to recover from the drought.

ROCKHOUNDING

Comment

772 "Not once under Recreation opportunities did you mention rock-hounding which was being conducted in the area long before it became an antelope refuge." (17)

Response. Rock hounding is a relatively low use of the Refuge, and would continue under current regulations. Current policy regarding rockhounding would be maintained under all alternatives.

Comment

773 "The seven pound daily limit is quite acceptable under most circumstances, except noted below...when a person is lucky enough to find a large (5 + lb)...If the final plan could allow for the collection of the larger pieces..."

Response. We feel that seven pounds per person per day is an adequate limit under most circumstances.

Comment

774 "A yearly limit is not necessary because of the low daily limit and the few trips the average person can make during the course of a year."

Response. We are not proposing a yearly limit. We would continue with the seven pounds per person per day limit.

MONITORING

Comments

775 "As part of the Alternatives discussion, the draft EIS should identify how the Hart Mountain NAR will handle increased recreational tourism in the area." (32)

776 "Habitat restoration plans should include mitigation measures for human impact and intrusion on vegetation and wildlife values." (32)

Response. We agree. Increased recreational use has been addressed in greater detail in the FEIS. Also, we have added more detail for mitigation measures concerning human impacts and intrusion on vegetation and wildlife values. Please see Chapter 2, Alternatives C and D, for more detail.

Comment

777 "The Final EIS should be more specific about long-term research and monitoring, with detailed plans for annual monitoring of all impacts [recreation]." (47)

Response. Comment noted.

Comment

778 "As the restoration projects are undertaken, it is important to involve as many people as possible in the program, and to document carefully the improvement in the habitat through annual photographs taken at the same sites. As funding permits, this story can be told with interpretive signing, by naturalist guides, or in printed brochures. This educational component of the program is very important. It fits in well with the Service's 'Watchable Wildlife' program, and should be a high priority for funding." (484)

Response. This is a very good idea. It would be considered for future interpretive projects, most likely in the form of brochures and tours.

Comment

779 Please consider a free camping permit to collect data (demographics) for the Refuge. (773)

Response. This is something that would be considered in the future. Currently, we use the visitor sign-in book to collect the general information we need.

CULTURAL

Comments

780 "I would like to see the interests of Native people taken into consideration by the EIS. For example, undesignated geographic features could be named in tribute to native people, in native language." (50)

781 "Place more emphasis on protection of Native American cultural and food gathering sites." (542)

782 "We believe that additional information needs to be gathered and provided on Native American traditional gathering places on Hart Mountain. The uses and rights of Native American's must be considered in this document." (735)

783 Fair amount of use by Native Americans and increasing. Description of Indians (page 140) limited. (774)

784 "OWF believes the Service should study ways to protect cultural resources better than Alternative D would protect them but without prohibiting overnight visitors to the refuge." (695)

785 "Has Native American use, past and present, been adequately considered? Native American cultural sites are scarcely considered in the DEIS. Has the entire Refuge been properly surveyed by archaeologists and are the proposed actions consistent with their findings?" (521)

Response. We have tried to increase the coverage of past, present, and future use of the Refuge by Native Americans. Please see Chapter 3, Section Two, Cultural Resources, for more detail on this subject. The Refuge has not been surveyed in any depth or detail. We do know from past work, archeological research and contact with Native Americans that much of the Refuge has sites. We do not necessarily need a complete inventory to know that there is a likelihood that sites are present. The removal of livestock from site areas will be a benefit to the sites. Any structural developments will have to go through the section 106 process before actions are completed. It would be possible to hold meetings with the Native Americans before any on the ground disturbances take place to see that they would not impact sites. We know that Native Americans from the region use the mountain for gatherings, plant gathering and religious uses (Bill Canon, Lakeview District BLM Archeologist). We have added more to the section on Native Americans. Please refer to Chapter 3, Cultural Resources, for more detail.

Comment

786 "The refuge should be surveyed by archaeologists for such sites before a final management plan is adopted." (655)

Response. Due to funding and time limitations it was not possible to have the Refuge surveyed by archaeologists before completing the FEIS. The Service Regional Archaeologist was consulted as to the potential effects on cultural resources from the location of the new campgrounds. The presence of cultural resources is one of the main reasons why the lower Guano site was dropped from the DEIS.

Comment

787 "The DEIS analyzes some impacts to insignificant Euro-cultural artifacts (ranch homesteads and the YCC camp), while tragic vandalization of a Native American sacred site took place in 1992. Refuge map names are exclusively ranchers and soldiers; no earlier Native American place names are recognized." (521)

Response. Thank you for you comment. We disagree, however, that the CCC structures are insignificant. Hart Mountain NAR has some of the finest examples of CCC work in original form in the Nation. These are well documented with the project files at the county museum (Bill Cannon, Lakeview District BLM Archeologist). Although many map names were derived from names of white settlers and soldiers, some map names do reference Native Americans (e.g. DeGarmo Canyon, Paiute Creek and Paiute Reservoir).

Comments

788 "Were Fort Bidwell, Burns, Klamath, and Fort McDermitt Paiute people not sent copies of the DEIS (page 225)? Were living Native Americans such as Clarence DeGarmo consulted for oral tradition records?" (521)

789 "Were ethnobotanists such as Dr. Housley consulted about potential or actual contemporary Native American food gathering sites and impacts of proposed vegetation management on them?" (521)

Response. We did not contact any ethnobotanists. The only Native American group on our mailing list is the Warm Springs Indians.

Comment

790 "Recommendations: (1) include a table of plants used by contemporary Paiutes as Table E-4, (2) include a table of Paiute names for animals as Table H-15 (3) include a map of Paiute territory and bands relative to the Hart-Sheldon Refuges. (Two tables and a map are enclosed:

Paiute animals names:

du-na' (antelope)
gi-du' (marmot)
koipu (bighorn)
zigwu-du (porcupine)
kugwu (ground squirrel)
ka-mu' (rabbit)
pagu'-tsu (bison)
pakwi (Lahontan cutthroat)
du-hu' (bobcat)
padu-hute (elk) [note elk petroglyph at base of Hart Mt.]
hu-na' (badger)
du-hu' (mule deer)
su-hu (duck)

Unnamed lakes and geographic features could receive Paiute names for balance. Thus pa wogadni (water canyon) would be a suitable name for Pronghorn RNA.

grass, waapi
juniper, hakinopu
larkspur, tupi
mountain mahogany;
cattail, tyba
tsinabi, aspen
tsuga, biscuitroot" (521)

Response. Thank you for your comment. The names you mentioned above will be considered in the future.

MINERAL MANAGEMENT

Comment

791 "Volume II, Appendix A-1: The Mineral Leasing Act of 1920 (30 U.S.C. 181 et. seq.) should be included in the list of legislation. While I realize that the list presented is only a partial list, this act should be referenced because the refuge is legally open to oil and gas leasing."

Volume 1, General: Hart Mountain is withdrawn from mineral location under the General Mining Laws. The Geothermal Steam Act precludes geothermal leasing on refuges (mentioned in Volume I, Appendix A-3). However, Hart Mountain is not withdrawn from oil and gas leasing, which is a discretionary action. If applications were received on the refuge, would leasing be considered? If so, on all lands? On some lands? Would leasing be acceptable in some areas with no surface occupancy? With seasonal constraints? A discussion addressing these questions and potential environmental impacts should be included in the EIS.

With respect to mineral material (e.g. rock, sand, gravel, and cinders), would quarries be allowed on the refuge? Would the material be available for projects, such as roads, on the refuge only, or outside the refuge? If so, a discussion addressing these questions and potential environmental impacts should be included in the EIS.

The DEIS briefly discusses the Back Country Byway which runs through the refuge and the High Desert Discovery project. Both of these are expected to increase economic diversity in the area by promoting tourism. The DEIS also describes the expected road maintenance activities associated with each alternative. However,there is no discussion of the potential need to increase maintenance or even upgrade existing roads in order to accommodate the expected increase in traffic. The DEIS does not document the potential impacts of increased tourism such as increased traffic. The BLM is particularly concerned about the Back Country Byway route which passes through the refuge. That portion which runs from Plush to the refuge headquarters is maintained by Lake County and is in generally good shape. The refuge is responsible for maintaining that portion continuing from the refuge headquarters to the east. This portion is generally not in good shape. Are there any plans to better maintain this road or to upgrade it? If so, these plans should be documented in the EIS. The BLM would strongly support such plans. (541)

Response. The Hart DEIS does not address Mineral Management as we do not anticipate, allow and/or condone secondary uses which have proven to be potentially disastrous to the environment.

As the writer has stated, the Refuge is subject to oil and gas leasing. Oil and gas leasing on Refuges is a discretionary action, meaning it is closed until open. Given the virtual absence of any such leasing in the area, the Service feels that the issue does not merit consideration. In the event of expressed interest in the leasing of such mineral rights the Service will reevaluate its position.

With respect to mineral material, the Refuge currently removes gravel from two sites for use on Refuge roads. The Service, in regard to Hart Mountain NAR, currently does not wish to take on the burden of marketing mineral material. The Service condones the removal of mineral materials from existent pits by its neighbors for uses which benefit the Refuge and/or the resource. However, excavation of new pits that are not centrally located to Refuge needs will not be considered.

In light of recent large budget and staff reductions, the Refuge does not anticipate having the capability of increasing maintenance or even upgrading present road conditions. The Service agrees that the road to Frenchglen is generally not in good shape. The Service currently is doing everything it can do to maintain roads and prevent them from getting worse. The promotion of the Back Country Byway has increased traffic through the Refuge but not to the degree which merits major road improvement. The Service intends to continue road maintenance as funding and staffing allow. Including road maintenance in the FEIS is not necessary as it is a categorical exclusion.

FUNDING/STAFF

General Comments

792 Before Barry got here, there were probably eight or nine people in the Fish and Wildlife that you know was there. It's growing like the Forest Service is. In another few years, it will be as big as the BLM. They will be building another building somewhere. Here, Carter, er Clinton is talking about cutting out the military. I think he better save his military, because he probably will need them. If he wants to cut, he should cut the Fish and Wildlife that don't do anything. (789)

793 The budget for Hart Mountain is $1.2 million, I think. That is the only published number that I have seen. It's a lot of waste of money. If Clinton wants to cut the damn budget, that would be a good place to start. They pretty well waste it there. (801)

Response. Comments noted.

Comment

794 No grazing fees will be received [if Alternative D is implemented]. (29)

Response. This is correct.

Comment

795 On the topic of project management, the draft EIS was not clear on the process of implementation of the preferred alternative. Will there be a tiering process that requires Environmental Assessment for each project? How will this management plan facilitate decision-making in the long-term? (32)

Response . Alternative D, contingent on approval, would facilitate decision-making in the long-term by outlining a strategy for reaching Refuge goals. Operation plans (3-5 year planning horizons) will be developed that provide greater detail for on-the-ground implementation of the strategy outlined in Alternative D. Where necessary, Environmental Assessments would be completed for Operation Plans, and these will be tiered to the FEIS.

Comment

796 "The draft EIS presents a list of assumptions on page 141 in the Environmental Consequences section. One of these is, "(f)unding and personnel would be sufficient to implement any alternatives selected." We believe that, although a statement such as this is justified in this context, it is also important to document what decisions will be made in the event that funding is not available. On page 26, in the Alternative Development section, it states, "during periods when the Refuge budget is lower than predicted, it may be difficult to obtain funding for even the most important projects." These "important" projects should be identified so that the public can see what will happen if funds are restricted.

In the final EIS, the EPA would like to see an analysis of how the project will be managed on a financial level. A schematic flow diagram of project priorities from a financial perspective may help to show what programs would be effected when funding becomes scarce." (32)

Response. Based on this and similar comments, part 5 was added to each of the alternatives in Chapter 2, Section Two of the FEIS. It provides an outline of estimated costs and staffing that would be needed to implement each of the alternative. It also identifies the projects that would receive top priority given limited funds.

Comment

797 "I would encourage you to seek additional funding to fully monitor the activities which you implement under Alternative D." (35)

Response. The budget proposed for implementation of Alternative D (Chapter 2) would substantially increase the biological staffing above the level that occurred before the management planning process was initiated.

Comment

798 "The value of proposed RNAs declines if monitoring is not promptly implemented. Has the Refuge budgeted for timely RNA establishment reports in 1994 to document current conditions for future researchers? The FEIS needs 8.5 x 11 maps showing RNA proposal boundaries on 7.5" or 15" quads to clarify their location." (521)

Response. Monitoring in the Proposed Action is described in detail in Appendix N. No specific funding would be scheduled for RNA inventories or monitoring, however, volunteer assistance would be solicited to address information needs. Contingent upon approval of the Proposed Action, Refuge staff would develop a series of reports that review the values and purposes associated with each proposed RNA. Inventory and monitoring needs would be addressed in these reports. Boundaries of existing and proposed RNAs were mapped at a 7.5' scale, boundaries were digitized, and maps displayed under each alternative in Chapter 2 were computer-generated. More detailed information on boundaries of existing and proposed RNAs is available by request from the Refuge Manager.

Comment

799 "Future personnel should have a work plan; this could involve volunteers where resources are limited." (528)

Response. Operation plans, with 3-5 year planning horizons, will be developed for individual programs following approval of the FEIS.

Comment

800 Regarding the Fish and Wildlife and the Draft EIS, I don't feel that it is quite complete, because I think that they have neglected to tell the public how many dollars of taxpayers money that they have spent and how many more dollars they are going to spend in trying to accomplish what they want to do. I have been told at one time that Mr. Andy Kerr and ONRC were going to help pay for this, especially with labor, but I really don't think that is the truth. OK. Fish and Wildlife have spent thousands of dollars on this study and if their intent was to lock up Hart Mountain and the surrounding area, maybe they have succeeded. But, if they would have spent this money working with Lake County people and the ranchers and the land owners, they could have very easily accomplished ten times the dollar value and create a wonderful wildlife and people habitat. (788)

Response. Costs to implement each of the alternatives are presented in Chapter 2 of the FEIS.

SOCIO-ECONOMICS

General Comments

801 "We also hope that the local people will understand the economic value of the recreational and restorative aspects of the Preferred Alternative compared to the limited value of continued grazing." (254)

802 "The economic return from raising cattle on the refuge does not justify the environmental damage caused by the practice. We need to continue to give the refuge a respite from grazing." (276)

803 "The cattlemen there don't want to lose their grazing land for the 15 year period. I think they ought to consider your plan as a good investment: the turn-around that can be facilitated for the ecosystem will

surprise all of us, I'm sure. The return on the investment will be great. In 2009 or 2010, the richness of that area will be a tremendous asset in the community." (566)

804 "I hope the citizens of Lake County come forth as leaders in the nation towards more intelligent, long-term planning for their economic health. They may think the present condition of the nature and wildlife is good enough. But by not supporting this preservation effort now, the citizens are reinforcing a mentality that will make it easy for other commercial entities to pry open the community for uncontrollable development." (566)

805 "I am not unsympathetic to the economic impact of the loss of grazing land, but from a larger perspective, the reserve is a small percentage of the public land available for grazing. We have on the reserve a special opportunity to investigate the true potential of this type of ecosystem. It would be a great loss to miss this opportunity." (644)

806 "Meyer Resources' analysis of economic impacts to the area near the refuge impressed Oregon Wildlife Federation. Analysis showing the area is better off financially under the preferred alternative than under the status quo also impressed OWF." (695)

807 "The most frustrating point is how quickly the United States Fish and Wildlife has jumped onto the statewide tourism panacea. To mitigate any negative economic impact on the community, we simply need to replace cattle with tourists. The old cow pies for beer cans trade-off. I'm not sure which would be more appealing to an antelope. I encourage you to further investigate the situation, evaluate whether its worthwhile to sacrifice a piece of the Great Basin ecosystem for the short term politically motivated hoopla of the moment." (798)

808 "I want to applaud the Fish and Wildlife for their concern that Lake County gets it's share of the tourist dollar. I appreciate that very much, but about eight months ago, the Tourism Committee for the Chamber of Commerce sat down and we put together a mission statement and it took us all day to do this and we worked very hard on it. I think in this process that the Fish and Wildlife say that they want to trade the loss of livestock dollars on Hart Mountain for tourism dollars. They are not thinking about that mission statement that we put together. I will get a copy of that for the Fish and Wildlife and I will get a copy of that for the Commissioners...The mission statement goes something like this: To promote tourism in such a way as to enhance Lake County's current lifestyle and industry. So in other words, if we are going to trade livestock dollars for tourism dollars, we really don't want it." (803)

Response. Comments noted.

Comment

809 "If the interests of the monetary economy are allowed to defy nature's economy they both will collapse in the long run." (70)

Response. The FEIS analysis concludes that the management option that is most productive ecologically also provides significant levels of net economic benefit.

Comment

810 "The DEIS also contains an economic analysis. In as much as it pertains to the economic effects on permittees it is overly simplistic and inaccurate. The DEIS estimates a $0.96 difference between public and private pasture. The study cited is based on season long occupancy. Most grazing on Hart NAR is done for a few months during the season and is integrated with other public land grazing surrounding the refuge. Shifting to private land grazing for only part of the season does not allow for the elimination of the fixed costs associated with grazing on government lands. Therefore, the actual impact of substituting private pasture for grazing eliminated on Hart Mountain NAR is several times higher than the estimate used." (206)

Response. It is correct that Obermiller (1992) analyzed pastures by season. However, season length varied between pastures, and some responding ranchers utilized both public and private pastures. Further, costs in that study were not estimated per year, but per AUM. The same study indicated that the principal factors that could alter rancher cost were: Length of season; number of animals on the allotment; and distance between home ranch and pasture - and the estimates incorporated variation in these parameters in eastern Oregon.

It is agreed that changes to the mix of public and private lands grazed in the region will alter grazing costs - but average regional costs should still be bounded by the estimates in Obermiller (1992). Costs for any individual operator may vary from these average estimates. However, it is not agreed, from the information available, that actual average costs would be "several times higher".

Comment
811 "I think the combination of Hart Mountain and Malheur Bird Refuge would attract a lot of people eventually. Good for the economy and all that. A plane trip to Lakeview from Portland and all the wildlife you can stand..." (265)

Response. Additional joint benefits associated with Hart Mountain NAR and Malheur Bird Refuge were not directly assessed in this DEIS.

Comment
812 "Discrepancy number 1: DEIS, Appendix L, page 44, paragraph one of section ii) Direct Revenue Impacts on Cattle Grazing. The last sentence of this paragraph states "indicates that the average rancher is operating at a loss". As Co-Author of the publication cited from which this statement is generated I provide the following. The enterprise budget is not or does not state that the data is supportive of the average ranch income in Lake County.

Furthermore I am not familiar with any publication that does state statically or otherwise what the average profit potential of a rancher in Lake is. EM 8470 is a model-education tool for ranchers to use in developing a budget for there given ranching operation. I refer you to EM 8354, Understanding and Using Enterprise Budgets for further information relating to EM 8470 cited in Appendix L.

This discrepancy is important to note, realizing that it has direct impacts on the conclusions described in Table 48, page 46." (505)

Response. The Cow/Calf Enterprise Budget for the Lakeview Area, developed by the OSU Extension Service, states:
This enterprise budget estimates the typical costs and returns of producing calves in the Lakeview area of south central Oregon. It should be used as a guide to estimate actual costs and is not representative of any particular ranch.

The EIS does not evaluate impacts on specific individual ranchers - and these typical costs are the most useful and geographically appropriate to this analysis. The term average will be replaced by the term typical in the cited section.

Comment
813 "Discrepancy number 2: DEIS, Appendix L, page 45, paragraph one. Meyer assumes that a rancher will act by cutting numbers, or finding alternative pasture to utilize. The discrepancy here is that 78% of Lake County is publicly owned. The opportunity to change to private grazing may not exist. As outlined in my Hart Mountain grazing report cited in Appendix L, the cattle leaving Hart Mountain will result in higher competition for private pasture land resulting in a net displacement of total cattle grazing in Lake County. Furthermore, given economies of scale, a given ranch that has historically grazed Hart Mountain may not be able to cut back production and maintain the ranch as an economically viable operation." (505)

Response. Given the amount of former cattle grazing on Hart Mountain NAR, it is not agreed there is no opportunity to shift to private pasturing. The socio-economic analysis (Appendix L) concurs that loss of cattle production is more likely the longer term effect. There is no evidence to conclude that the Hart Mountain NAR alternative plans would force out of business a typical economic ranching unit that might otherwise use a grazing lease on the Refuge. There may be economically marginal ranching units in the area, that could be vulnerable to any changes which might affect them.

Comment
814 "Discrepancy number 3: DEIS, Appendix L, page 44, paragraph two. Meyer concludes that management alternatives will "not substantially impact overall revenue from grazing". As cited in my testimony at the Lake County Commissioners public hearing report, upwards of $700,000.00 worth of grazing revenue is being lost. On a national basis or regional basis this probably is not substantial, however this means that the Federal Government now has that much less money being generated from public lands. Although it may not be substantial in the overall grazing revenue budget, it is very substantial for the grazing revenue generated on Hart Mountain and should not be discounted. The FEIS should further address this issue and its relationship

to other uses of Hart Mountain. My point here is that grazing is the only use on the mountain that generates new and direct dollars for the government on this parcel of public land." (505)

Response. This comment is incorrect. First, the DEIS section cited by the commentator refers to "federal revenue from grazing", not "all revenue from grazing", as stated in the comment. Second, if the testimony referred to reflects data in Hart Mountain Grazing: Economic Impacts on Lake County, by W. Riggs, estimated direct impacts range from $189,000 to $756,000. Third, special use permits return direct income to the Service (not directly to the Refuge). The budget that the Refuge receives to administer Special Use permits and to manage the Refuge is not dependent on the amount of revenue received from Special Use permits.

Comment
815 "Discrepancy number 4: DEIS, Volume I, page 263. Hart Mountain Grazing: Economic impacts on Lake County is a peer reviewed, numbered publication from Oregon State University and should be cited as such. This paper was also submitted and not addressed in the DEIS." (505)

Response. The copy that the Service received was an unnumbered copy. The Lake County Special Report number was identified and the FEIS subsequently was revised to reflect the error.

Comment
816 "Although Myers considers the given alternatives in the Socio-Economic analysis, a comparative analysis was not completed. A table or graphic comparing the economic values for the varying alternatives needs to be developed once data discrepancies, as described above, are accounted for. Although Decision Theory is applied in this research report and is applicable, simple cost and returns analysis needs to be incorporated and included in the FEIS." (505)

Response. The DEIS provides comparative data on economic impacts in Tables 50 through 55 of Appendix L.

Comment
817 "BLM public records identify the participants in the consortium that purchased the nearby MC Ranch; at least one of these includes a former Refuge permit. The economic analysis should be updated to reflect the current situation, which mitigates local economic impacts significantly." (521)

Response. It is agreed that information on subsequent actions by former Hart Mountain NAR grazing lessees would be useful. We have been unable to obtain sufficient information to reach objective judgements. Further, the circumstances of former lessees may or may not adequately represent the typical circumstances of potential future lessees. It is considered that the DEIS adequately presents the range of potential economic effect on potential typical grazing lessees at Hart Mountain NAR.

Comment
818 "If grazing is discontinued here on the Refuge for a period of time, a limited number of ranchers will be directly affected. The need to find other grazing areas on private lands may even be a benefit to the private sector economy locally." (583)

Response. We believe that the socio-economic impact analysis (Appendix L) generally reflects the magnitude of beneficial and adverse effects on the local economy.

Comments
819 "Enclosed is a copy of an article from Smithsonian, October 1993 which describes the tourism effect on two northern California counties following the formation and expansion of Redwood National Park. The economic information for the recently dedicated Warner Wetlands near Hart Mountain and similar information for this DEIS is false and is based on erroneous assumptions. In fact, the loss of grazing on Hart Mountain by four existing vested permit holders amounts to approximately $900,000 per year in the local economy. That figure is based upon a typical operation of 700-1000 head of breeding stock grossing a minimum of $350,000 in annual sales. Using a very conservative local multiplier of 2.5 means that $875,000 per year will no longer circulate in the Lakeview/Burns economy. State and national economic losses are less respectively, but in aggregate, Alternative D will cost the taxpayers over $1,000,000 in lost opportunity in addition to the prohibitive cost of supporting personnel, supplies and equipment to carry out the proposed activities. Lake and Harney Counties will experience loss of revenue and increased expenses which

accompany government proposals to increase citizen traffic in remote areas. Increased tourism dictates increased investment in county infrastructure, especially roads and emergency services." (600)

Response. This comment is not agreed to. Neither underlying data citation nor sufficient calculation is provided to substantiate assertions with respect to economic impact in the Lake County region. The estimates provided also appear to deal with gross economic impact, not net economic impact, as identified in the DEIS.

The local multiplier of 2.5, used by the commentator, is likely excessive. For example, recent work on agricultural multipliers at the University of Nevada suggests a livestock final demand multiplier of 2.1 (Technical Report UCED 92-01- Economic Linkages in the Economy of Churchill County). Work by Davis (Davis 1986) suggests that multipliers will be even lower in more remote regions, due to expenditure leakages by local residents.

The article on Redwood National Park, cited by the commentator, chronicals economic difficulties along the northern California coast - and relates them to expansion of the Park. In fact, as the article notes, the northwest coastal area has been adversely affected by declines in timber harvest and processing due to prior overcutting (An Analysis of the Timber Situation in the United States, U.S. Forest Service: General Technical Report RM-199), and by substantial declines in commercial fisheries as well as by Park expansion. Further, Hart Mountain NAR is primarily a destination park, while Redwood National Park primarily receives visitors traveling through on Highway 101. It is concluded that, for these reasons, there is insufficient linkage between Redwood Park and Hart Mountain NAR to amend the Hart Mountain DEIS based on this article.

Comment

820 "This management plan significantly affects the human environment as well as wildlife. Therefore, the human environment needs to be considered and impacts mitigated to maintain the cultural aspects and quality of life of the people affected by the selected alternative. The economic stability of communities near the refuge is negatively impacted due to the loss of ranch income and loss of tax dollars for schools and roads in Lake County.

There is no mention of maintaining or preserving the culture, customs, and economy of our area. The loss of income to the ranchers due to reduced cattle numbers is not mitigated. The quality of life from a cultural aspect is not considered in the Hart Mountain Management Plan. The socio-economic impacts on the County and local communities is not considered." (605)

Response. We believe that the DEIS fairly considers the economic effects on the local community. It is agreed that preservation of the culture of the Lake County area is a valid potential impact consideration. Such considerations are usually described under the term preservation value. Preservation value does not refer to discrete changes in the mix of local activity, but rather to changes that are sufficiently large to significantly change a community or county's socio-cultural makeup or lifestyle. Actions that would remove all ranching from Lake County would clearly represent such a change. The impacts envisioned from alternative management at Hart Mountain NAR are far more discrete. It is consequently concluded, at this scale of impact, that the culture and lifestyle of Lake County would not be materially affected.

Comment

821 "The normal return (Alternative A) from grazing at $4.00 per AUM yields just over $51,000 based on the average AUMs from page 32 and probable 1/4 of that goes to the local county government. And I expect the cost of administrating the program is far in excess of this return to say nothing of the environmental cost to the land and streams. It really is time for the grazing to be terminated. The tradition of grazing cows on the public domain needs to be changed, at least as far as the Refuge is concerned. Put your energy into running the Refuge for wild native species of animals, birds, fish and plants." (718)

Response. The Service paid an average of $39,017 to Lake County government in lieu of taxes during the years 1983 to 1990 (based on 1982-1989 figures) during which time livestock were being grazed on the Refuge. Approximately 12 percent of the dollar amount ($4,659) was from livestock grazing receipts (25 percent of net receipts on reserve lands). The remaining 88 percent of the dollar amount was based on $0.75/acre of fee lands on the Refuge. In 1992 and 1993, the Service paid Lake County government approximately $40,153 and $38,282 in lieu of taxes (these amounts include livestock grazing receipts). The absence of livestock on the Refuge would result in a small reduction in the amount of revenue paid to Lake County in lieu of taxes. The revenue generated from livestock grazing receipts goes directly to the Revenue Sharing Fund for the Service. The budget that the Refuge receives to manage the Refuge is not dependent on the amount of revenue generated from livestock grazing receipts.

Comment
822 "Tourism" on Hart Mountain is not an overall economically beneficial consideration, at this time; and the "cattle permitting" has been the only positive economic benefit to offset the management cost of the refuge. The statement "By the 15 year benchmark; increased business revenue associated with recreation/tourism under Alternative B,C, or D would exceed adverse impacts on agriculture" is a figment of someone's wild imagination, and has no place in this document. All long-range predictions are made for 15 years, yet the statement "At the 50 years, this net beneficial affect would have increased to $350,000 to $1,035,000, depending on assumptions used." How can a responsible agency make these preposterous presumptions and yet, not come up with an estimated cost for responsible management on the refuge. Cattle grazing and recreation have been compatible for many years. Visitor hours and days on the Steens and other areas in Harney County seem to be increasing, regardless of the level of cattle grazing." (730)

Response. Data in the FEIS (Appendix L) indicate that tourism is presently beneficial to local businesses, and that such benefits are likely to increase in the future.

The statement in the DEIS commencing, "By the 15 year benchmark...", has been revised in the FEIS to reflect adjusted data on vegetative recovery associated with management alternatives B, C and D.

The FEIS employs 15-year and 50-year benchmarks so that effects of the alternative management plans can be considered progressively over time. Impacts at 15 years are not comparable with impacts at 50 years.

Visits to Hart Mountain NAR are increasing. However, level of cattle grazing does affect the vegetative capability of Refuge lands to support species that are of interest to these visitors.

Comment
823 "The economic analysis is a bit confusing. It assumes that any permit cancellation will result in complete loss of that number from the economy. In reality, the only loss is for the AUMs that were permitted. In other words, a canceled 100 head permit for 6 months is a loss of only 50 head to the annual economy, not a 100 head loss. A canceled 6 mo permit is a total loss to the economy only if the permittee were running yearlings which were grazed only on the refuge. Your analysis seems to be very strongly a worse case analysis. This is OK if it is clearly stated as such. Some clarification is needed here." (736)

Response. This comment is correct. The FEIS has been adjusted appropriately.

Comment
824 "Pardue - If there was no restrictions on your permits, how many head of livestock would you have on the mountain right now?

Miller - We would have 150 pairs.

O'Keefe - I would have to ask the guy that runs the livestock at our place.

Pardue - Of course you have had to make other arrangements for these cattle?

Miller - We had to.

Pardue - You have gone pretty much to private land?

Miller - A lot of them were sold." (781)

Response. Loss of cattle production where ranchers cannot find alternative pasture are included in the socio-economic analysis of the DEIS.

Comment
825 "The losses to the community reach far greater than the increased costs of operation to a rancher. The preferred alternative D will result in the reduction of the county's tax base. That has negative aspects for school districts and other vital services. The DEIS is grossly deficient in addressing all of the economic issues. The attempt to mitigate the loss of real dollars with tourism dollars is an example of the total disregard the current political agenda has for this community. Tourism estimates are also in error and they admit that on page 133. The number of local residents visiting the mountain are sorely underestimated and the number of visitors from other areas is grossly overestimated. The one major economic item entirely lacking discussion is the fact that Alternative D will result in higher governmental expenditures. At a time

when federal government spending is out of control and the nation is facing a two trillion dollar deficit, what effect will this, as well as the thousands of other similar projects throughout this country, have on the wealth of this nation and its people." (795)

Response. The Service makes a payment in lieu of taxes to local government primarily with respect to the lands of Hart Mountain NAR. In 1989 this payment approximated $40,000 (please also refer to comment 821). Similar payments in lieu of taxes would continue under any of the management alternatives considered. Other tax impacts would be related to the business effects on ranching and on businesses servicing recreation/tourism. Reference to summary Table 50 indicates that these impacts would be positive under Alternative D at the 15 year benchmark, and would be positive for Alternatives C and D if prospective grazing lessees at Hart Mountain NAR could find alternative pasture, and negative if they would not. At the 50 year benchmark, it is estimated that Alternatives B, C and D would all have positive effects on local businesses and tax revenue. Alternative E would be adverse for local tax revenues at both the 15 year and 50 year benchmarks.

Comment

826 "Every dollar that they don't make is $7 that's lost to our community. A dollar will trickle down seven times in our community before it moves. That is a lot of money." (801)

Response. This multiplier estimate is far too high. Also refer to response to comment 600.

MISCELLANEOUS

Inholdings

Comments

827 "I can find no considerations for private land holdings within the refuge. Unless you have acquired considerable parcels of private land that I am unaware of you plan to:

a. include private land holdings within WSA's,
b. close two-track roads that were made prior to the refuge by ranchers maintaining their springs, and
c. control private lands by denying access." (17)

828 "Are you prepared to compensate non-federal land owners on the refuge for the proposed taking of their holdings?" (17)

Response. At present, there are several private inholdings along the western boundary of the Poker Jim recommended Wilderness, which is pending Congressional action. These private inholdings are accessible from the base of the mountain. The existence of private inholdings does not preclude an area from being studied for its wilderness potential. However, the large number of private inholdings in the Fort Warner area, on South Hart Mountain, was one of the reasons it was dropped from consideration. Road closures would not preclude access of private inholdings by landowners; these issues would be handled on a case by case basis. The Service will continue to purchase land from willing sellers only.

Comment

829 "If you persist in your present course of action, I'm prepared to donate my services to the private land owners to help them survey in their properties and fence them as exclosures so they can utilize them some for their livestock. This could create some problems for you in certain areas where all of the water is in private holdings." (17)

Response. Comment noted.

Comment

830 "Oregon Wildlife Federation supports the Service's efforts to purchase inholdings within the Refuge. Inholdings deleteriously effect the Service's implementation of Alternative D, especially regarding the Service's prescribed burning program. In addition, certain inholdings' owners tend to exhibit behavior which can repel wildlife as well as humans. OWF envisions a Refuge in the future with no inholdings, state or private." (695)

Response. Comment noted.

Comment

831 "There are still several individual land owners on the Refuge and I presume that they still will be there. The landowners constitutional right to farm has not been addressed except to remove the livestock for 15 years. Then what?" (788)

Response. The Proposed Action applies to Refuge lands only.

Domino Effect

General Comment

832 "If ranchers can't survive without federal subsidies and federal land, maybe they should find another way to make a living. Because, the cost of allowing cattle to roam freely has become much too high. Those animals are simply too destructive. As a nation, we can no longer afford the subsidies or the clean-up costs." (118)

Response. Comment noted.

Comment

833 "I also have a huge feeling of distrust when I hear that this is not a pre-curser to ridding all public lands from cattle grazing. I feel that this is the main thrust of all mis-directed environmental moves going on." (9)

Response. Strategies outlined in the Proposed Action reflect strategies that the Service believes would best contribute to achieving goals and long-range objectives of Hart Mountain NAR.

Military

Comment

834 "The potential impacts of future proposed utility corridors and low-level military operating areas (MOA's) on refuge activities should be addressed in the DEIS." (541)

Response. This is beyond the scope of the EIS. Please also refer to next comment.

Comment

835 Do something about low level flying. (766)

Response. The U.S. Navy Military Training Route VR 1353 crosses Hart Mountain NAR in the S.E. corner over Crump lake. Special operating procedures require military aircraft operating on VR 1353 to maintain a minimum altitude of 1000' AGL (above ground level) and to remain south of the route centerline while in the vicinity of Hart Mountain NAR.

Hart Mountain NAR also is within the Hart Military Operations Area (MOA). Military aircraft activity within the Hart MOA must stay above 11,000 feet which is approximately 3,000 feet above ground level of the Refuge. The south boundary of the Juniper South MOA is the north boundary of the Hart Mountain NAR, and therefore, activity from this MOA should not occur over Refuge property.

Service and Navy personnel are cooperating in efforts to eliminate violations of these operating procedures. (Refuge files)

MAPS

Comment

836 "Can the maps be improved in the FEIS? Improvements to cartographic resources are needed. For consistency, one scale should be chosen for all 8.5 x 11 maps. A practical advantage of the same scale is that a reader could xerox, say, the WSA/RNA map onto a transparency and overly it on the geographical place names map. However, three different map scale sizes are used on the 8.5 x 11 maps in Volume I. The scale ratios are 1 : 1.07 : 1.16, an awkward and arbitrary set. (Maps 2-3, 2-5, etc. are at a smaller scale than Maps 2-1, 2-2, 2-9, etc., while Map 2-4 is at a larger scale.) The scale should also be sensible in terms of miles to the inch or ration. Map 2-4 is currently 1.4" = 5 miles, or 1" = 3.57 miles; or 1 mile = 0.28", or 1 : 226,195. Some maps (e.g., 1-4) also show scales to the foot, not helpful given the size of the Refuge. Some maps (i.e., Map 2.1) show no scale at all. Ratio scales (e.g., 1:250,000) should be given on all maps as well as inches to the mile. More useful than a mileage scale would be a faint township grid overlay. It is

helpful to give the multiplier relative to 7.5' quad maps: 5 miles = 2.040" or 1 mile = 0.4080" or 1 : 155,142 scale. Thus the multiplier for Map 1-3 to 1:24,000 USGS Quad maps is 6.471 (or 16.54% for reduction of quad map to same scale)." (521)

Response. We have attempted to make the map scales more consistent (with the exception of Map 2-4 which needs a different scale to be able to read the text). However, due to funding constraints and limited personnel with map making experience, the maps may not be of the highest quality. Maps in the FEIS are of sufficient quality for the purposes of this EIS.

Comment
837 "For legibility, maps should make maximal use of the printable area, which was 7.25" x 9.5" (allowing for margins, gutter, and trim). The footer text could be reduced on map pages to just the page number, making space. Note that the Refuge is conveniently proportioned at 1 EW : 1.27 NS. Map 2.3 could thus be enlarged 30.3% to fit perfectly on the page. Suggestion: print small maps four to an 11 x 17 page at 1:200,000 (so two pages front and back for Alternatives A.B,C, and E). Higher quality maps for Alternative D could match the scale on Maps 1-3 and 1-4. A map packet is more convenient than bound maps for both reader and printer." (521)

Response. Comment noted.

Comment
838 "The Refuge has seven non-contiguous parcels that caused numerous printing problems such as cover-up of the eastern fragments by legend in Map 2-1, outright omission in Map 2-4, and unsightly overprinting in Map 2-6. The non-contiguous parcels (notably Shirk Ranch) forced a smaller map scale to be used, with a resultant loss of legibility (i.e., Map 2.1, Big Flat congestion). Suggestion: consolidate outlying areas in a box...in the under-utilized NW corner. The Guano Slough fragments to the east receive no discussion whatsoever in the text." (521)

Response. Thank you for your comment and for pointing out printing errors. Most of these were corrected in the FEIS. Map 2-1 still has the eastern parcel covered up because the map legend is too long to fit anywhere else.

Comment
839 "Note that the executive boundary, used only in Map 1-2, incorrectly shows a parcel of Refuge land as private, namely the outlying fragment in T37S R25E S30, whereas Map 2-1 shows it as the Village management unit of the Refuge. Maps need to reflect the 11,997.88 acres July 23, 1992 SLB sale." (521)

Response. Thank you for pointing out these errors. These were corrected in the FEIS.

Comment
840 "Can projection conventions be given in the legend for each map? Projection conventions are absolutely essential to state in cartography. Ideally, a single convention is used throughout, making rescaling possible and (inevitable) metric errors at least consistent. The DEIS probably used Lambert conformal conic regional (33-45 degree cone latitudes) admixed with the state plane south system (43 degrees 20' to 44 degrees 20' cone latitudes), though the military Mercator projection system (used by the Fremont Forest) may also have snuck in. (The Refuge falls across zones 10 and 11). A hodge-podge of projections makes it impossible to do registered overlays for 99.9% of the DEIS' readership. A mix of 1927 datum and 1989 datum based maps is likely, which results in a 3" discrepancy on a standard quad map. Area and length measures are in part projection-dependant. There is a need to look ahead to Sheldon for consistency and regional integration--a radically different east-west polyconic system is used in Nevada that won't work with Oregon's south plane system." (521)

Response. Thank you for your comment. Minor changes were made to the maps in the FEIS; however, they generally remained the same. We included maps in the EIS for general reference only. Any detailed analysis concerning maps will not occur until the Refuge has a Geographic Information System.

Comment
841 "Can acreages be adjusted to on-the ground acreages? A significant (and common) GIS error seems to have been made throughout the DEIS in regards to acres of habitat and miles of streams and roads. This error distorts analysis of available habitat for featured species, air quality impacts and effected environment for

prescribed burns, areas of RNAs, and the Accuracy of upland/wetland acreages in Tables B-2 and B-3, and so on. Basically there is a need to accommodate gradients by cosine normalization. Thus a mile of stream measured in projection from a 33% slope is actually 1.15 miles long on the ground; one of 50% slope is 1.41 miles longer. These numbers are typical on both sides of the escarpment. The DEIS mixes Flook Lake apples and DeGarmo Canyon oranges. Projected lengths and areas are appropriate and standard for property taxes but not for scientific land management. The technology and data needed to correct the DEIS-- a digital elevation map-- is available and free from the SSCGIS in Salem, along with the derived slope and aspect files. These are basic resources and should be printed out as important interpretational resources (enclosed). The twelve-layer GIS file compiled by Refuge staff should be posted at the SSCGIS to facilitate informed public comment. Alternatively, each layer could be output on a high resolution laser printer for interested readers to compile. It is troublesome to see analysis in the DEIS supported by Refuge computer files that are essentially unavailable." (521)

Response. We are aware that acreages presented in the EIS do not reflect on-the-ground acreage. Due to shortage of funding and time constraints, topographic information was not incorporated into calculating acreages. Upon incorporation of this information, pending purchase of a GIS system, figures will be recalculated based on the more accurate information. At the time the calculations were made, we did not realize that the information could be obtained free from the SSCGIS. We will pursue this option.

Comment

842 "Can the wetland and upland maps be printed at better resolution? Upland and wetland vegetation maps, 1-3 and 1-4, were intended as GIS Boolean complements: each point on the Refuge is either wetland or upland but never both, thus is in color on exactly one of the maps. Enclosed is a 'discrepancy map' constructed by manipulating overlaid computer scans. Note the many inconsistencies. Due south of Big Flat, an area is coded on the upland map as low sagebrush and on the wetland map as silver sagebrush. Is that NS finger along Guano Creek low sage or bluegrass-ryegrass? What is the vegetation downstream of Jacob's Reservoir? The problem is in part due to excessive dot gain (ink bleed), in turn due to excessive color saturation (chrom) and to flaws in vector GIS implementation. The crucial upland and wetland vegetation 11 x 17 maps could be technically improved. The fold-out maps are currently printed on 11 x 17 paper at almost full bleed at 5 miles = 2.05" or 1: 154,535." (521)

Response. We are aware of the inconsistencies between upland and wetland vegetation type maps.

Comment

843 "By moving the legend, scale, outlying areas, and the non-critical NE township to the NW corner, with a linear title on the bottom, the Refuge scales to 9.93" x 16.5", so 34.1% larger linearly than the current map or an 80% improvement in area and pixel resolution, while staying on 11 x 17 paper." (521)

Response. Comment noted.

Comment

844 "It seems there is ample room to display more detail, e.g., more of the centripetal zones at Mound Lake. Is the resolution uneven across the map, with more landscape features shown on the west side canyons than in the low sage? The Nevada Bureau of Mines evidently does not have the technology to print these color maps at the needed quality. Since vector files rescale, a better option is printing master maps on the meter-wide 400 dpi printer at the Stat Service Center for GIS in Salem, photographing these for CMYK separations. The SSCGIS can import ARCINFO or Atlas Pro files into Adobe Illustrator where text can be added professionally or into Photoshop for color separations and printing to slides or film at 2200 dpi." (521)

Response. Comments noted. The Nevada Bureau of Mines calculated acreages for the Refuge, but did not print the maps. The map printing was contracted out of our Regional Office in Portland.

Comment

845 "Can the accuracy of the wetlands map be improved? The wetland map, 1-4, has numerous inconsistencies with the National Wetlands Inventory map (done with less ground-truthing but printed at better resolution). These warrant discussion, even where the DEIS is correct. For example, in the south headwater swale of Willow Creek (section 25), the NWI found emergent vegetation in a seasonally flooded palustran zone (PEMC), I myself found 'sedge-rush-bluegrass' consistently over the last fifteen years, including 1993,

whereas the DEIS puts it down as willow. Why does the DEIS find a 'tendency' towards willow here while so many other 'sedge-rush-bluegrass' are declared stable." (521)

Response. Because the wetland map only shows 'potential' types, vegetation characteristic of 'existing' stages of progression is not shown. We did not show these stages because of presentation considerations in the EIS wetland maps. All stages are referred to in the EIS (Chapter 2) and are contained in the map database.

Comment
846 "Can a geology map be included? A 1993 geology map is available for Hart Mt. and should be included. (See enclosed map and legend.) Resolution of apparent discrepancies with the vegetation type maps is essential, For example, the quaternary alluvium NNE of Flook Lake, so conspicuous on the ERSAL photo and so manifestly unique in the field (as a Cleome platycarpa site) is ignored (treated as low sage) in the upland map, despite its size. Overall, geology seems remarkably uncorrelated with predicted vegetation; this deserves analysis in the DEIS." (521)

Response. A geology map could have been included in the EIS, although we chose not to do so. We recognize that geology has relatively low power to predict vegetation types.

Comment
847 "Can an elevation map be provided? A map showing labeled elevation contours should be included since elevation zones are so important in the narrative. Map 2-9 seems to more or less exhibit contours such as the 5600' and 6000' level curves, but these are not labeled and not quite in accord with, say, the Alger Lake quad. Boundaries of Map 2-9 seem totally unwieldy to work as management zones, being seemingly impossible to follow on the ground. Incidentally, a quad index of 7.5' maps overlaying the Refuge is an easily prepared and useful resource for visitors (enclosed)." (521)

Response. We agree that an elevation map would be useful to persons reviewing the EIS. Unfortunately, this information has not been obtained by the Refuge and thus could not be incorporated as a map in the Draft or Final EIS.

Comment
848 "Can the FEIS maps satisfy visitor needs? The visitor center map and brochure currently provided at Headquarters are lame in the extreme. Good quality 11 x 17 maps in the FEIS could serve double duty. With all due respect to the hard-working Refuge Complex staff, it might be advisable to contract out the cartography to cartographers. The Refuge will still need a computer graphics workstation of its own in Lakeview, given the huge acreages at Hart and Sheldon and the amount of data and number of layers envisioned for the GIS. Funding for this should be a top priority." (521)

Response. A new visitor brochure is planned for Hart Mountain NAR and it would include a high quality map. At present we do not have the funding to contract our cartography work out. A GIS station has been proposed for the complex office, and the maps used in the EIS have provided us with a 'learning experience' in map work.

Comment
849 "Can geographic names mentioned in the narrative shown on a map? Certain geographic names are cited in significant ways in the text but are missing from the Geographic Locations Map 2-4. Thus Water Canyon, Swede Knoll, Warner Ponds, and Buck Pasture are not shown. There are two Reservoir Lakes on the Refuge and none on the Map 2-4, making the narrative hard to evaluate. To protect Native American cultural sites, map names suggestive of cultural sites should be changed or deleted to discourage looting. (There was extensive vandalism at Crump Lake during the last drought.) The DEIS contains one unfortunate name on the pasture map that may need to be changed. Warner Lake seems to be called Hilltop Reservoir on USGS quads. Water Canyon should be called Waterhole Canyon. It was explicitly named for its plunge pools by Luther Cressman's party in August, 1934, who noted that in spring 'water rumbling over its numerous falls and rapids can be heard for miles.'" (521)

Response. Some of the names you suggested have been added to maps in the FEIS. Some map names suggestive of cultural sites (e.g. Petroglyph Lake) were taken from USGS topographic maps, to maintain consistency among maps. The rest of the names pointed out would be taken into consideration when new maps are printed in the future.

POTENTIAL ERRORS

Comment
850 "The alternative C write up on page 55 says that no herbicides will be used. The write up goes on to say that only mechanical treatment would be used. The display of comparison of alternatives on page 85 shows that in alternative C, 20% to 40% of the brush treatment will be done with herbicides and 0% will be by mechanical treatment. Which of these is correct? I would hope that the write up would be correct and that less than 40% of the brush treatment would be from herbicides." (25)

Response. Thank you for catching this error. The FEIS has been revised to reflect that 20-40 percent of shrub cover reduction would be accomplished through mechanical treatment. Herbicide use for shrub reduction would not be used in Alternative C.

Comment
851 "Can the bibliography be proof-read and balanced? The bibliography is not alphabetized properly (e.g., Leonard et. al. is out of place), has numerous typos (e.g., Rickard entry), and is either missing items cited in text or gives wrong dates (e.g., Leonard 1991). Bibliographic entries might be usefully starred (*) if the entry specifically deals with Hart Mt., as opposed to just being generic ecological work in eastern Oregon or the Great Basin." (521)

Response. Thank you for pointing out two errors in the literature cited. The literature cited in the FEIS has been edited.

Comment
852 "There appears to be a discrepancy concerning vegetation condition. Table 3-3 (page 99) indicates that 93% of the refuge is in a late seral condition. This appears to conflict with the statement of page 5 of Appendix I which states that "much of the range is not in good ecological condition...". According to the SCS handbook, late seral condition would indicate that at least 50% of the vegetation composition by weight is what one would expect to find in the climax community. It does not appear that vegetation composition was determined by weight in the DEIS." (541)

Response. The statement that "much of the range is not in good ecological condition..." was revised in the FEIS to state that "much of the range is not in good ecological condition for pronghorn..." Condition of ecological systems cannot be based solely on one parameter (e.g., vegetation composition), and condition can only be assessed relative to some resource or component (e.g., pronghorn, sagebrush lizard, aspen wildlife community).

Comment
853 "There appears to be a discrepancy in a reference to Yoakum (1968) on page 116 which discusses population increases for pronghorn sheep..."populations increased to 30,000 by 1924 and for the next 60 years increased 3,000 percent". Sixty years from 1924 would be 1984, sixteen years after Yoakum was published." (541)

Response. Yoakum (1986) was incorrectly cited as Yoakum (1968). The FEIS was corrected.

Comment
854 "(page) 142 & 146 If I correctly understand your explanation on page 142, the first line on 146 is showing 1700 acres of early and mid stages and 87,876 acres in the late stage. If this interpretation is not correct, you may want to try again. (You probably are aware the reference on page 142 to fig. 2-2 on page 98 should read 3-3.)" (555)

Response. We apologize for confusions related to the explanation on page 142 of the DEIS. We have taken another stab at clarifying the explanation. The writer is correct in his assessment of the figures presented in Table 4-3. Thank you for pointing out our error in regard to Figure 3-3; the text has been amended.

Comment
855 "(Page) 144 It seems reasonable that the projected percentage might not reach the objective when the existing percentage is low, but the movement of big-sagebrush-bitterbrush is difficult to understand. Apparently, in managing other types, this one is incidentally affected - favorably in the midterm and unfavorably in the long. (There's apparently a typographical error under the "existing" for this type.)" (555)

Response. There is not a typographical error under the "existing" column for big sagebrush-bitterbrush in Table 4-1. The figure reflects the present over-abundance (relative to Refuge objectives) of early to mid succession stages of this vegetation type that resulted primarly from a 1985 wildfire. The reason that the proportion of area in early to mid succession would increase slightly in the short-term under most alternatives, even though existing levels are already "too" high, is because juniper cover would be reduced where it has expanded into this vegetation type. In the process of juniper reduction (e.g., cutting and prescribed burning), sites would be converted from a very late stage of succession to an early stage. Late succession stands, although some may be incidentally burned, would not be targeted. Table 2-2 presents the number of acres of juniper control that would be targeted for big sagebrush-bitterbrush under each alternative. Based on this comment, an additional table has been added to the FEIS (Table 2-3); note that acreages in Table 2-2 include acreages presented in the new table.

Comment
856 "Compare pages 152 and 162. On page 152, Entitled; "1. Desert Shrub Habitats; a) Wyoming Big Sagebrush", soil erosion is a serious consideration. On page 162, same title, soil erosion is not mentioned. Why does it appear that Big Sage Wyoming sites are compared to land [low?] sage sites?" (605)

Response. The FEIS has been revised to state that soil erosion would continue at near present levels because herbaceous cover would remain virtually unchanged throughout the Wyoming big sagebrush vegetation type during the next 15 years. We did not mean to imply a comparison of the Wyoming big sagebrush vegetation type with the low sagebrush type. In the statement, "As with Wyoming big sagebrush, very little change would be expected throughout the low sagebrush vegetation type," meant only that the expected trends would be similar in Wyoming big sagebrush and low sagebrush vegetation types.

Comment
857 "Page 156, discusses competition for forage; pronghorns versus cattle. Yet on page 195 the text indicates little or no competition for forage." (605)

Response. This is a correct assessment. Discussion on page 156 of the DEIS explains that competetion between cattle and pronghorn would continue under Alternative A (no change from past management -- most cattle grazing of any alternative). Discussion on page 195 points out that without any cattle grazing on the Refuge, competition between cattle and pronghorn would not exist.

Comment
858 Vol. 1, Chapter 2-67, first para. third sentence - Add to the wording "..all native plant and wildlife (game & non-game) species..." (657)

Response. We appreciate your concern regarding past biases toward game species. However, as written, the statement addresses all native plant and wildlife species.

Comment
859 It appears that the terms habitat, habitat type, plant community, vegetation, and vegetation type are used synonymously in the Draft Plan, although some are distinguished in the glossary. This is significant because it blurs important distinctions between actual vegetation now occurring in various stands on the Refuge, the potential vegetation of those sites, and generalized community or landscape categories that obscure most of the natural and potential variability found on the ground. Extra care should be taken in the Final Plan and EIS to ensure that staff have chosen the correct term for the concept they intend to convey. (745)

Response. We agree that each term, except for "habitat" and "vegetation", has a distinct meaning and that they should not be interchanged. The term "habitat" is used in reference to the place where a plant or animal lives and grows. As such, habitat encompasses habitat types, vegetation types, and plant communities. The term "vegetation" refers to the sum total of plants in an area (or particular group of plants identified by a descriptor), and as such, can include one or more plant communities or a subdivision of a plant community.

Comment
860 Put more hunting data in document. (755)

Response. We decided, after re-evaluation, to not include more hunting data in the FEIS. Additional information, upon request, can be obtained from the Refuge Manager.

Comment
861 Clarify bighorn sheep translocation in Alternative E; would it occur? (759)

Response. No, bighorn sheep translocation would not take place under Alternative E.

Comment
862 Regarding the statement on the bottom of page 219 that discusses the irretrievable loss to the livestock industry, you should point out that this doesn't hold for private inholdings on Refuge. This should be spelled out. Private landowners will still be able to graze their land. (766)

Response. The FEIS was revised to clarify that elimination of livestock grazing proposed in Alternative D only applies to Refuge lands -- it does not apply to private inholdings (Section Two of Chapter 4).

GLOSSARY

GLOSSARY

Aquatic - Pertaining to water, in contrast to land. Living in or upon water.

Aquatic Ecosystems - An interacting system comprised of the stream channel or lakebed, water, and the physical, chemical and biological features that occur in the water; aquatic ecosystems interact with the associated terrestrial ecosystems.

Aquatic Habitat - The stream channel or lakebed, water, and the physical, chemical and vegetative features that occur in the water.

Animal Unit Month (AUM) - The amount of forage required by one mature (1,000 lb.) cow and one calf or its equivalent for one month.

Annual (plant) - A plant living only one year or season.

Basin - A depressed area with no or limited surface water; an area where water flows in, but where surface water does not flow out.

Big Game - Large mammals hunted for sport. On Hart Mountain National Antelope Refuge, these include pronghorn, mule deer, and bighorn sheep.

Biome - A natural community characterized by distinctive vegetation within a biogeographic province or region (grassland, desertland, etc.); a single biome is not to be confused with a single biogeographic province which may include several biomes (Brown 1981).

Breeding Assemblage - A group of vertebrate wildlife species with a specific combination of habitat requirements for breeding; assemblages were developed on the basis of a partitioning of breeding and feeding components of lifeforms of vertebrate wildlife described by Maser et al. (1984a).

Candidate Species - Those species recommended for listing under the federal Endangered Species Act; information may or may not be sufficient to support listing. Candidate species are not afforded any protection under the Endangered Species Act.

Carrying Capacity - The number of animals of a given species that can be sustained within a certain area without having adverse impacts on their food or other resources. Carrying capacity can change over a period of years as habitat conditions change.

Climax - The endpoint of a succession sequence; a community that has reached a steady state under a particular set of environmental conditions.

Community - An assemblage of plants and/or animal populations within a particular area.

Competition - A demand on a given resource by more than one plant or animal that is in excess of the immediate supply of that resource. Plants can compete for things such as sunlight, water, and nutrients. Animals can compete for things such as forage, nesting sites in tree cavities, and parcels of land (territories).

Composition - See Species Composition.

Comprehensive Management Plan - A document that guides management decisions, and that outlines management actions to be used in reaching Refuge goals and objectives.

Concealment Cover - Habitat features, usually vegetation and rocks, that help conceal or hide animals or nests from predators. Vegetation and other habitat features also can provide scent barriers between predators and their prey.

Core Problem - A concise statement that identifies underlying or root causes of related problems (*problem statement* as used in Coughlan and Armour 1992).

Cover - see Vegetation Cover or Concealment Cover.

Cumulative Effect - The impact on an environment which results from the combined and incremental impact of more than one action. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Cultural Resource - The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples) of an area. It includes historical, archaeological and architectural significant resources.

Deferred Grazing System - Annual postponement of livestock grazing until after important forage plants have matured and produced seed.

Density - Refers to the number of individual plants or stems that occupy a defined area (density does not compare directly to any kind of cover measurement).

Deposition - The laying down of any material through the actions of wind, water, ice, or other natural processes.

Direct Effects - Effects on the environment which occur at the same time and place as the initial cause or action.

Disturbance - (a) Habitat Disturbance - in reference to disturbances on vegetation communities, it consists of any management activity that has the potential to change vegetation structure and composition (fire, herbicide application and cattle grazing are examples); (b) Human Disturbance - any activity that tends to disrupt the normal movement or habits of a particular wildlife species.

Diversity - Variety; usually used in reference to the number of species in a given area, including some reference to their abundance (Brewer 1979). See also Habitat Diversity.

Ecosystem - The sum of all interacting parts of the physical environment and ecological communities and processes within a particular area. Many levels of ecosystems have been recognized from an ecosystem in a cavity of a tree to the earth and surrounding atmosphere. Very few, if any ecosystems are self-contained; most influence, or are influenced by components or forces outside the system (Brewer 1979).

Effects - Physical, biological, social, and economic results (expected or experienced) resulting from natural events or management activities. Effects can be direct, indirect, and/or cumulative.

Embeddedness - The degree to which larger substrate particles (gravel, rubble, and cobble) are surrounded and covered by sand or silt (Platts et al. 1983).

Endangered Species - Any species which is in danger of extinction throughout all or a significant portion of its range and listed as such by the Secretary of the Interior in accordance with the Endangered Species Act of 1973. Endangered species are afforded protection under the federal Endangered Species Act of 1973 as amended or under various state acts for state-listed endangered species.

Endemic Species - A species only found in a particular area or region, such as the Great Basin.

Environment - The surroundings of a plant or animal.

Erosion - The wearing away of the land's surface by water, wind, ice, or other physical processes.

Extinct - No longer existing.

Fauna - The animals of a particular region, taken collectively.

Featured Species - Wildlife species identified in a planning process, which are of public interest and are used to monitor the effects of management actions. Included are species that are socially or economically important (Maser et al. 1983).

Feeding Assemblage - A group of vertebrate wildlife species with a specific combination of habitat requirements for feeding. Assemblages were developed on the basis of a partitioning of breeding and feeding components of lifeforms of vertebrate wildlife described by Maser et al. (1984a).

Feral Horse - Non-native, unbranded, unclaimed descendants of domestic horses which roam free on the Refuge.

Fine Fuel - Thin or narrow vegetation such as grass, leaves, and small diameter twigs that ignite easily.

Flood Plain - Low land and relatively flat areas adjacent to streams which are periodically submerged by over-bank flows of water. Flood plains are formed and maintained by deposition of sediments during high water events.

Flora - The plants of a particular region, taken collectively.

Forage - All browse and non-woody plants available to wildlife and livestock for feed.

Forb - A herb that is not a grass or grass-like plant. Wildflowers are forbs.

Fuel - Living and dead plant material that is capable of burning.

Goal - See Refuge Goal.

Gradient - Refers to the steepness, or pitch, of a stream or section of stream.

Grazing - The process by which animals consume plants to acquire energy and nutrients (Briske and Heitschmidt 1991).

Guzzler - A device for catching and storing precipitation for use by wildlife. It consists of a water collection area, a storage facility, and a trough from which animals can drink.

Habitat - A place where a plant or animal naturally or normally lives and grows.

Habitat Diversity - In reference to the variety in habitat; structural and compositional variety of habitat.

Habitat Specialist - A wildlife species that uses a limited number of vegetation types and structural stages (succession or progression) within vegetation types for primary breeding and feeding purposes. Wildlife classified as breeding and feeding habitat specialists have a breeding and feeding versatility score in the lowest five percent of the cumulative frequency distribution of scores.

Herb - A non-woody plant; includes grasses, broad-leaved flowering plants (forbs), and sedges and rushes (grass-like plants).

Herbaceous Cover - The amount of area taken up by grasses, forbs and other herbaceous vegetation; the amount of ground covered by herbaceous vegetation.

Herbivore - A plant-eating animal.

Herbicide - A chemical agent used to kill plants or inhibit plant growth.

Impacts - see effects.

Indirect Effects - Physical, biological, social, and economic consequences resulting from management actions that occur after (in time) or away (in distance) from the action.

Induced Habitat Diversity - Habitat diversity resulting from two or more succession stages existing together within a relatively small area of vegetation type.

Infiltration - Water penetration into the soil through pores in the soil.

Inherent Habitat Diversity - Habitat diversity resulting from two or more vegetation types existing together within a relatively small area.

Introduced Species - A plant or animal species originating in another region or continent that has become established through introduction by humans or range expansion after being introduced in another nearby region.

Invertebrate - Animals that do not have a back bone. Included are insects, spiders, mollusks (clams, snails, etc.), and crustaceans (shrimp, crayfish, etc).

Issue - A subject or question of widespread public discussion or interest regarding management of National Forest System lands.

Lek - A site where grouse traditionally gather for courtship displays.

Ladder Fuels - Fuels that provide a link, or continuity, between fuels near the ground and crowns of tall trees. They give fire the potential of burning from ground level, up through ladder fuels, and into the crowns of trees.

Lifeform - (a) As applied to wildlife, groups of vertebrate wildlife species with specific combinations of habitat requirements for breeding and feeding (Maser et al. 1984a). (b) As applied to plants, groups of plant species with similar life history attributes (e.g., annual grasses).

Limiting Factor - A factor which may limit the growth or existence of a plant or animal species at a particular location, such as available moisture, nutrients, soil type, temperature, etc. for plants. Animal populations are limited by factors such as food, nesting sites, water, and specific habitat conditions.

Litter - Plants or plant material that are laying on the ground surface in a loose arrangement. It includes freshly fallen plant parts and slightly decomposed organic material.

Livestock Grazing - see Grazing.

Long-distance (neotropical) migrant - Birds (in reference to those occurring on the Refuge) whose winter distribution occurs wholly or partially south of the U.S. and whose distribution during the breeding season or during migration includes Hart Mountain NAR.

Long-range Objectives - Concise statements that describe, in measurable terms, desired conditions, and thus provide focal points for directing management activities. They describe desired conditions in greater detail than Refuge goals. Refuge goals and core problems provide the basis from which long-range objectives are developed.

Long-term Effects - Those effects which generally would occur after the 15-year planning horizon of the Comprehensive Management Plan.

Management Action - An activity, procedure, treatment, or course of action used to bring about a desired result. Usually conducted to reach a pre-defined objective.

Meandering - See Sinuosity.

Mechanical Treatment - As used in this EIS, the process of physically breaking, crushing, cutting, or uprooting woody-vegetation in uplands using farm machinery, other heavy equipment or power tools such as chainsaws; and cutting herbaceous vegetation in meadows using haying equipment.

Mitigate - To avoid or minimize impacts of an action by limiting the degree or magnitude of the action; to rectify the impact by repairing, rehabilitating, or restoring the affected environment; to reduce or eliminate the impact by preservation and maintenance operations during the life of the action.

Mosaic - A variety of different habitats intermixed in a relatively small area. In the same manner, several successional stages intermixed within a vegetation type.

Multiple Use - A concept of land management in which a number of products are deliberately produced from the same land base; contrast with Dominant Use.

National Environmental Policy Act (NEPA) - An act which encourages productive and enjoyable harmony between humans and their environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere, to stimulate the health and welfare of humans, to enrich our understanding of the ecological systems and natural resources important to our Nation, and to establish a Council on Environmental Quality.

National Environmental Policy Act (NEPA) Process - An interdisciplinary process, mandated by the National Environmental Policy Act, which concentrates decision-making around issues, concerns, and alternatives, and the effects of those alternatives on the natural and human environment.

Native - This term describes plant and animal species, habitats, or communities that originated in a particular region or area, or those that have established in a particular region or area without the influence of humans.

Naturalness (of an area) - The degree to which native plant and animal species occupy an area, and the degree to which natural processes influence the site (Young 1991).

NEPA - See National Environmental Policy Act.

Nutrient - Something that nourishes; especially a nourishing ingredient in food.

Objective - See Long-range Objective.

Organic - Anything originating from a living organism.

Overstory - The portion of vegetation that forms the uppermost layer in a particular area.

Percolation - The downward movement of water through the soil, after water has infiltrated (penetrated) the soil surface.

Perennial Plant - A plant that lives for more than one year.

Perennial Stream - A stream which normally flows throughout the year.

Permittee - A person or business formally allowed to graze livestock on a refuge, other federal land, state land, or private land.

Petroglyph - A figure, design, or indentation carved, abraded, or pecked into a rock.

Plant Community - A group of one or more populations of plants in a particular area at a certain point in time. The plant community of an area can change over time due to disturbance (for example, fire) or succession.

Playa - A shallow basin where water gathers and is evaporated.

Pool - A portion of the stream with reduced velocity (average velocity is generally less than 1 foot per second), and often with water deeper than the surrounding areas.

Potential - A term used to indicate the expected natural conditions for a particular ecological setting (Collins et al. 1992).

Predation - The act of stalking, killing and eating animals.

Predator - A flesh-eating animal; contrast with herbivore.

Prescribed Burning - The intentional application of fire to vegetation under specific environmental conditions to accomplish specific management objectives in specific areas identified in approved prescribed fire plans. See also Prescribed Natural Fire.

Prescribed Natural Fire - Fires ignited by natural means (usually lightning) which are permitted to burn under specific environmental conditions, in preplanned locations, with adequate fire management personnel and equipment available to achieve defined objectives. Only unplanned fires that meet all conditions of the fire prescription for that area would be considered a prescribed natural fire. If one or more conditions are not met, they would be treated as a wildfire.

Prescription - A written statement describing procedures to follow, outlining specific environmental conditions under which specified management actions would be applied, and defining objectives to be obtained. In reference to prescribed natural fires, the definition is broadened to include a written description of specific environmental conditions under which naturally ignited fires may be permitted to burn.

Prey - An animal taken by a predator as food (noun). To seize and devour prey (verb).

Progression - See Site Progression.

Project File - More detailed documentation of an environmental analysis, usually located in files in refuge field offices.

Range Site - a kind of land with a specific potential natural community and specific physical site characteristics, differing from other kinds of land in its ability to produce vegetation and to respond to management (Kirby 1987).

Raptor - A bird of prey, such as a hawk, eagle, or owl.

Recreation Opportunity Setting - The combination of physical, biological, social, and managerial conditions that give value to a place. This includes qualities provided by nature (vegetation, landscape, topography, and scenery), qualities associated with recreational use (levels and types of use), and conditions provided by management (developments, roads, and regulations).

Recreation Opportunity Spectrum (ROS) - A system developed by the USDA Forest Service to classify lands based on a combination of biological, social, and managerial conditions. The spectrum consists of six classes which span from Primitive to Urban. Appendix K describes ROS classifications in more detail.

Refuge Goal - A statement that describes a desired condition. Refuge goals are expressed in broad, general terms. They provide direction for developing long-range objectives.

Regional Endemic Species - Wildlife species that breeds or thought to breed on the Refuge, and have greater than 80 percent of its breeding distribution within the Great Basin (Appendix H, part 1).

Remoteness - The extent to which individuals perceive themselves removed from the sights and sounds of human activity.

Research Natural Area - An area in a condition as near to natural as possible, which exemplifies typical or unique vegetation and associated biotic, soil, geologic, and aquatic features. The area is set aside to preserve a representative sample of an ecological community, primarily for scientific and educational purposes; commercial and general public use is not allowed.

Residual Herbaceous Vegetation - Grasses, forbs and other herbs that remain standing from one growing season to the next, and sometimes beyond. Generally, the above ground portion of herbaceous vegetation dies after the growing season, and if left undisturbed can remain upright for a period of time. Strong wind, heavy cover, and livestock grazing can reduce the amount of residual vegetation remaining from one season to the next.

Resource Condition - An assessment of habitat condition of streams based on the degree of channel stability, bank erosion, bank stability, water table level, and prevalence of woody-riparian vegetation (Appendix D).

Rest Rotation Grazing System - A grazing strategy in which animals are moved from one pasture to another on a scheduled basis, with one pasture left ungrazed in a given year. The number of pastures used in the system will dictate how often a given pasture is rested.

Riding - Range management techniques used to distribute livestock in order to obtain proper utilization of forage resources. For example, livestock grazing permittees riding horses on grazing allotments on a regular basis to monitor where the livestock are grazing and move them if necessary.

Riffle - A shallow portion of the stream where water flows swiftly over rocks or large gravel to produce surface agitation.

Riparian Area - The land adjacent to streams where vegetation is influenced by higher amounts of water than the surrounding uplands. For the purposes of this EIS, riparian areas do not include the land surrounding lakes and basin marshes (emergent wetlands)(Johnson et al. 1984).

Riparian Vegetation - Plant communities dependent upon the presence of free or unbound water near the ground surface (high water table) and that are associated with streams.

ROS classes -

Primitive (PRIM) Area is characterized by an essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other area users is minimal. The area is managed to be essentially free from evidence of human induced restrictions and controls. Motorized use within the area is not permitted.

Semi-Primitive Non-Motorized (SPNM) Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is not permitted.

Semi-Primitive Motorized (SPM) Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other area users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

Roaded Natural Appearing (RNA) Area is characterized by a predominantly natural appearing environment with moderate evidences of the sights and sounds of humans. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but evidence of other users is prevalent. Resource modification and utilization practices are evident, but they harmonize with the natural environment. Conventional motorized use is provided for in the construction standards and design of facilities.

Roaded Modified (RM) Area is characterized by a substantially modified natural environment where evidence of humans' activities are readily apparent. Such activities are usually resource-based. Typical activities include timber harvest, mineral extraction, and livestock grazing. Such evidences may or may not harmonize with the natural environment. Interaction between users may be low to moderate, but evidence of other users prevails. Resource modification and utilization practices are readily evident and may dominate. Conventional motorized use is provided for in the construction standards and design of facilities.

Rural (R) Area is characterized by substantially modified natural environment.

Rosgen Stream Type - A stream Classification System based on a combination of stream gradient, sinuosity, width:depth ratio, channel materials, entrenchment, confinement, and soil/land/form (Rosgen 1988).

Scoping - A process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues. It is a process whereby the public and Federal, State, and local agencies are invited to participate.

Season of Use - The season of the year when a particular area is grazed by livestock.

Sediment - Any material, carried in suspension by water, which will ultimately settle to the bottom of watercourses. Sediments may also settle on streambanks or flood plains during high water flow.

Sensitive Species - Vertebrate wildlife species that occur or are thought to occur on the Refuge, and are listed as rare, threatened, or endangered at the federal, state, or Refuge level (Appendix H, part 1).

Shrub - A plant usually with several woody stems; a bush. A shrub differs from a tree by its low height.

Shrub Cover - The amount of ground covered by the above-ground portion of shrubs.

Sinuosity - In reference to a stream, a winding course. It is the ratio of stream channel length to valley length (Burton et al. 1992).

Site Progression - The change in structure and species composition of wetland vegetation types associated with change in water availability to plants. Different vegetation characterizes different stages of site progression (Leonard et al. 1992). Please refer to Table 3-2.

Social Encounters - Refers to the number and type of other recreationists met along travel-ways, or camped within sights or sounds of others.

Species - A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification. Examples include the robin, mule deer, domestic cattle, quaking aspen, and low sagebrush.

Species Composition - An expression of the make-up or combination of plant or animal species that occur in a particular area, or under particular conditions such as succession stages or progression stages.

Species Richness - The number of plants or animals in a particular area. Higher numbers of species present in an area equates to a higher degree of species richness (Magurran 1988).

Stable Streambank - A bank that shows no evidence of active erosion, breakdown, tension cracking, shearing, or slumping (Collins et al. 1992).

Stand - A plant community in a given area that is relatively uniform in age and species composition.

Stream Reach - A designated section of a stream in which monitoring is conducted and hydrologic and/or fishery assessments are made (Burton et al. 1992).

Stream Type - See Rosgen Stream Type.

Structure - See Vegetative Structure.

Substrate - The mineral particles lying on the surface of the streambed. Typically, six substrate classes are recognized: sand/silt, gravel, rubble, cobble, boulder, and bedrock.

Succession - The change in plant species and vegetation structure in a given area following a disturbance such as fire. Typically, succession advances through distinct stages (Luken 1990). The mountain big sagebrush vegetation type provides an example; succession after a fire proceeds from a grass-forb community to a plant community dominated by shrubs and grass (please also see the definition in part I, F of Chapter 3, Section One).

Succession Stage - A recognizable plant community that occurs at a given point in time during the advancement from bare ground to a stage in which the plant community has reached a stable condition. The stable condition is referred to as climax, and happens when similar plant species occur year after year, and the abundance of each species remains relatively the same, allowing for some fluctuation due to differences in year to year moisture levels. If disturbances such as fire occur fairly frequently, climax may not be reached. Refer to Table 3-1 for succession stages of upland vegetation types of the Refuge.

Tableland - A flat, elevated region such as a mesa or plateau.

Talus - The accumulation of broken rocks that occurs at the base of cliffs and other steep slopes.

Terrestrial - Pertaining to land, in contrast to water. Living on land. Terrestrial animals include those that live underground or above the ground, such as in trees and shrubs.

Thermal Protection (Cover) - Cover used by animals to lessen the effects of weather.

Threatened Species - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and one that has been designated as a threatened species in the Federal Register by the Secretary of the Interior. Threatened species are afforded protection under the federal Endangered Species Act.

Topography - Surface features of the landscape.

Underburning - Burning through prescription the ground layer of vegetation in a mature stand of trees without burning tree canopies; usually of low intensity (cool fire).

Undercut Bank - A bank that overhangs the water surface. It results from water eroding lower portions of the bank at a faster rate than upper portions of the bank. Undercut banks are an important part of stable streambanks in meadows where deep-rooted sedges prevent undercut banks from caving (under undisturbed situations).

Understory - Usually refers to the herbaceous vegetation growing under the canopy of shrubs.

Unstable Streambank - Streambanks showing evidence of active erosion, shearing, breakdown, sloughing, or that are dominated by upland plant species.

Uplands - Areas where water normally does not collect and where water does not flow on an extended basis. Uplands are non-wetland areas.

Utilization - The proportion of the current year's forage production that is consumed or destroyed by grazing animals. May refer either to a single species of forage, or to the vegetation as a whole.

Vegetation - Plants in general, or the sum total of the plant life in an area.

Vegetation Structure - The horizontal and vertical arrangement, configuration, or pattern of vegetation.

Vegetation Succession - see Succession.

Vegetation Type - A category of land based on potential or existing dominant plant species of a particular area when it is in late succession (uplands), late progression (basin wetlands), or very late progression (riparian wetlands).

Vegetative Cover - The amount of area covered by the above-ground parts of plants, usually expressed as a percent (adapted from *Cover, Percent* in Burton et al. 1992).

Versatile - Capable of, or adapted for surviving in several plant communities and/or succession stages (Thomas 1979).

Versatility Index - Relative value derived for vertebrate wildlife species based on the sum total number of vegetation types, succession stages, and progression stages within vegetation types used for primary breeding and feeding purposes. Indices are used in part to determine the relative sensitivity of species to management actions based on their reliance on vegetation types and conditions within vegetation type.

Vertebrate - An animal having a segmental "backbone" or vertebral column. Includes mammals, birds, fish, amphibians and reptiles.

Viable Population - A population of wildlife of sufficient size to maintain its existence over time in spite of normal fluctuations in population levels (Thomas 1979).

Vigor - The relative well being and health of a plant as reflected by its ability to efficiently manufacture sufficient food for growth.

Visitor Management - The degree to which visitors are regulated and controlled, and the level of information and services provided for visitor enjoyment.

Water Development - A water source developed by public land managers and permittees, meant to provide water to livestock, and could be used by wildlife.

Water Table - The upper surface of groundwater; that level below which soil is saturated with water. Usually in reference to groundwater that is near the surface of the ground.

Watershed - The entire land area that collects and drains water into a stream or stream system.

Wetland - Areas such as lakes, marshes, and streams that are inundated by surface or ground water for a long enough period of time each year to support, and do support under natural conditions, plants and animals that require saturated or seasonally saturated soils (Cowardin et al. 1979).

Wilderness - An area designated by Congress as part of the Wilderness Preservation System. Wilderness areas generally are undeveloped Federal lands that retain their primeval character.

Wilderness Study Area - A roadless area without developments that has wilderness characteristics and that is being subjected to planning and public review to determine wilderness suitability.

Wildfire - An unplanned fire that does not fall under prescription; includes natural and accidental human caused ignitions (contrast with prescribed burning and prescribed natural fire).

Wildlife - All non-domesticated animal life; feral animals are not defined as wildlife (Refuge Manual 1982:7 RM 12).

Wildlife Diversity - A measure of the number of wildlife species in an area and their relative abundance.

Wildlife Management - The art of making the land produce wildlife (Peek 1986).

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