SHELDON NATIONAL WILDLIFE REFUGE

FIRE MANAGEMENT PLAN

2001

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WILDLAND FIRE MANAGEMENT PLAN

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Prepared: ______________________________ ____________
Chris Farinetti — Date
Fire Management Officer
Sheldon NWR

______________________________ ____________
Michael Nunn — Date
Project Leader
Sheldon NWR

Concurred: ______________________________ ____________
Pam Ensley — Date
Regional Fire Management Coordinator
Pacific Region, US Fish and Wildlife Service

Approved: ______________________________ ____________
Anne Badgley — Date
Regional Director
Pacific Region, US Fish and Wildlife Service

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

When approved, this document will become the Sheldon National Wildlife Refuge's fire management plan (FMP). This plan is written to provide guidelines for appropriate suppression and prescribed fire programs at Sheldon NWR. Prescribed fires may be used to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research.

Format changes in this document adhere to Service policy and direction from the Fire Management Handbook (release date 6/2000). The 1995 National Fire Policy has been addressed and updated throughout the document. The 2000 FWS prescribed burning policies and direction have been implemented and updated accordingly.

The 1995 Prescribed Burning EA, 1980 Coordinated Resource Management Plan, 1995 Sheldon Scientific Working Group SWG Entitled "Management Recommendations for the Sheldon National Wildlife Refuge Offered by the SWG", and 2001 DRAFT Pronghorn Management Plan PMP all support the fire management objectives presented in this FMP. The refuge's management plan, the Sheldon National Wildlife Refuge Coordinated Resource Management Plan, was approved in 1980. This plan's primary objective was to improve wildlife habitat conditions while administering a livestock grazing program and periodically removing feral horses and burros. The Game Range Act of 1976, which gave exclusive jurisdiction of the Sheldon by the Fish and Wildlife Service, provided for a continuation of livestock grazing under existing BLM permits until the permits expired. During the early 1990's, all grazing permits on Sheldon were purchased by The Conservation Fund and retired.

Sheldon is scheduled to begin developing a Comprehensive Conservation Plan in 2002 to meet the current policies and guidelines for management of the National Wildlife Refuge System as prescribed in the National Wildlife Refuge System Administration Act, as amended . This planning process will culminate in a new set of management objectives and management guidelines. In the interim, the management goals and objectives of Sheldon NWR are to manage it as a representative area of high-desert habitat for optimum populations of native plants and animals. These goals and objectives have been derived from the purposes for which the refuge was established, i.e, ". . . as a breeding ground for wild animals and birds . . .", and, to be " . . .set apart for the conservation and development of natural wildlife resources and for the protection and improvement of public grazing lands and natural forage resources . . ."

This plan is written to provide guidelines for appropriate suppression and prescribed fire programs at Sheldon NWR. Prescribed fires may be used to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research.

INTRODUCTION

The Sheldon National Wildlife Refuge fire management program has evolved with the body of ecological thought and philosophy of ecosystem-based management. Documented use of prescribed fire for vegetation management dates back to 1983, although oral histories indicate the use of prescribed fire on the Refuge as far back as the 1940's. The primary objective of early burns was to improve range conditions. This has changed due to recognition of the value of biological diversity and community structure. Similarly, the philosophy of refuge management has changed since the establishment of the Refuge because of changes in ecological theory and the values of the American public.

Recognizing that the fire management of natural areas within a refuge will include objectives other than those which are ecological, the role of fire in natural ecosystems remains paramount. Other fire management objectives such as protection of life and property, protection of boundaries, and smoke management are superimposed on this basic objective.

The 1962 Fire Management Plan objectives (O.V. Deming) were focused on the use of prescribed fire to promote improved ecological conditions of the range. In addition, the Plan also recognized that even wildland fires (lightning and human caused) have resulted in improved range conditions.

The current theme of management for the Refuge is to improve vegetative condition and vigor, thereby enhancing wildlife habitat, ultimately resulting in increased diversity and abundance of native plant and wildlife species. Vegetative communities historically evolved in the presence of periodic wildland fires. This Plan is focused on the use of prescribed fire in the role of Refuge ecosystem restoration.

Hart Mountain National Antelope Refuge and Sheldon National Wildlife Refuge share considerable similarity in ecosystem, habitat types, fire history, geography and geology and have identical management objectives. Because of this, the Hart Mountain National Antelope Refuge Comprehensive Management Plan (1994) and Final Environmental Impact Statement (1994) will be drawn upon to support the Sheldon National Wildlife Refuge Fire Management Plan.

Determination of a natural fire regime for the Refuge is difficult at best. Forty years of aggressive fire suppression policy and the use of cattle grazing for vegetation manipulation have altered the natural distribution of native vegetation. The fire return interval for the woody shrub vegetation types common to the Refuge vary from 12 to 25 years in mountain big sage, to 25 to 100 years in Wyoming big sage, and 100 to 200 years in low sage.

Fire is a critical ecological process that served, in part, to shape and diversify the Great Basin vegetation communities. Fire suppression has reduced the natural role of fire on the Refuge. As a result, a dominance of late succession monotypical uniform shrub cover has been reached over much of the Refuge (Franzen). This condition is not only unnatural and less productive for wildlife, but presents a significant hazard fuels dilemma. The application of prescribed fire promotes greater habitat diversity and edge. In addition, hazard fuel loadings will be reduced to levels that do not foster large and catastrophic wildland fires.

COMPLIANCE WITH USFWS POLICY

The Fire Management Plan is based on broad management objectives found in the enacting legislation for the Refuge, other pertinent acts, management guidelines, and the mission statement of the agency.

Sheldon National Wildlife Refuge was enacted into law by President Franklin D. Roosevelt, by Executive Order 7522, December 21, 1936. These lands were set aside "for the conservation and development of natural wildlife resources".

U.S. Fish and Wildlife Service Refuges with vegetation capable of sustaining fire are required to develop fire management plans as per Service policy and guidance from the U.S. Fish and Wildlife Service Fire Management Handbook (FMH; USFWS 2000). The first Fire Management Plan written for Sheldon National Antelope Refuge was in 1961. The most recent plan was written in 1997. These early plans focused primarily on range improvement.

It is intended that this plan adhere to the U.S. Fish and Wildlife Service Fire Management Handbooks and Service policy. As such, this Fire Management Plan will serve as the detailed program of action to implement Department of Interior and U.S. Fish and Wildlife Service fire management policies and objectives on Sheldon National Wildlife Refuge lands. This includes fire suppression and prescribed fire operations. Without objective professional planning, fire management activities would result in random and uncoordinated acts with no clear objectives.

Authorities:

1. Departmental Manual (910 DM) statutes authorize the prevention, preparedness, control, and suppression of fire on, or threatening lands under, the jurisdiction of the Department of Interior. 910 DM 1, requires Department of Interior agencies to "prepare and implement comprehensive and coordinated fire management plans that are based on sound ecological principles, and which have been subject to full public participation."

2. U.S. Fish and Wildlife Service Fire Management Handbook (2000), requires refuges that manage lands with vegetation capable of sustaining fire to develop Fire Management Plans.

The Fire Management Plan is an action plan drawn from the 1980 Sheldon National Wildlife Refuge (NWR) Environmental Impact Statement (EIS), and as such will aid managers in achieving the following Refuge objectives:

1. Manage for optimum populations of native plants and wildlife in their natural habitat.

2. As quantity and quality of habitat are the major limiting factors in wildlife populations, manage for habitat improvement by improving vegetative vigor and condition.

NEPA/NHPA requirements will be met via an Environmental Assessment specific to this Fire Management Plan (Appendix C). The use of prescribed fire as a management tool is clearly defined in this document. Prescribed fire has been selected as the primary management tool for improving vegetative vigor and condition, and consequently, improving habitat diversity.

The Fire Management Plan is a detailed program of action to implement fire management policies and objectives.

The Department Manual, DM 910 (USDI 1997) states the following regarding wildland fires:

> "Wildland fires may result in loss of life, have detrimental impacts upon natural resources, and damage to or destruction of man-made developments. However, the use of fire under carefully defined conditions is to be a valuable tool in wildland management. Therefore, all wildland fires within the Department will be classified either as wildland fire or as prescribed fires. Wildland fires, whether on lands administered by the Department or adjacent thereto, which threaten life, man-made structures, or are determined to be a threat to the natural resources or the facilities under the Department's jurisdiction, will be considered emergencies and their suppression given priority over normal Departmental programs.
>
> Bureaus will give the highest priority to preventing the disaster fire - the situation in which a wildland fire causes damage of such magnitude as to impact management objectives and/or socio-economic conditions of an area. However, no wildland fire situation, with the possible exception of threat to human survival, requires the exposure of firefighters to life threatening situations.
>
> Within the framework of management objective and plans, overall wildland fire damage will be held to the minimum possible giving full consideration to (1) an aggressive fire prevention program; (2) the least expenditure of public funds for effective suppression; (3) the methods of suppression least damaging to resources and the environment; and (4) the integration of cooperative suppression actions by agencies of the Department among themselves or with other qualified suppression organizations.
>
> Prescribed fires...may be used to achieve agency land or resource management objectives as defined in the fire management plans....Prescribed fires will be conducted only when the following conditions are met:
>
> a. Conducted by qualified personnel under written prescriptions.
> b. Monitored to assure they remain within prescription.
>
> Prescribed fires that exceed the limits of an approved prescribed fire plan will be reclassified as a wildland fire. Once classified a wildland fire, the fire will be suppressed and will not be returned to prescribed fire status."

The authority for funding (normal fire year programming) and all emergency fire accounts is found in the following authorities:

> Section 102 of the General Provisions of the Department of Interior's annual Appropriations Bill provides the authority under which appropriated monies can be expended or transferred to fund expenditures arising from the emergency prevention and suppression of wildland fire.
>
> P.L. 101-121, Department of the Interior and Related Agencies Appropriation Act of 1990, established the funding mechanism for normal year expenditures of funds for fire management purposes.
>
> 31 US Code 665(E)(1)(B) provides the authority to exceed appropriations due to wildland fire management activities involving the safety of human life and protection of property.

Authorities for procurement and administrative activities necessary to support wildland fire suppression missions are contained in the Interagency Fire Business Management Handbook.

The Reciprocal Fire Protection Act of May 27, 1955 (42 USC 815a; 69Stat 66) provides Authorities to enter into agreements with other Federal bureaus and agencies; with state, county, and municipal governments; and with private companies, groups, corporations, and individuals regarding fire activities. Authority for interagency agreements is found in “Interagency Agreement between the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, US Fish and Wildlife Service of the United States Department of the Interior and the Forest Service of the United States Department of Agriculture” (1996).

FIRE MANAGEMENT OBJECTIVES

The Refuge Fire Management Plan targets late succession shrub-dominated communities for treatment with fire. Natural fires will continue to occur as well, but we cannot assume that their effects will be natural due to the current condition of the vegetation. Indeed, prescribed fires will also have effects other than what would be naturally occurring. As a result, fire effects monitoring must be conducted to ensure that Refuge fire management practices are continually working toward Refuge management objectives.

Renewable Natural Resources Management Plan Objectives and their implications to Fire Management.

1. Manage for healthy and balanced populations of pronghorn and other species of native wildlife in their natural habitat.
   a. Reintroduce fire in natural ecosystems.
   b. Protect sensitive areas from fire intrusion.
   c. Use prescribed fire as a management tool to improve the ecological condition of the Refuge.

2. Restore and maintain the structure, species composition, and processes of native ecological communities and ecosystems of the northern Great Basin region.
   a. Promote ecological diversity with the use of fire.
   b. Establish a fire effects monitoring system that inventories pre-burn species composition and resulting post-fire response, over time.
   c. Utilize prescribed fire to promote increased productivity.

An additional fire management objective that does not easily correlate to stated Refuge objectives is to protect life and property, and to recognize human values which may be impacted by fire management planning. A variety of Native American archeological sites, early European settlement sites and unique natural areas exist on the refuge. While there are not any established Wilderness Areas on the Refuge, approximately 320,000 acres of the Refuge are proposed wilderness areas and have been recommended to Congress for wilderness designation.

Refuge improvements include the Dufferena sub-headquarters, residences at Thousand Creek, Little Sheldon, Virgin Valley, Alkali Ranch and Badger Cabin, facilities at Gooch Camp and Kinney Camp, and numerous undeveloped campsites and campgrounds. Inholdings consist of 3,040 acres of privately-owned lands. Total acreage within the Refuge boundaries is 575,186 acres in Nevada and 627 acres in Oregon for a total of 575,813 acres. Neighboring lands are in Bureau of Land Management or private ownership.

Broad Objectives of the Fire Management Program

1. Protect life, property and resources from unwanted fire.
2. Use fire to accomplish resource management objectives.
3. Restore fire as a natural ecological process.
4. Develop and implement a process to ensure the collection, analysis and application of high quality fire management information needed for sound management decisions.

Specific Objectives of the Fire Management Program

1. Protect from fire important human, scientific, cultural, historic and pre-historic, and scenic resources, all retained use and occupancy sites, private lands, and key visitor and administrative facilities. These sites and resources and the methods used to protect them

are identified in later sections of this plan and in documents held at the Lakeview Interagency Fire Center.

2. Restore and maintain the structure, species composition, and processes of native ecological communities and ecosystems of the northern Great Basin Region.
3. Reconstruct Refuge fire history, where possible, for use in future fire and resource management decision making.
4. Develop and implement a fire effects and behavior monitoring program that aids fire managers in developing, refining and executing prescribed fire prescriptions.

The core application of this fire management plan is focused on improving wildlife habitat condition on the Refuge. This plan describes implementing prescribed fire to type-convert the existing monotypical shrub condition to more diverse plant communities where representation of grasses and forbs is increased. The plan also recognizes the need to manage wildland fires safely and cost effectively by defining less intensive wildland fire suppression strategies where practical. Finally, this plan promotes a scientific-based monitoring system that will be used by future managers to measure the success or failure of the plan.

DESCRIPTION OF REFUGE

Sheldon National Wildlife Refuge natural and cultural resources are described in the Renewable Natural Resources Management Plan. The following is a summary of that information.

The Refuge is located in northwestern Nevada in the northern portions of Washoe and Humboldt Counties, and in the southeastern portion of Lake County, Oregon (Figure 1). The Refuge is situated within the northwestern Great Basin. The northern portion of the Refuge is traversed by state highway 140. Services and communities in the surrounding area are Lakeview, Oregon (68 miles northwest), Cedarville, California (43 miles west-southwest), Denio, Nevada (14 miles east), and Winnemucca, Nevada (106 miles south).

The Refuge is part of a large area of southeastern Oregon and large areas of Nevada commonly referred to as "high desert country". This is characterized by wide open spaces and a variety of land forms. Narrow canyons empty into rolling valleys with no drainage outlet to the sea, and broad flat tables end abruptly in vertical and/or near-vertical cliffs. Elevations range from a high of 7,294 feet on Catnip Mountain (west-central portion of the Refuge) to a low of approximately 4,200 feet on the northeastern boundary. The area generally decreases in elevation from west to east.

The IXL Ranch is a somewhat isolated wetland site located in the south end of the Guano Valley, in Lake County, Oregon, and Washoe County, Nevada. Extensive meadow and seasonal standing water make this site an excellent migratory bird use area.

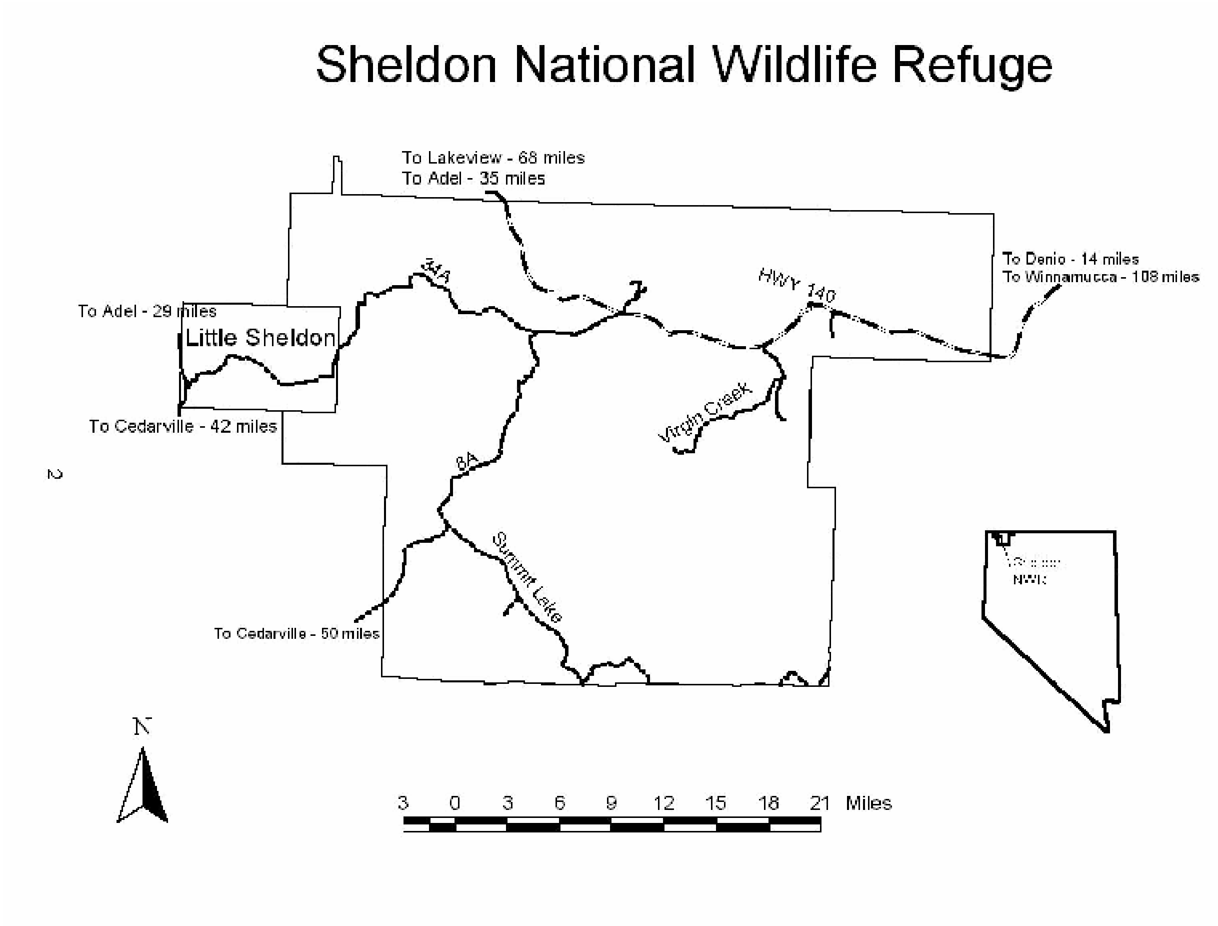
GEOLOGY

Three rock units dominate the area. The oldest unit, a layer of Rhyolite flows called Canyon Rhyolite, commonly forms the bedrock upon which the other two rock units in the area are laid. The most prominent exposures of Canyon Rhyolite on the Refuge are McGee Mountain in the extreme east, and the walls of Virgin and Thousand Creek Canyons.

Above the Rhyolite, in thicknesses up to 1,200 feet, is the High Rock Sequence. This formation is composed primarily of volcanic tuff and stream and lake sediments. The Virgin Valley Formation and Thousand Creek Beds are considered to be part of this rock unit exposed on the Refuge. They comprise the area of the Virgin Valley and part of the outcrops east and west of Railroad Point, both of which are located in the northeastern portion of the Refuge. The Virgin Valley Formation and Thousand Creek Beds are important because the soils which originate from them are fragile, erode easily and support vegetation somewhat different from the surrounding area. The Virgin Valley Formation is also the only area with mineral production on the Refuge.

The third unit is comprised of extensive basalt flows up to 100 feet thick which form large broad tables and cap most of the mountains. Wherever the flows end or have been cut by erosion, natural barriers in the form of rimrock have been created. This rimrock is usually steep enough to restrict livestock access onto the tables, however, livestock were historically driven up tables via access points. Tablelands on the Refuge include Railroad Point, Big Spring Table, Rock Spring Table, Fish Creek Table and Gooch Table.

Figure 1: Vicinity Map



CLIMATE

Sheldon National Wildlife Refuge is influenced by climatic forces that restrict water supply and vegetation. Annual precipitation occurs mainly in the form of snow and averages about 6 inches on the east side and 13 inches on the west side. High summer temperatures, especially in the lower elevation areas, result in significant evaporation and contribute to scarcity of surface water and available soil moisture during the summer months. The possible occurrence of frost during any month restricts the growing season to the summer months.

VEGETATION AND SOILS

Soils on the Refuge are largely a result of lake sedimentation, volcanic activity, and water erosion. A discussion of soils is included in the following site descriptions for the most prominent site types on the Refuge.

Shrubby Rolling Hills

Shrubby rolling hills occurs in mountainous terrain and footslopes of prominent hills from 6,000 to 6,500 feet in elevation. This site is dominated by bitterbrush, but Idaho fescue and mountain big and low sagebrush are also important. Soils are moderately deep to deep, and stony or gravelly on the surface. Erosion hazard is moderate. Shrubby rolling hills is used by mule deer in the summer and fall, and antelope in the late summer and fall because of the browse provided by bitterbrush.

Approximately 71,598 acres (12%) of the Refuge is covered by this site. Since 1964 the general ecological condition has gone from poor to fair. However, vigor is still low in many areas and must be restored if ecological condition is to improve significantly.

Mahogany rockland

Mahogany rockland occurs at around 6,000 feet elevation in small clumps or strips on rocky ridges and similar mountainous areas where bedrock outcrops occur. The dominant plant on this site is curlleaf mountain mahogany. Soils on this site are shallow to moderately deep over basalt bedrock, and are stony and gravelly throughout. Erosion hazard is slight to moderate. Mahogany rockland is associated with bitterbrush areas (shrubby rolling hills) and provides important hiding and thermal cover for mule deer. It also contains a wide variety of bird life because of interfacing with bitterbrush and rock outcrops and the vertical stratification provided by mountain mahogany.

Mahogany rockland comprises approximately 4,200 acres (0.7%) of the Refuge. Trend information is not available, but it is known that mahogany is not reproducing and the stands are even-aged and tree-like in form. Grazing pressure by wild and domestic animals is the probable cause. It is likely that many stands will be lost due to recent defoliation by moths and wildland fire.

Stony and claypan terrace

Stony terrace and claypan terrace sites occur on gently rolling tablelands around 5,600 feet, are dominated by low sagebrush, and are important for bighorn sheep, antelope and sage grouse. The major difference between them is soil type. The soils of stony terrace are very stony on the surface. The soils of claypan terrace have gravelly loamy surface layers. Because these sites often occur in association, and the surface of the stony terrace is rocky, cattle prefer the claypan terrace site. As a result, vigor is low on the claypan terrace site, and ecological condition is poor and has remained in this condition since 1964. Ecological condition on the stony terrace site has gone from fair to good since 1964 and is still on an upward trend, although vigor remains low in many areas. Stony terrace comprises 93,500 acres (16%) of the Refuge, while claypan terrace occupies about 100,000 acres (17%).

Arid rolling hills
Arid rolling hills occurs on nearly level to rolling areas from 4,300 to 5,400 feet and is dominated by Wyoming big sagebrush. Soils of this site are shallow, very stony, and have moderate erosion potential. Arid rolling hills is potentially ideal habitat for bighorn sheep and serves as winter range for mule deer during severe winters. Arid rolling hills comprises 63,900 acres (11%) of the Refuge. Ecological condition has been static since 1964 in the high-poor or low-fair class. Vigor of key forage species is medium.

Arid loamy terrace
Arid loamy terrace occurs on nearly level to gently sloping basin terraces from 4,500 to 5,500 feet. This site is dominated by Wyoming big sagebrush. The soils are gravelly throughout with a hardpan or cemented gravel at 18 inches. Erosion hazard is slight. Sage grouse utilize this site for mating, nesting and winter use. About 95,927 acres (17%) of the Refuge is comprised of this site. The trend in ecological condition on about 80% of this site has been rising since 1964 from fair to good and the vigor of key forage species is medium. The remaining 20% of this site is in very poor ecological condition. It will remain that way because big sagebrush uses all the available moisture, few native plants remain, and harvester ants are thought to curtail natural reseeding of herbaceous species.

Snowpockets
Snowpockets occur on north-facing slopes where snowdrifts form and persist into spring and summer. Slope gradient is 15-60% and elevation is above 6,000 feet. There are three phases of this site, characterized respectively by chokecherry, bitterbrush and aspen, and ceanothus and snowberry. All three provide cover for mule deer. No trend data is available for this site, although observations indicate that portions of the ceanothus-snowberry phase have been destroyed by frost in some areas and have not been replaced.

Mountain swale
Mountain swale occurs in mountainous terrain as narrow alluvial fans in the bottoms of drainages and as small basin-like depressions in the uplands. Elevation is about 6,000-7,000 feet. The plant community is dominated by basin wildrye, mountain big sagebrush, green rabbitbrush and mountain snowberry. Soils are loamy, deep and very gravelly, with low erosion hazard. This site is extremely important for mule deer fawning. Trend data is not available for this site, as only 201 acres in isolated patches occurs on the Refuge.

Meadows
Poorly drained bottom (meadows) occurs in nearly level bottoms in basins having large or mountainous watersheds and is usually associated with perennial springs. Elevation is 4,500-6,500 feet. Dominant plants are those characteristic of grasslands, such as basin wildrye, Kentucky bluegrass, Nevada bluegrass, rushes and sedges. Surface soil layers are black; subsoils are very gray and mottled due to poor drainage. A restrictive layer usually occurs at three to four feet which retains the water table. Potential for gully erosion is high. Meadows are the most biologically productive areas on the Refuge, thus, they are critical sources of food, cover, and water to a diversity of wildlife. There are only 444 acres of this site on the Refuge. Vigor is low on most of the areas and ecological condition is poor or fair largely due to heavy erosion from use by cattle and horses.

Juniper rolling hills
Juniper rolling hills and juniper south exposure sites occur on prominent hills, ridges, plateaus, and south-facing slopes with a gradient of 2-50%. Elevation is about 4,300-6,000 feet. Dominant plants are western juniper and Wyoming big sagebrush, mountain big sagebrush and low sagebrush. Soils are stony to very

stony throughout the profile and are usually shallow over basalt bedrock. Erosion hazard is low. Both sites are important for mule deer and song birds. These two sites comprise 820 acres on the Refuge. Trend data is not available, but observations indicate that they are generally in low fair condition.

Aspen grove

Aspen grove sites occur near some springs on the Refuge, but are very small and contain less than 100 trees per site. Soils of this site have thick, dark-colored surface layers with loamy and gravelly subsoils. Erosion hazard is low. The vertical stratification provided by aspen and the potential for a profuse grass and forb understory provides excellent wildlife habitat. Trend data is not available for this site, but observations indicate that grazing has adversely impacted the herbaceous understory and aspen reproduction.

Riparian

Riparian areas occur along Hell, Virgin, Catnip, and Fish Creeks and some spring sites. The dominant plant is willow with some occasional aspen. Soils are highly erodible. The vertical stratification provided by willows, and profuse grass and forb understory, provides excellent habitat for wildlife. Trend data and observations indicate that many areas have been damaged or destroyed. This site comprises less than .01% of the Refuge.

Virgin Valley

Virgin Valley hills consists of a complex of ecological sites, within a unique geological and physiographic area. It is typified by lacustrine deposits, steep truncated slopes and butte caps of igneous rock. This soil is extremely fragile and erodible. In the past, mining and grazing have had considerable impact because of this. As this area is usually free of snow, it is an important wintering area for mule deer. The Virgin Valley hills constitutes about 34,208 acres (6%) of the Refuge. Vegetation is dominated by salt desert shrubs, including shadscale, bud sagebrush, spring hopsage, Wyoming big sage and greasewood. Vigor of plants is generally low.

AIR QUALITY

The Refuge is currently classified as a class II airshed. The area is subject to periodic hazy conditions of unknown origin. The northern portion of the Refuge is traversed by state highway 140, and smoke in this area from wildland fire or prescribed has potential to create safety or political issues.

STRUCTURES AND FACILITIES

Values at risk from fire suppression and prescribed fire operations include the Duferrena subheadquarters complex (valued at $489,000), Field stations at Badger Cabin ($92,000) and Little Sheldon complex ($966,000), and the residence complex at Thousand Creeks ($538,400). Other government-owned historic ranches exist at Virgin Valley, Gooch Camp and Kinney Camp. Total real property held by the federal government on the Refuge is valued at over $2.5 million. Numerous unimproved campgrounds, homesteads, and recent ranch sites exist as well. Other cultural sites include subsurface and surface lithic scatter sites and rock art. Lastly, the Virgin Valley area is an active mining district, with numerous active claims and private improvements at risk.

WILDLIFE

Over 200 wildlife species are known to occur on the Refuge. Featured species include pronghorn antelope, bighorn sheep, mule deer, and sage grouse. There is only one transitory vertebrate currently listed as threatened or endangered on the refuge, Bald Eagle (*Haliaeetus leucocephalus)*. A list of common wildlife species on the refuge is in Appendix L.

The higher elevations are typified by several steep canyons, rock bluffs, and cliffs with snowbrush, wild gooseberry, chokecherry, juniper, and aspen thickets. This is preferred habitat for mule deer, bighorn sheep, golden eagles, prairie falcons, and numerous smaller bird species.

In contrast, the lower country to has shallow intermittent lakes, is the preferred area of the antelope, kangaroo rats, burrowing owls, and sage sparrows, and such reptile as rattlesnake, bull snakes, yellow-bellied racers, and sagebrush lizards.

Between these extremes, among the big and short sage, mountain mahogany, and numerous kinds of bunch grasses, are the animals for which the mountain is so well known. Bands of antelope roam the gently-sloping east face. Also living in this vast area are mule deer, coyotes, bobcats, jackrabbits, cottontails, marmots, ground squirrels, night-hawks, northern flickers, and many other species of mammals and birds.

CULTURAL RESOURCES

The Refuge has numerous pre- and post-European settlement sites. Native American sites are common and include rock art and lithic scatter concentrations. Known sites are listed by the Regional Archeologist, and a site list is maintained at the Regional Office and the Nevada State Preservation Office. There have been a number of archaeological excavations and surveys undertaken by various universities on the refuge which show a rich and varied cultural history.

The effects of fire on these sites is not easily measured or mitigated. The fire return interval for much of the area has been estimated to be less than 100 years. As such, prehistoric sites have most likely experienced fire and in part are in their current condition as a result of fire. Fire suppression operations using mechanized equipment will have a much greater impact on these sites than fire itself, and disturbance should be avoided (Valentine). Fire generally has a detrimental effect on most historic sites.

Whenever possible during wildland fire events, resource advisors will be utilized in conjunction with suppression activities to identify and avoid impacts to sites. In the event sites are located during fire management operations, the sites will be avoided as much as possible and the Regional Archeologist notified.

Wooden structures remaining at post-European settlement sites are at considerably more risk from fire. These structures are considered values at risk from wildland fire. Hazardous fuels reduction projects (removal of encroaching sage and grass) are performed yearly by Refuge fire crews at the beginning of summer to minimize risk from wildland fires. In addition, prescribed fire operations are planned and conducted to avoid impact to these sites.

Any planned prescribed fire project which involves soil disturbance or excavation will include consultation with the Regional Archeologist as well as a cultural resources surface inventory by qualified cultural resources staff to identify and avoid any cultural resources.

WILDLAND FIRE MANAGEMENT SITUATION

HISTORIC ROLE OF FIRE

Pre-settlement Fire

Free-burning fire was a constant ecological presence on the American landscape prior to Euro-American settlement (Pyne 1997). Agee (1993) states that ecosystems with substantial presence of fire almost always contain species that are able to take advantage of fire effects to survive as a species. Such was likely the case in the pre-settlement shrub steppes of the western Great Basin and specifically Sheldon Refuge. Pre-settlement fire occurrence in the Great Basin shrub steppe has received relatively little study compared to other plant communities in the West. However, fire ecologists have believed that prior to Euro-American settlement fires occurred in the western Great Basin sage steppe every 20 to 100 years (Burkhardt and Tisdale 1976, Miller et. al. 1994), maintaining and shaping the plant communities.

Miller and Rose (1998), after extensive research of eastern Oregon, northwestern Nevada, and northeastern California, coupled with examination of other research projects, refined fire return intervals for western Great Basin shrub steppes. The more productive mountain big sage (*Artemisia tridentata* spp. *vaseyana*) burned more frequently with fire return intervals typically ranging between 12 and 25 years. Fire return intervals in less productive Wyoming big sage (*Artemisia tridentata* spp. *wymingensis*) likely ranged between 25 to 100 years. In low sage (*Artemisia arbuscula*) fire return intervals range between 100 and 200 years.

Limited fire history studies on Sheldon juniper stands have been done by Refuge fire staff. Although fire history data is not particularly easy to locate in western juniper, limited data has been assessed. Moderate to high intensity fire often kills juniper, eliminating most potential evidence of past fire events. Preliminary analysis of fire scars from the Little Sheldon area shows a mean fire return interval of 78 years with evidence of fire from 1806 to the 1930's (Refuge Files). This estimate is likely longer than the actual fire return interval, as a fire scar record for all fires is impossible to obtain.

Fire history studies based upon analysis of fire-scarred trees sampled at Blue Sky, a relic 60-acre Ponderosa Pine stand on Hart Mountain, have produced quantitative information on past fire events. This stand is the closest ponderosa pine stand to Sheldon Refuge. Gruell (1995), using limited sampling, established a mean fire return interval of 13 years for this stand. Additional study by Sheldon-Hart Mountain fire staff has lowered this interval to 10 years, with fire-free intervals ranging from 2 to 19 years (Refuge Files 2000). Seasonality identification using microscopic examination of fire scars also showed that fires burned almost exclusively in the late summer/fall. These fire return intervals compare favorably with other studies in semi-arid regions of the Intermountain West which show that fires were frequent , mostly low intensity events with pre-1900 fire return intervals of 4-20 years in ponderosa pine dominated forest.

Although lightning was likely the primary ignition source for fires on Sheldon, anthropogenic-set fires should not be discounted. Ignitions can likely be attributed to Native American peoples (Gruell 1985, Rose and Miller 1998). The reasons for Native American burning include forage enhancement, food gathering, and clearing dense vegetation. Examination of the archaeological record of the prehistoric sites on Sheldon and the surrounding area shows extensive fire usage for cooking/camping and it is likely that numerous fires escaped control to burn as wildland fires.

The true frequency and size of pre-settlement fires on Sheldon is unknown. They likely were varied, depending on topography, potential ignition source, weather, and fuels. Pre-settlement fires likely burned as a mosaic creating multiple aged communities. Gruell (1994) speculated that pre-settlement mountain and shrub steppe in the western Great Basin supported a high complement of perennial grasses and forbs rather tan shrubs. These highly flammable fine fuels would have contributed to close fire return intervals, which in turn would have perpetuated a predominance of herbs and grass over woody vegetation (shrubs). Fire likely restricted the development of juniper, curlleaf mountain mahogany, and antelope bitterbrush (Young and Evans 1981, West, 1988, Gruel 1994). With Euro-American settlement came disruptions to the natural processes. Given a disruption in natural fire regimes due to fire suppression/exclusion and intensive livestock grazing, shrubs have been allowed to dominate at the expense of herbaceous species. An absence of fire or other disturbance has allowed formation of monotypic stands of late succession shrubs and wide expansions of those species of limited historic population size and distribution such as western juniper, antelope bitterbrush, and curlleaf mountain mahogany.

Post-settlement Fire History

Prior to the establishment of the Refuge in late 1936, it is unknown if fire suppression activities took place on Sheldon. Records simply do not exist for the time period before 1934. However, during this time period it was a generally held belief by the U.S. public that wildland fires were "bad" and fire was vigorously suppressed all across the U.S.. By the mid-1930's, particularly with the establishment of the CCC camp in first Colman Valley, then at Duffurina, fire suppression became a reality. From the time period 1935 to the early 1980's, partial/incomplete records on file in the Lakeview Complex office and the FWS Regional Office in Portland suggest that all wildland fires were as aggressively suppressed by Refuge staff as possible with assistance from cooperating agencies (BLM, State of Oregon, the CCC's, and U.S. Forest Service). Agreements signed with the Surprise BLM to provide fire protection/suppression services on the Refuge were formalized by at least the late 1960's. BLM continued these services until 1985 when a fire management program was established at Sheldon.

By the mid-1960's the biological staff on Sheldon Refuge had noted a drastic reduction in native grasses and associated range carrying capacity.   A limited prescribed burn program was instituted under the guise of range improvement. In the next 18 years a handful of prescribed burns were carried out. Records are sketchy as to what was burned and the results. By the early 1980's the consideration for burning had gradually changed from range improvement to a habitat management/restoration emphasis.

Typically, the majority of all wildland fires occur during the driest period of the year; mid-June through early November. Lightning accounts for 59% of all wildland fire starts, with the other 41% human caused. The lightning season is typically from June through September. Thunderstorms tracking across Sheldon are generally wet, and as a result, fires set by lightning most often are fairly small with limited spread and intensity. Many go out before any suppression activities take place. Fire crews on the Refuge have been effective in suppressing most fires soon after ignition, keeping the average lightning fire to under 15 acres. Human-caused fires on the other hand are often set under more extreme conditions. They have been set in every month of the year except the most extreme winter months (December - February) when snow is on the ground. Human-caused fires can be characterized as of two types; escaped prescribed burns or carelessness, and average 1800 acres per incident. These fires usually burn with rapid spread and high intensity, requiring aggressive initial attack and mobilization of off-Refuge resources.

Eighteen years (1984-2001) of available fire history is summarized in Tables 1 through 3. The Refuge fire history files of historic fires is not complete for the years prior to 1984. Surprise BLM provided a great deal of information to complete the records from 1984 to 1988.

Table 1: Summary of wildland fire history by ignition source

Year	# Human Fires	# Lightning Fires	Total Fires	#Human Acres	#Lightning Acres	Total Acres
1984	0	0	0	0	0	0
1985	0	2	2	0	1502	1502
1986	0	7	7	0	202	202
1987	0	3	3	0	83	83
1988	0	2	2	0	2284	2284
1989	1	3	4	2261	83	2344
1990	0	2	2	0	11	11
1991	0	8	8	0	628	628
1992	0	3	3	0	461	461
1993	0	0	0	0	0	0
1994	1	3	4	1	8211	8211
1995	0	0	0	0	0	0
1996	1	5	6	5120	1	5121
1997	2	5	7	201	1	202
1998	1	2	3	1	9	10
1999	0	2	2	0	38000	38000
2000	0	1	1	0	1	1
2001	0	0	0	0	0	0

Table 2: Summary of 18 years of fire history by fire type

Year	Type 1	Type 2	Type 3	Type 4	Type 5
1984	0	0	0	1	0
1985	2	2	0	1	0
1986	7	0	0	0	0
1987	3	0	1	0	1
1988	2	0	0	0	0
1989	4	0	1	0	0
1990	2	0	6	2	2
1991	8	0	5	10	0
1992	3	0	10	17	0
1993	0	0	1	2	1
1994	3	0	4	6	0
1995	0	0	6	4	0
1996	6	0	13	5	2
1997	7	0	5	12	0
1998	3	0	4	7	1
1999	1	1	8	1	1

2000	1	0	5	6	0
2001	0	0	0	7	0
Total	52	3	69	81	7

Fire Type Key:
Type 1 - Fire Suppressed by FWS
Type 2 - Natural Outs
Type 3 - Support Actions
Type 4 - Prescribed Fires
Type 5 - False Alarms

Prescribed fire history

Prescribed burns are carried out on Sheldon Refuge at all times of the year. Typically, meadows are burned in the winter/spring when grasses will readily burn but the fire will not spread into surrounding shrub lands due to increased live fuel moisture contents or snow pack. Most sagebrush communities are burned in late summer or early fall when low live fuel moisture content combines with low relative humidity and high temperatures to allow for free burning fire conditions. Juniper is burned in the fall after tree dormancy or in the spring prior to green-up.

Currently the Refuge has a very active prescribed fire program. The role of prescribed fire on Sheldon has been to use fire as a management tool to improve ecological condition of the Refuge, to promote greater diversity within plant communities on the Refuge, to re-introduce fire in natural ecosystems, and to reduce hazardous fuels levels. In effect, prescribed fire is being used as a tool to mimic the natural fire regimes which were present prior to Euro-American settlement.

Table 3: Summary of Prescribed Fire (PF) History

Year	# of PF	PF Acres
1984	1	138
1985	1	42
1986	0	0
1987	0	0
1988	0	0
1989	0	0

1990	2	210
1991	10	787
1992	17	1461
1993	2	401
1994	6	1199
1995	4	1014
1996	5	7742
1997	12	2661
1998	7	1427
1999	1	5
2000	6	93
2001	7	2915
Total	81	20095

FIRE MANAGEMENT STRATEGIES

All wildland fires on the Refuge are classified as wildland fires and will be suppressed, with firefighter and public safety, suppression costs, and values to be protected as considerations in selecting suppression strategies. Wildland fire will not be managed primarilly to achieve resource objectives for the following reasons:

- Current staffing is not adequate.
- Probability of obtaining contingency resources is at its lowest during wildland fire season.
- Ignitions are not a planned event, time of ignition is a mystery.
- Cost of ensuring success is much higher than using prescribed fire.
- Risk to firefighter safety is higher compared to prescribed fire.

The full spectrum of suppression strategies ranging from aggressive control (least possible acres) to confining fires to broad, defensible boundaries will be used. The appropriate suppression strategy will be selected in an Wildland Fire Situation Analysis (Appendix E). Recommended strategies will be developed from current and forecasted weather and fire behavior, values at risk, safety, fuel conditions and available resources.

All wildland fires will be suppressed using the full range of strategies that provide flexibility for managers to analyze firefighter and public safety, values to be protected, ecological effects of fire, and costs associated with suppression actions.

Heavy equipment will only be used to improve the fire holding capability of existing roads. No new mechanical line will be constructed in the Refuge, unless life or property is threatened, or is approved by the Refuge Manager. Mechanical line may be constructed to protect structures and improvements.

The use of aerial retardants will be determined on a case-by-case basis, and only after careful analysis of the risk to resources. Aerial retardants may be used to protect firefighters, structures and improvements regardless of cost. Off-road driving will be restricted to the minimum necessary for fire management operations. Fragile dry soils can be disturbed by rubber-tired vehicles.

Prescribed fire will be used to achieve resource management objectives. Hazard fuel reduction burning and mechanical treatments will be conducted along transportation corridors and around values at risk to reduce unnaturally high fuel loadings. Resource management prescribed burning will be conducted to encourage recovery of riparian areas, improve grass and forb production and generally improve wildlife habitat.

The judicious use of prescribed fire is the most cost effective and ecologically sound means available to convert late succession woody shrub stands to more productive early succession communities which promote biological diversity and improved habitat condition.

RESPONSIBILITIES

Regional Director

< Approves Fire Management Plan.
< Approves wildland fire Rehabilitation Plans.

Regional Fire Management Coordinator

< Fire program review leader.
< Provides Refuges with budget and technical leadership.

Project Leader

< Supervises the complex fire management program.
< Approves Refuge Prescribed Burn Plans.
< Selects and certifies the preferred alternative for the Wildland Fire Situation Analysis
< Approves the Delegation of Authority.
< Validates prescribed fire status daily.

Deputy Project Leader

< Supervises Fire Management Officer.
< Coordinates Refuge and complex programs to ensure personnel and equipment are made available and utilized for fire management activities including fire suppression, prescribed burning and fire effects monitoring.
< Ensures that fire management program has access to Refuge and complex resources when

needed.

< Ensures that Refuge Managers and Complex staff consider fire management program during Refuge related planning and implementation.

Refuge Manager

< Identifies prescribed burn units and biological objectives to Fire Management Officer (FMO).

< Notifies FMO of prescribed fire project constraints.

< Ensures that Refuge resources are available to accomplish prescribed fire and fire suppression objectives.

< Acts as the primary Refuge Resource Management Specialist during fire management planning and operations.

< Ensures fire effects monitoring is being implemented.

< Drafts wildland fire Rehabilitation Plans for Deputy Project Leader.

< Responsible for posting and enforcing fire restriction regulations.

Fire Management Officer

< Responsible for all fire related planning and implementation for the complex.

< Supervises Assistant Fire Management Officer and Prescribed Fire Specialist.

< Integrates biological Refuge objectives into all fire management planning and implementation.

< Proactively solicits program input from Refuge Managers and Biologists.

< Supervises prescribed fire planning.

< Coordinates fire related training.

< Coordinates with cooperators to ensure adequate resources are available for fire operational needs.

< Determines when ecological and political triggers are reached for wildland fire and prescribed fire implementation purposes.

< Maintains fiscal control of preparedness and prescribed burning budgets.

Assistant Fire Management Officer

< Responsible for assisting the FMO in all aspects of the fire program.

< Performs as the acting FMO in the absence of the FMO.

< Interacts closely with Refuge personnel in the planning and implementation of the Refuge fire program.

< Supervises Refuge fire crews.

< Coordinates fire related training.

< Coordinates with interagency partners.

Prescribed Fire Specialist

< Performs prescribed fire planning.

< Interacts closely with Refuge Managers, FMO's and Biologists to identify prescribed burn projects, establish burn units and resource objectives, and eliminate resource conflicts.

< Coordinates Complex Live Fuel Moisture project.

< Designs and leads implementation of fire behavior monitoring and Level 1 fire effects monitoring.

< Coordinates prescribed fire project documentation process and maintains files.

< Coordinates fire research projects with researchers.

Biologists

< Coordinates, through Refuge Managers and Deputy Project Leader, to provide biological input to the FMO.

< Designs and leads implementation of fire effects monitoring, with input from FMO.

< Participates as requested in prescribed burning and wildland fire suppression.

Incident Commander

Incident Commanders (of any level) use strategies and tactics as directed by the Project Leader or designee and WFSA, where applicable, to implement selected objectives on a particular incident. A specific Limited Delegation of Authority (Appendix F) will be provided to each Incident Commander prior to assuming responsibility for an incident. Major duties of the Incident Commander are given in NWCG Fireline Handbook, including:

< Brief subordinates, direct their actions and provide work tools.

< Ensure that safety standards identified in the Fire Orders, the Watch Out Situations, and agency policies are followed at all times.

< Personally scout and communicate with others to be knowledgeable of fire conditions, fire weather, tactical progress, safety concerns and hazards, condition of personnel, and needs for additional resources.

< Order resources to implement the management objectives for the fire.

< Inform appropriate dispatch of current situation and expected needs.

< Coordinate mobilization and demobilization with dispatch and the FMO.

< Perform administrative duties; i.e., approving work hours, completing fire reports for command period, maintaining property accountability, providing or obtaining medical treatment, and evaluating performance of subordinates.

< Assure aviation safety is maintained to the highest standards.

Initial attack teams:

Initial attack teams will consist of trained and experienced, fully- qualified firefighters, with qualified leadership. Teams will be prepared and equipped with hand and power tools as needed and will be dispatched with a day's supply of food and water, so they can continue work for 24 hours without additional support.

Employees participating in any wildland fire activities on Fish and Wildlife Service or cooperator’s lands will meet fitness requirements established in PMS 310-1, except where Service-specific fitness requirements apply.

Exceptions to fitness requirements on Initial attack activity are available from the Regional Fire Management Coordinator per guidelines in the Fire Management Handbook (USFWS 2000).

INTERAGENCY OPERATIONS

Cooperative agreements with various federal, state and local agencies (Appendix G) generally provide that resources of each agency are available to assist in initial attack efforts. These agreements have detail payment among cooperators, list of response areas, communications frequencies, and have been reviewed by a contract specialist and/or solicitor.

Sheldon NWR will use the Incident Command System (ICS) as a guide for fireline organization. Qualifications for individuals is per DOI Wildland Fire Qualifications and Certification System, part of

NIIMS and the National Wildfire Coordination Group (NWCG) Wildland and Prescribed Fire Qualification Guide (Pms 310-1). Depending on fire complexity, some positions may be filled by the same person.

The Lakeview Interagency Fire Center (LIFC) is the servicing dispatch center for all public land management agencies in North West Nevada and south central Oregon. LIFC provides the following services to Sheldon NWR through the authority of a Memorandum of Understanding (Appendix G):

< Collection and dissemination of fire weather forecasts and observations.
< Mobilization of suppression forces as instructed by the FMO's or Duty Officer for the complex.
< Aircraft scheduling and flight following for fire related aircraft use.
< Incorporating Refuge detection needs into cooperator detection flights.
< Situation reporting.
< WIMS Daily Inputs.
< Expanded Dispatch.
< Coordinates Local Training.

LIFC is staffed by all local agencies, including USFWS, and operates to service all local agencies. The primary employees of the Center are the Center Coordinator and 2 Assistant coordinator. All local public land agencies with fire management responsibilities can be mobilized through LIFC. The Zone FMO sits on the LIFC Oversite Committee. The dispatch plan is in Appendix H.

Cooperators for Wildland fire operations on Sheldon NWR are as follows; Burns District BLM, Vail District BLM, Lakeview District BLM, Cedarville District BLM, Winnemucca District BLM, BIA-Fort Bidwell, Modoc National Forest, and the Fremont National Forest. Agreements and operating plans currently require annual renewal. Cooperating agencies are looking at a five year renewal process starting in FY 2002. Agreements can be found in Appendix G.

PROTECTION OF SENSITIVE RESOURCES

The Comprehensive Management Plan for the Refuge will include managing significant land areas as proposed wilderness areas (Figure 2).

Fire management strategies for each area will be formulated during Prescribed Burn Plan preparation, pre attack planning, and Wildland Fire Situation Analysis strategy selection. A resource management specialist will be involved in all phases of fire management planning and implementation.

Significant cultural sites are also present on the Refuge. These sites include standing and fallen homestead sites, lithic scatters, and Rock Art sites. Because of the diversity of site location, type and resultant fire effect, strategies will be developed during Prescribed Burn Plan preparation, pre attack planning, and Wildland Fire Situation Analysis strategy selection to eliminate or minimize site disturbance. Mechanical fuels reduction work to reduce potential damage\destruction from wildland fires will be conducted periodically around the following developments/structures; 1000 Creek Ranch, Dufferrena Complex, Gooch Camp, Kinney Camp, West Rock Springs Camp, Badger Cabin, Andy's Cabin, Badger radio repeater, Last Chance Ranch, Little Sheldon, and IXL Ranch.

The Regional Archaeologist and/or his/her staff will work with fire staff, project leaders, and incident commanders to ensure that cultural resources are protected from fire and fire management activities. The "Request For Cultural Resource Compliance" form (RCRC, Appendix R) will be used to inform the

Regional Archaeologist of impending activities, thereby meeting the regulations and directions governing the protection of cultural resources as outlined in Departmental Manual Part 519, National Historic Preservation Act (NHPA) of 1966, Code of Federal Regulations (36CFR800), the Archaeological Resources Protection Act of 1979, as amended, and the Archaeological and Historic Preservation Act of 1974. The NHPA Section 106 clearance will be followed for any fire management activity that may affect historic properties (cultural resources eligible to the National Register of Historic Places).

Impacts to archaeological resources by fire resources vary. The four basic sources of damage are (1) fire intensity, (2) duration of heat, (3) heat penetration into soil, and (4) suppression actions. Of the four, the most significant threat is from equipment during line construction for prescribed fires or wildland fire holding actions (Anderson 1983).

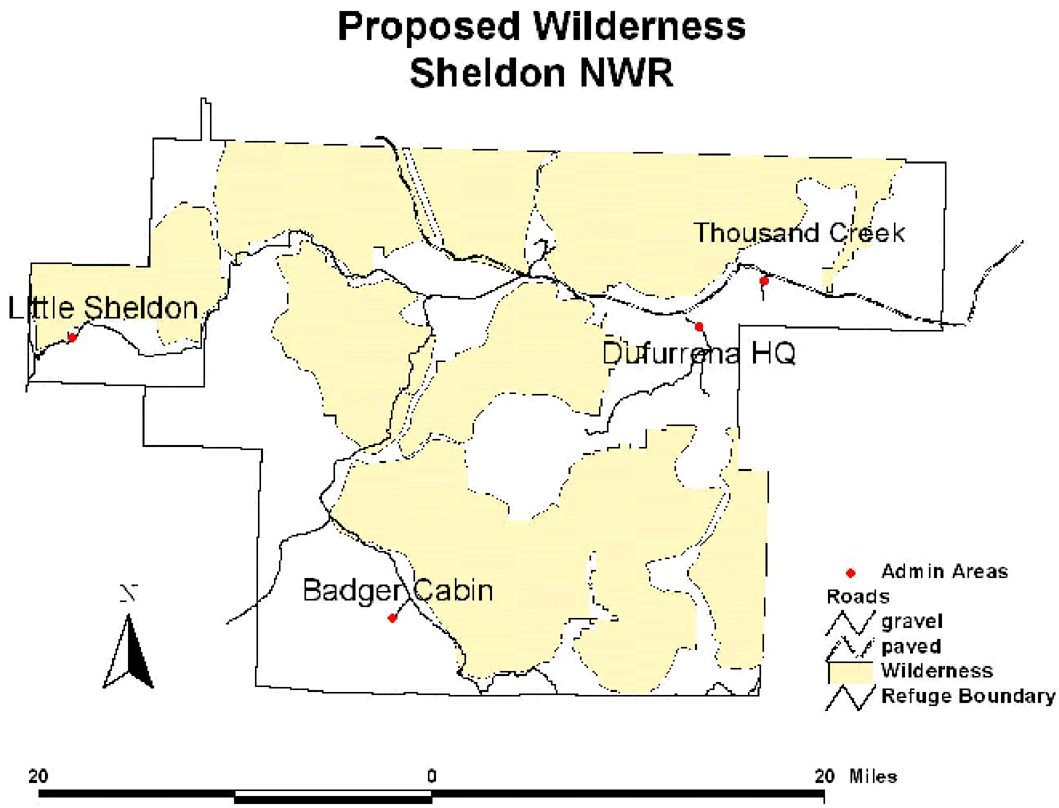
The following actions will be taken to protect archaeological and cultural resources:
Wildland Fires

- $ Minimum impact fire suppression tactics will be used to the fullest extent possible.
- $ Resource Advisors will inform Fire Suppression personnel of any areas with cultural resources. The Resource advisor should contact the Regional Archaeologist and/or his/her staff for more detailed information.
- $ Foam use will me minimized in areas known to harbor surface artifacts.
- $ Mechanized equipment should not be used in areas of known cultural significance.
- $ The location of any sites discovered as the result of fire management activities will be reported to the Regional Archaeologist.
- $ Rehabilitation plans will address cultural resources impacts and will be submitted to the Regional Archaeologist using the RCRC.

Prescribed Fires

- $ The Refuge Fire staff will submit a completed RCRC to the Regional Archaeologist and/or his/her staff as soon as the burn area is identified (i.e., as soon as feasible).
- $ Upon receipt of the RCRC, the Regional Archaeologist and/or his/her staff will be responsible for consulting with the FMO and evaluating the potential for adverse impacts to cultural resources.
- $ When necessary, the Regional Archaeologist and/or his/her staff will coordinate with the State Historic Preservation Officer (SHPO). The SHPO has 30 days to respond. The Refuge will consider all SHPO recommendations.
- $ Mechanized equipment should not be used in areas of know cultural significance.
- $ The location of any sites discovered as the result of fire management activities will be reported to the Regional Archaeologist.

Figure 2: Wilderness areas



Heavy equipment will not be used indiscriminately during fire management activities. However, heavy equipment and aerial retardants may be used during initial attack of wildland fires which threaten life and/or property. A good faith effort will be made to avoid impacts to cultural sites during these activities. Resource Advisors will be utilized as fully as possible to help in this effort.

There is one transitory vertebrate currently listed as threatened or endangered on the Refuge, Bald Eagle (*Haliaeetus leucocephalus*).

There are no plants currently listed as threatened or endangered on the Refuge. All nine species of concern in the 1980 Sheldon EIS are no longer considered rare and none is a Federal candidate for listing under the Endangered Species Act because they are more widely distributed than previously believed. No additional full-scale botanical work has been conducted on the Refuge since 1979. However, numerous other rare plant species have been recently discovered and described and may occur on or near the Refuge. These species include:

Table 4: Rare plants near the refuge

Scientific Name:	**Common Name:**	**Federal Status:**
Astragalus tiehmii	Tiehm milkvetch	C2
Cryptantha schoolcraftii	Schoolcraft catseye	C2
Eriogonum crosbyae	Crosby buckwheat	C2
Ivesia paniculata	Ash Creek ivesia	C2
Ivesia rhypara var. rhypara	grimy ivesia	C2
Lepidium montanum var. nevadense	Pueblo Valley peppergrass	pC2
Lomatium packardiaae	Succor Valley parsley	pC2
Mentzelia mollis	smooth stickleaf	C2
Penstemon floribundis	Cordelia beardtongue	C2
Potentilla basaltica	basalt cinquefoil	C1
Senecio ertterae	Ertter ragwort	C1

Primary and secondary effects of fire on these populations are expected to be short term only. Strategies for individual fires will be developed during Prescribed Burn Plan preparation, pre attack planning, and Wildland Fire Situation Analysis strategy selection.

WILDLAND FIRE ACTIVITIES

Fire program management describes the operational procedures necessary to implement fire management at Sheldon NWR. Program management includes: fire prevention, preparedness, emergency preparedness, fire behavior predictions, step-up staffing plan, fire detection, fire suppression, minimum impact suppression, minimum impact rehabilitation, and documentation.

All fires not classified as prescribed fires are wildland fires and will be appropriately suppressed. There are two heavy (type 4) engines with a total of eight crew members stationed on the refuge from approximately June 15 - September 30. These crews are the primary initial attack fire suppression resources for the refuge and surrounding federal and state lands. Should additional resources be necessary, agreements exist for the use of cooperating agencies, closest forces concept applies to all fires (Appendix G). The primary cooperators are the USFS, BLM, and BIA-Fort Bidwell. In the event a fire escapes initial attack efforts, local type 3 teams may be utilized or an area type 2 team may be mobilized. It is unlikely that a type 1 team would be utilized on the refuge given the remoteness, predominant fuel types, lack of values at risk, and minimal urban interface. The Lakeview Interagency Fire Center (LIFC) is the primary dispatch center for refuge fire activities.

Records show that fire season is typically from April through November with the core season being June-September.

PREPAREDNESS

Preparedness is the work accomplished prior to fire occurrence to ensure that the appropriate response, as directed by the Fire Management Plan, can be carried out. Preparedness activities include: budget planning, equipment acquisition, equipment maintenance, dispatch (Initial attack, extended, and expanded), equipment inventory, personnel qualifications, and training. The preparedness objective is to have a well trained and equipped fire management organization to manage all fire situations within the refuge. Preparedness efforts are to be accomplished in the time frames outside the normal fire season dates.

Annual Activities

The following flow of activities will guide the Refuge fire program during fire readiness preparations:

January	Seasonal Fire Crew hiring begins Supervisory technicians inspect cache and engines to determine procurement needs AFMO attends LIFC Operations Group Meetings Training as scheduled PFS, LFM sampling as needed Fire Management Plan reviewed
February	Seasonal Fire Crew hiring completed AFMO provides input to FMO as to procurement needs AFMO attends LIFC Operation Group Meeting AFMO orders necessary basic training materials from RFMO Training as scheduled LFM sampling as needed
March	AFMO attends LIFC Steering Group Meeting AFMO coordinates with cooperators to reserve slots in basic fire schools if available

	Supervisory Technician begins employment period
	Training as scheduled
	LFM sampling regular program begins
	FMO attends LIFC Oversite Group Meeting
April	Last minute hiring changes completed
	Supervisory technicians ensure All fire equipment is serviced
	Pack-Test and Annual Refresher Training for permanent employees completed
	PFS conducts LFM program
	LIFC Operation Committee Meeting
May	All fire radios are serviced
	Basic training for regular employees
	PFS conducts LFM program
	Step-up plan and Refuge dispatch plans reviewed
	LIFC Operation Committee Meeting
June	Seasonal Fire Crew on board
	All basic training is completed
	Engine crews go through engines, bring to NUS
	Cache items checked out
	Last minute changes to equipment completed
	PFS conducts LFM program
	Seasonal Fire Crew goes to Refuges
	LIFC Operation Committee Meeting
	Fire effects monitoring
July	July 4th weekend (Order of the Antelope rendevous) extended staffing if indices warrant.
	LFM program
	LIFC Operations Committee Meeting
August	LIFC Operations Committee Meeting
	Fire Budget reviewed, balanced and zeroed
	PFS conducts LFM program
September	LIFC Operations Committee Meeting
	Budget for next fiscal year drafted.
	Summer seasonals evaluated and terminated or extended for RX burning
	PFS conducts LFM program
October	LIFC Operations Committee Meeting
	PFS conducts LFM program
November	Fire history for year reviewed and updated in GIS
	PFS conducts LFM program
	Lead Technicians in non-pay status
	Equipment refurbished and winterized
December	PFS conducts LFM program
	Fire history project completed for year

Historical weather analysis
The current wildland fire season for Sheldon NWR is set in the Firepro system from June 1-September 30. Ninety-five percent of all wildland fires on Sheldon have occurred during the listed fire season, with the months of July and August evenly split at 38% each of the total recorded wildland fire incidents. Analysis of the past 8 years of weather data from the Catnip Mountain RAWS station (the life-span of the unit) shows that the month of August averages the lowest relative humidity, highest mean temperature, lowest fuel moisture, highest burn index (BI), and highest energy release component (ERC), all factors which influence the start, behavior, and spread of wildland fires. August and July share the same percentage of fire starts (38% each). August, however, is the month when wildland fires are most apt to become large. Seventy-three percent of all wildland fire acres have occurred during the month of August. From 1985 to 2000, an average of 3775 acres per year have burned on Sheldon in wildland fires.

Appendix I references historical weather data from the Catnip Mountain RAWS station.

Fire Prevention
An active fire prevention program will be conducted in conjunction with other agencies to protect human life and property, and prevent damage to cultural resources or physical facilities. Industrial Fire Precaution Level (IFPL) closures and media contacts are coordinated through the South Central Oregon Fire Management Partnership (SCOFMP). A copy of the SCOFMP guide (Goose Book) is on file in the FMO's office.

A program of internal and external education regarding potential fire danger will be implemented as determined necessary by Refuge staff. Visitor contacts, bulletin board materials, handouts and interpretive programs may be utilized to increase visitor and neighbor awareness of fire hazards. During periods of extreme or prolonged fire danger emergency restrictions regarding refuge operations, or area closures may become necessary. Such restrictions, when imposed, will usually be consistent with those implemented by cooperators. Closures will be authorized by the Refuge Manager or Project Leader.

Staffing Priority Levels
The National Fire Danger Rating System (NFDRS) is the process by which relative fire danger indices are assigned and corresponding staffing priority levels assessed. Fire weather information is integrated with refuge specific fuel and topographic information to determine various fire danger indices. This system is operated through the Weather Information Management System (WIMS) using archived historical weather data stored in the national depository in Kansas City. Sheldon weather data from the Rock Creek/Fish Fin/Catnip Remote Automated Weather Station (RAWS) is collected daily by LIFC and has been archived for the past 16 years. Using historic data and the FIREFAMILYPLUS computer program, predictions based upon historic weather data and fire occurrence can be made. Refuge fire season and abnormal fire danger is annually predicted.

Staffing priority levels are designed to direct incremental prepardness actions in response to increasing fire danger. Staffing levels describe escalations in prepardness activities and staffing. These are approved, predetermined responses to increased fire danger for a burn burning period, which is defined as the period of the day when fire burns most actively in a given fuel type. Five staffing levels (1-5) have been determined, with level 1 reflecting limited need for staffing due to a potential to limit fire starts to very small size and level 5 to high prepardness and increased staffing due to a potential for any fire start to grow rapidly to project-sized wildland fires. Of utmost importance is the Burning Index (BI) and, to a lesser degree, Energy Release Component (ERC), which are used as the basis to determining and ranking fire danger and increased or decreased prepardness. The BI, in particular, is designed to reflect the difficulty in controlling a new fire start. Break points between staffing levels are determined by the cumulative percentages of occurrence of the BI during the fire season. For fire management purposes, the most critical break points occur at the 90th and 97th percentile break points. These two points define staffing classes 4 and 5, the classes reflecting the most fire potential and most need for increased staffing. The Catnip Mtn. RAWS, using an NFDRS fuel model T (sagebrush with grass), collects the daily data necessary to determine all WIMS inputs and NRFDS outputs. LIFC, analyzing this data, provides daily updates in predicted BI's and ERC's, and associated staffing levels.

why not on CD?
FIREFAMILYPLUS computer program runs determining 90th and 97th percentile breakpoints for Sheldon BI's and ERC's using NFDRS Fuel Model T (sagebrush with Grass) are shown in Appendix I. The step-up plan for the refuge is located in Appendix P.

Training
Departmental policy requires that all personnel engaged in suppression and prescribed fire duties meet the standards set by the National Wildfire Coordinating Group (NWCG). Sheldon NWR will conform strictly to the requirements of the wildland fire management qualification and certification system and USFWS guidelines.

Sheldon NWR will use the Incident Command System (ICS) as a guide for fireline organization. Qualifications for individuals is per DOI Wildland Fire Qualifications and Certification System, part of NIIMS and the National Wildland Fire Coordination Group (NWCG) Prescribed Fire Qualification Guide. Depending on fire complexity, some positions may be filled by the same person.

Basic wildland fire training refreshers are offered annually for red-carded firefighters and records kept in a centralized database. Additional training is available from surrounding agencies in pump and engine operation, power saws, firefighter safety, fire weather and fire behavior, helicopter safety and prescribed fire objectives and activities. On-the job training is encouraged and will be conducted at the field level. Whenever appropriate, the use of fire qualification task books will be used to document fire experience of trainees. The FMO will coordinate fire training needs with those of other nearby refuges, cooperating agencies, and the RO.

The refuge supports the development of individual Incident Command System (ICS) overhead personnel from among qualified and experienced refuge staff for assignment to overhead teams at the local, regional, and national level.

Fire suppression is an arduous duty. On prescribed fires, personnel may be required to shift from implementation/monitoring activities to suppression. Poor physical condition of crew members can endanger safety and lives during critical situations.

Personnel performing fire management duties will maintain a high level of physical fitness. This requires successful completion of a fitness pack test. Personnel must complete a three mile hike with a 45 pound pack in less than 45 minutes.

Fire training is a primary responsibility of the Assistant Fire Management Officer. Minimum acceptable training is include in Table 5:

Table 5: Minimum acceptable training

S130, S190, Standards for Survival and I220	All seasonal fire crew members
Standards for Survival, Annual Refresher	All employees engaged in fire suppression. And Rx operations
S290, S390, S230, S260, S270, S205, S211,	Lead Technicians and potential
S212, S215 and I200	assistant engine operators
RX Classes	ALL RX Personnel in supervisory roles
I300 and above position training	Lead Technicians, PFS, AFMO, and FMO

Every opportunity for employee career development beyond the above listed minimum standards will be taken advantage of as funding permits.

Supplies and Equipment

The Sheldon 30- person cache is co-located in Lakeview. The AFMO issues equipment and NUS to firefighters prior and during fire season (this may be delegated to Station Managers). The station manager outfits the engines with enough supplies to make it through a 48 hour shift. Due to inadequate storage space, re-supplying of engines must be done in Lakeview. If multiple fires dictate immediate re-supply a truck can be sent from Lakeview with requested supplies. Additional equipment and supplies are available through cooperators and the Interagency cache system in Boise. Requests for additional personnel and equipment are made through the servicing Dispatch Centers. Type 4 and Type 3 Incident Commanders place resource orders through dispatch via radio, cell phone or fax machine. Dispatch then contacts the duty officer for appropriate approvals for the order.

Basic equipment needs which will be suplied by the FWS include: Personal protective equipment and basic firefighter equipment needs for up to 30 people, equipment necessary to outfit 3 heavy and 1 light engine, prescribed fire equipment necessary to maintain an active prescribed fire program and miscellaneous equipment common to basic fire suppression needs.

A listing of the current NUS for the cache can be viewed in Appendix J.

DETECTION

Fire detection strategy for the Refuge is generally tied to the Interagency Partnership Operations Committee (OPS). The OPS committee members frequently determine detection flight routes and priorities during periods of high fire danger. Cost-sharing for flights is alternated between the partnership members.

During lightning activity, Refuge personnel will implement fire patrols.

A fire lookout, located on top of Yellow Peak immediately south of the Little Sheldon Complex, is staffed during periods when lighting is predicted or has recently occurred. Through an agreement with the BLM, Surprise Resource Area, staffing for Yellow Peak is provided by BLM at a cost to the Complex of $2000 annually.

COMMUNICATIONS

Lakeview Interagency Fire Center (LIFC) provides daily communication and dispatch functions for all fire related activities i.e., initial attack, prescribed burning, aviation flight following, daily availability of engines and personnel. Communication support falls under the South Central Oregon Fire Management Partnership (SCOFMP) MOU.

The following frequencies are shared by a Interagency Radio Frequency Use Agreement **Note:** frequency agreements will be located in the FMO's filing system under Agreements):

U.S. Forest Service, Fremont National Forest
172.350 MHZ, 171.700 MHZ, 170.600 MHZ, 168.725 MHZ with simplex and repeater access.

Bureau of Land Management, Lakeview District
166.325 MHZ, 166.925 MHZ with simplex and repeater access.

Sheldon-Hart Refuges
168.575 MHZ, 169.650 with simplex and repeater access.

The complex utilizes 3 frequencies on a daily basis for all fire management activities. Fish and Wildlife Direct is a line of sight frequency used on most prescribed burns and smaller type 4 incidents. Two solar-powered repeaters are located on mountain tops and serviced by the BLM/FS radio shop in Lakeview. Warner Peak on Hart Mt. and Badger Mountain on Sheldon are the USFWS repeaters. BLM owns a repeater on Hart Mt. which is co-located next to the USFWS repeater.

Radios are programable Analog Wideband King hand held and Midland mobile vehicle radios. Sheldon-Hart Complex is slated to change over to Digital Narrowband radios in 2005. All REALLY? ALL?firefighters are issued a programmable hand held radio prior to fire season. All fire vehicles are equipped with 28 channel mobile radio's.

A frequency list is located in Appendix K.

PRE-ATTACK PLAN

The dispatch plan will be used by Fire Management Unit and Staffing Class to provide effective and adequate initial attack on the Refuge. The Duty Officer may reduce or increase response levels commensurate with local and regional fire activity, drought conditions and observed and forecasted weather conditions.

Table 6: Recommended Staffing Class

Staffing Class	**FMU I**	**FMU II**	**FMU III**
1/2/3	Engine	Engine	Engine

4	Engine	2 Engine	2 Engine
	FWS Duty Officer	FWS Duty Officer	FWS Duty Officer
	Resource Advisor	Resource Advisor	Resource Advisor
	Interagency Helitack Crew in Lakeview	Interagency Helitack Crew in Lakeview	Interagency Helitack Crew in Lakeview
5	Engine	Engine	Engine

Is this table additive (i.e., for class 4, FMU I, would it be 1 more engine (2) or just 1?)

FWS Resource Advisors are as follows: Sheldon Refuge Manager, Sheldon Refuge Biologist, Sheldon Operations Specialist, Sheldon /Hart Project Leader. Notification procedures are managed by LIFC .

FIRE MANAGEMENT UNITS

Fire Management Units (FMUs) are areas on a refuge which have common wildland fire management objectives and strategies, are manageable units from a wildland fire standpoint, and can be based on natural or manmade fuel breaks. An FMU may coincide with a prescribed fire burn block or treatment area or unit, but this is not always the case. On smaller refuges the whole refuge may be treated as a single FMU.

Fire effects information for vegetation types, cultural resources, and wildlife species is located in Appendix O.

Three Fire Management Units (FMU) adequately associate the relationship that fire has to the Refuge. These FMUs were designed by differences in management objectives rather than vegetation type.

FMU I: Wilderness

Fire Management Unit I encompasses all proposed wilderness areas on the Refuge, as well as some intervening non-wilderness acres. These proposed wilderness areas are generally tablelands bordered by moderate to steep slopes. This unit is remote, rugged and natural in character. Elevations range from about 5500 feet to 7294 on Catnip Mountain. All aspects are included. FMU I contains 319,445 acres.

The vegetative makeup of FMU I includes native species: ponderosa pine, quaking aspen, willow, western juniper, mountain mahogany, mountain big sagebrush, bitterbrush, low sagebrush, rabbitbrush, wheatgrass, bluegrass, wild-rye, fescue, and squirreltail. Cheatgrass and Mediterranean sage are also present, but represent a small percentage of the total composition of species.

Wildland fire suppression strategies implemented in FMU I will protect the natural characteristics of the area. Incident Commanders can use the full range of suppression strategies but should primarily use natural and constructed firebreaks to contain fires to specific areas. Rock outcroppings and rocky drainages, roads, aerial retardant, and blackline can be used as containment area boundaries. No mechanized fireline or off-road driving will be allowed in this FMU, unless approved by the Refuge manager or included in the approved strategy of an Wildland Fire Situation Analysis and Delegation of Authority. Use of Minimum Impact Suppression Tactics (MIST) will produce minimal surface disturbance from fire suppression. Acceptable fire suppression resources include handcrews and all handtools, helicopters, vehicles on roads only, aerial retardants and foam. Utilization of indirect attack suppression tactics should be considered as a primary tactic in this FMU. Fires leaving the refuge will be aggressively suppressed to protect lands in other ownership. Strategy in this case will be control, using direct attack when safe. Fires leaving this FMU and entering another will fall under the strategy applicable to the new FMU. All firelines and associated surface disturbances will be rehabilitated as soon as possible following suppression activities.

Fire History in FMU I is not well documented, which is consistent for the rest of the Refuge. However, it has been postulated that natural fire occurrence has been infrequent since 1890, and subsequent fires reached only small size.

FMU I is considered suitable habitat for antelope. Most notable in this area are the California bighorn sheep, pronghorn, mule deer and sage grouse. The majority of wildlife diversity on the Refuge occurs here. Fire management strategies in this FMU are to improve habitat through prescribed fire and to suppress wildland fires. In addition, all fire management activities will be consistent with the wilderness characteristics of the area.

No mention of strategy
Fuels are generally represented by NFDRS model T and FBPS models 5 and 6, depending on the season of the fire event (Anderson, 1982). Live fuel moisture is an important fire behavior, intensity and severity indicator in this fuel complex. When live fuel moistures (LFM) are above 100%, fires generally require moderate to high wind speeds to grow rapidly. When LFM is below 100%, rapid rates of spread, spotting and flame lengths in excess of 20 feet can be anticipated. Important fire indicator species include the presence of large stands of young juniper, aspen suckers, rabbitbrush and cheatgrass. Juniper presence indicates fire exclusion (Gruell, 1994), aspen suckers may indicate fire occurrence (Ibid) and rabbit- brush and cheatgrass are both fire adapted species that quickly reoccupy burned areas.

Fire Behavior in FMU I is generally dependent on slope and wind speed and direction. The boundaries of the unit generally consist of slopes in excess of 70%, and exposure to wind can be either 100% exposed or 100% sheltered, depending on local and free air wind directions, which change quite frequently. Generally, rapid upslope, cross slope and downslope runs can be anticipated. Flame lengths in excess of 20 feet are frequently observed during upslope runs. Duration of fires is usually less than three burning periods, and more often than not limited to one burning period because of cold night time temperatures (35-40 ^{o}F) and little relative humidity recovery (35-50%). However, actively spreading fires can become quite large in this fuel type in one burning period. It is not possible to correlate fire size or occurrence on the Refuge to fire danger, severity or intensity indices because of the lack of fire history data available. However, refer to the fire history table 2, and note that the Badger Mountain Fire in 1994 reached a size of 7910 acres (the amount of acreage due to burnout is unknown). This fire occurred during a prolonged drought in the Great Basin Region and is also the largest wildland fire on record for the Refuge. Fires that occurred during the peak of the drought were suppressed at a small size (this could be due to countless reasons including effective initial attack, time and location of ignition). An analysis of this type is often subjective and provides little scientific basis from which to make decisions.

Late winter, spring and fall prescribed burning in this FMU have resulted in a range of fire effects that are acceptable and meet Refuge management objectives. The target species for burning (shrubs and western juniper) are easily killed by fire regardless of season. However, successful burns must be conducted during windows of opportunity that include such factors as live fuel moisture below 100%, fine fuel moisture 3-10%, dry bulb temperature greater than 35 ^{o}F and relative humidities below 30%.

The plants' physiological condition at the time of burning is really the single most important factor to consider when determining burning prescriptions. As a result, all prescribed burning in this FMU will be conducted during the phase of dormancy of perennial grasses, generally after summer cure and prior to green-up.

Late winter and spring burning windows of opportunity are short, inconsistent and easily missed. Late summer and fall burning windows are by far the longest and most consistent. The annual fire weather cycle for this FMU is extremely sensitive to drought conditions. During normal snow years, snow covers most of FMU I above elevations ranging from 5,000 to 6,000 feet. In cold drainages and northern aspects, snow drifts may remain until well into late summer.

At elevations of 5,000 feet and below, green up will begin February-March. Green up at higher elevations is dependent on the melt of snow cover and can be expected to occur during the early months of summer. Annual grasses are usually in the purple stage by July and begin to cure by the end of that month. Most grasses are cured and readily available as fuel by August.

Most sagebrush species come out of winter dormancy early in the spring and begin to put on new growth in April-May. Live fuel moistures are well above 100% during this period of time. Live fuel moisture generally drops below 100% in the first weeks of August, and continues to drop through the fall, until the plant reaches winter dormancy.

Drought conditions play a significant role in live fuel moisture and affect the amount of moisture the plants can accumulate and successfully store during the dry summer months. As such, curing of grasses and reduction in shrub live fuel moisture can be accelerated during drought summers or occur much earlier in the year.

The Keetch-Byram Drought Index (KBDI) is used to monitor drought conditions through the Weather Information Management System (WIMS), a commonly used tool of fire managers. Observed conditions indicate that a KBDI value of 200 or greater indicates drought conditions on the Refuge.

FMU II: Mining District

FMU II encompasses the Virgin Valley mining district, and is located in the east-central and northeastern corner of the Refuge. Elevations range from about 4000 to 5500 feet, generally the lowest of the Refuge. The area includes riparian areas associated with the Thousand Creek and Virgin Valley drainages. This FMU generally consists of moderate slopes of all aspects, valley bottoms and flats. Accordingly, fires in FMU II will be wind driven. Fuel model 3 will support rapid downwind runs and spotting is common. Flame lengths of 8-12 feet are frequently observed. These fast moving, low severity fires often leave the basal and rhizomatous sub-surface portions of the plants unburned. Fires can be expected to slow significantly when reaching the shrubby fuels surrounding the meadows. FMU II contains 63,126 acres.

The vegetative makeup of FMU II includes native species: willow, mountain mahogany, mountain big sagebrush, Wyoming big sagebrush, basin big sagebrush, bitterbrush, low sagebrush, rabbitbrush, greasewood, annual and perennial grasses, sedges, bulrushes, emergent grasses, saltgrass and saltbush. Cheatgrass is also present but represents a small percentage of vegetative cover.

Fire suppression strategy in this FMU will be characteristic of the values at risk. Incident Commanders should consider aggressive initial attack to protect structures and improvements as the preferred suppression strategy. This FMU includes the highest use areas of the refuge, most of the structures and improvements and much of the riparian habitat. Portions of this FMU have been heavily disturbed and roaded, associated with mining activities. There are no restrictions on heavy equipment use in this FMU. Utilization of direct attack suppression tactics should be considered as a primary tactic, when feasible and safe. Protection of life, structures and private property are the primary concerns. Fires leaving the Refuge will be aggressively suppressed to protect lands in other ownership. Fires leaving this FMU and entering another will fall under the strategy applicable to the new FMU. All firelines and associated surface disturbances will be rehabilitated following suppression activities.

FMU II is considered suitable habitat for bighorn sheep, pronghorn and mule deer. These lower elevations include most of the Refuge's big game winter range. Fire management strategies in this FMU are to improve habitat through prescribed fire and to suppress wildland fires.what about retaining winter range.

Fuels are generally represented by NFDRS model T and FBPS models 5 and 6, depending on the season of the fire event (Anderson, 1982). Live fuel moisture is an important fire behavior, intensity and severity indicator in this fuel complex. When live fuel moistures (LFM) are above 100%, fires generally require high wind speeds. When LFM is below 100%, rapid rates of spread, spotting and flame lengths in excess of ten feet can be anticipated. Important fire indicator species include rabbitbrush and cheatgrass. Rabbitbrush and cheatgrass are both fire adapted species that quickly reoccupy burned areas.

Fire Behavior in FMU II is dependent on slope, wind speed and direction. The boundaries of the unit consist of slopes in excess of 50%, and exposure to wind can vary depending on local and free air wind directions, which change quite frequently. Generally, rapid upslope, cross slope and downslope runs can be anticipated. Flame lengths in excess of 20 feet are frequently observed during upslope runs. Duration of fires is usually less than three burning periods, and more often than not limited to one burning period because of cold nighttime temperatures (35-40 ^{o}F) and relative humidity recovery (35-50%). However, actively spreading fires can become quite large in this fuel type in one burning period.

Fire effects in FMU II are similar to those in FMU I, except that because FMU II is lower in elevation, it will also be warmer and dryer. The annual fire weather cycle for this FMU is also sensitive to drought conditions. Prior to green up, shrubs and grasses are available fuels as a result of their dormant physiological conditions.

Green up will become noticeable as early as February in areas free of snow. Most grasses are cured and readily available as fuel by August. Generally, sagebrush species come out of winter dormancy early in spring and begin to put on new growth in March. Live fuel moistures are well above 100% during this period of time. Live fuel moisture generally drops below 100% in the first weeks of August, and continues to drop through the fall, until the plant reaches winter dormancy.

Drought conditions play a significant role in live fuel moistures and affect the amount of moisture the plants can accumulate and successfully store during the dry summer months. As such, curing of grasses and drop of shrub live fuel moisture can be accelerated during drought summers.

FMU III: All Other Lands
Fire Management Unit III consists of the higher elevation areas of the southwestern portion of the refuge (including Badger Mountain, at 7188 feet), the southern portion of the original Charles Sheldon Antelope

Refuge (including Bald Mountain at 7191 feet), the south end of Guano Valley/IXL Ranch (at about 5000 feet) and travel corridors and bottom lands throughout the Refuge. The FMU varies from nearly flat and rolling to steep and rugged terrain. Wet and dry meadows are associated with the flood plains of the two major perennial streams, Catnip Creek and Virgin Creek, and numerous annual streams. In addition, numerous natural playa lakes are also present. Many of the developed sites and structures on the Refuge are located in this FMU. One area of particular concern is the IXL Ranch-south Guano Valley. The wetlands in this area comprise the best waterfowl habitat on the Refuge. Prescribed burning in this particular area will be associated with maintaining high-quality wetland habitat. Cheat grass is common in the uplands surrounding the wetland, greatly increasing potential fire danger. FMU III contains 193,242 acres.

The vegetative makeup of FMU III includes a vast majority of low sage. Other species include basin big sage, bitterbrush, Wyoming big sage, mountain big sage, snowberry, rabbitbrush, and annual and perennial grasses. Emergent grasses, rushes and sedges, are associated with seasonally wet areas. Cheatgrass is also present, and is becoming more common every year.

Prescribed burning will continue to be implemented with the primary objective of reducing shrub cover and promotion of perennial herbaceous plants. Sites selected for burning will contain less than 10% composition of cheatgrass which is consistent with all FMU's.

FMU III is considered suitable habitat for the featured species of the Refuge. Most notable in this area are pronghorn antelope, mule deer and sage grouse. Fire management strategies in this FMU are to improve habitat through prescribed fire and to suppress wildland fires. In addition, all fire management activities will be consistent with the wilderness characteristics of the area.

Representative NFDRS fuel models for FMU III include T and A. FBPS fuel models include 1 and 5. Fire behavior in FMU III will be determined by topography, wind speed and relative humidity and fine fuel moisture relationships. Under severe burning conditions, fires can be expected to make fast runs through light, flashy fuels. Fire perimeters will be jagged and broken due to areas of discontinuous fuels. Cured cheatgrass in the fuel bed will be receptive to spotting, and could contribute to fire control problems. Historic Wildland fires in this area show that wind events often determine fire spread and behavior.

The annual fire weather cycle for FMU III is similar to FMU I.

Fire behavior in FMU III will be a combination of that for FMUs I and II, dependent on topography, local fuels, and local winds. This FMU has a topography range from sparsely vegetated lower elevation flats to steep, rocky terrain and higher elevation tables. In general, the fuel complex is consistent throughout the Refuge.

Incident Commanders can use the full range of suppression strategies but should primarily use natural and constructed breaks to contain fires to specific areas, depending on location, utilizing indirect attack when feasible and safe. In high resource value areas, private inholdings, near structures and improvements and near the State Highway 140 corridor, aggressive initial attack is the requisite strategy and direct attack the primary tactic when feasible and safe. The highway is the major travel route through this part of the state, and fires in this area can present major safety and political concerns. Fires leaving the Refuge will be aggressively suppressed to protect lands in other ownership. Fires leaving this FMU and entering another will fall under the strategy applicable to the new FMU.

Mechanized fireline will only be allowed when authorized by the Refuge manager. Use of light hand on the land tactics will be the preferred method. Acceptable suppression resources include; handcrews, vehicles on roads only, aerial retardants and foam. All firelines and associated surface disturbances will be rehabilitated following suppression activities.

Fuel Types

The fuel conditions on the Refuge are easily grouped into grass, shrub and timber associations. In addition, some slash exists as a result of mechanical treatments to juniper.

Fire behavior in grass types is strongly linked to fine dead fuel moisture (DFM) and wind speed. Fires generally occur after annuals and perennials have cured. High probability of ignition and rapid rates of spread can be expected when fine DFM is below 10%. Topography will also support rapid, intense runs upslope. Under these conditions, fires are generally not severe, leaving patches of unburned fuels. The moisture of extinction in this fuel type is 12-25% (Anderson).

Fires in the shrub group require moderate to high surface winds and low live fuel moisture (LFM) to promote fire spread. When LFM drops below 100%, high probability of ignition and rapid rates of spread can be expected, co-dependent on moderate to high surface wind speeds. Fire severity is dependent on fire residence time. Upslope runs can be expected. The moisture of extinction in these fuels is 20%. This fuel association represents most of the Refuge area.

Less than one percent of the Refuge is represented by the timber fuel type. Fires in this type are strongly influenced by duff moisture, ladder fuels, topography and foliar moisture. While flame lengths are not as great as other fuel types, fire severity is an important element of the fire management decision process due to the extended duff burnout time. Severe fires will torch trees, damage fragile root systems and may cause girdling and cat-facing along the tree bases. The moisture of extinction in these fuels is approximately 25%.

Juniper slash piles are a product of mechanical treatment and are mentioned in this discussion as related to fuels management.

Fires occurring on the Refuge may exhibit extreme fire behavior under favorable conditions. Dependent and independent crown fires may occur when fires are burning through dense stands of aerial fuels on slopes over 20% with upslope winds and unstable atmospheric conditions. Ladder fuels must also be present. This is often the case for juniper.

Fire whirls can be expected on flatter terrain when surface winds are over 10 mph and unstable atmospheric conditions are present. The period of time immediately following the breakdown of a stable atmosphere event is especially likely to promote fire whirls (Werth and Ochoa).

Spotting can be expected when low relative humidity, high winds and highly convective fire fronts coincide to produce firebrands and transport mechanisms. Probability of ignition above 50% will increase the possibility of spotting.

The Refuge falls into the Haines Lower Atmospheric Stability Index (LASI) high elevation regional zone. As a result, fires occurring during LASI value 5 or 6 forecasted days should be considered as having high potential for development of plume-dominated fire conditions.

Fire Behavior

Fire behavior in the shrub-grass models is extremely dynamic and dependent on live fuel moisture (LFM), mid-flame wind speed (MFW) and dead fine fuel moisture (DFM). Slope interacts within the prediction model similarly to wind (increasing slope will generally speed the model up). A live fuel moisture sampling project was initiated for the Refuge in 1993, refined in 1994 and will continue in the future to aid fire managers in critical fire suppression decisions.

The impacts of drought on this fuel complex directly affect the live and dead fuel moisture available in the plants. Drought years accelerate the physiological processes so that grasses and shrubs flower and enter dormancy earlier in the summer. The Keetch-Byram Drought Index (KBDI) is calculated daily through WIMS to provide drought indices. The KBDI value of >200 seems to indicate the trigger for drought conditions on the Refuge.

The key LFM value for shrubs in terms of a trigger to extreme fire behavior is 100%. Resulting fire behavior below 100% LFM can be extreme, including such activities as spotting and plume dominated fires. Shrubs with LFM above 100% will also burn, but require higher MFW speeds, greater slope and/or higher grass loadings in the understory.

SUPPRESSION TACTICS

Wildland fires will be suppressed in a prompt, safe, aggressive, and cost-effective manner to produce fast, efficient action with minimum damage to resources. Suppression involves a range of possible actions from initial attack to final suppression. All wildland fires will be suppressed.

Personnel and equipment must be efficiently organized to suppress fire effectively and safely. To this end, the FMO or Designee assumes the command function on major or multiple fire situations, setting priorities for the use of available resources and establishing a suppression organization.

The Incident Commander will designate all overhead positions on fires requiring extended attack.

For additional information regarding suppression procedures, see the Incident Management Team Transition Guidelines in the 6/1/200 release of the Fire Management Handbook (3.2-12).

Chris Farinetti FMO and Tom Romanello AFMO have been granted Delegation of Authority in advance to perform as Incident Commanders for Type III Incidents on Sheldon-Hart Mountain Complex for the U.S. Fish and Wildlife Service, effective January 1, 2001.

A sample Delegation of Authority is in Appendix F.

Suppression Conditions

The primary objective of fire suppression operations on the Refuge will be to reduce risk to human life and property. The full range of suppression strategies will be used to achieve this objective. In addition, long term disturbance such as mechanical fireline is to be avoided whenever possible as long as the primary objective can be met during fire suppression operations.

Minimum impact suppression tactics (MIST) will be used whenever feasible. This means that containment strategies will be implemented when conditions allow. Large expanses of natural fuel breaks and the Refuge road system will be used as containment boundaries. Exceptions include using mechanical equipment to protect structures and private property, and along boundaries to prevent fires from escaping onto neighboring lands.

All wildland fires will be appropriately suppressed. However, monitoring wildland fires (which are being suppressed) may be appropriate and potentially valuable in mapping and documenting the growth of the fire, measuring on-site weather and fuel loading to provide the fire staff with present and expected fire behavior and effects. Monitoring should include mapping, weather, site and fuel measurements and direct observation of fire characteristics such as flame length, rate of spread and fire intensity. Operational monitoring provides a check to insure that the fire remains in prescription and serves as a basis for evaluation and comparison of management actions in response to measured, changing fire conditions, and changes such as fuel conditions and species composition.

The use of heavy equipment may be authorized in a Wildland Fire Situation Analysis. Heavy equipment will not be used indiscriminately during fire management activities. However, heavy equipment and aerial retardants may be used during initial attack of wildland fires which threaten life and/or property. A good faith effort will be made to avoid impacts to cultural sites during these activities (see *Protection of Sensitive Resources*). Resource Advisors will be utilized as fully as possible to help in this effort.

The decision to use aerial retardants will be made by the Initial Attack Incident Commander. However, resources at risk must be considered in determining any suppression strategy.

Wildland Fire Situation Analysis
For fires that cannot be contained in one burning period, a WFSA must be prepared In the case of a wildland fire, the Incident Commander, in conjunction with the FMO, will prepare the WFSA. Approval of the WFSA resides with the Project Leader or Designee.

The purpose of the WFSA is to allow for a consideration of alternatives by which a fire may be controlled. Damages from the fire, suppression costs, safety, and the probable character of suppression actions are all important considerations.
Public safety will require coordination between all refuge staff and the IC. Notices should be posted to warn visitors, trails may be closed, traffic control will be necessary where smoke crosses roads, etc. Where wildland fires cross roads, the burned area adjacent to the road should be mopped up and dangerous snags felled. Every attempt will be made to utilize natural and constructed barriers, including changing fuel complexes, in the control of wildland fire. Rehabilitation efforts will concentrate on the damages done by suppression activities rather than on the burned area itself.

Aircraft Operations
As in all fire management activities, safety is a primary consideration. Qualified aviation personnel will be assigned to all flight operations. For larger more complex prescribed burns an Aviation Project Safety Plan. Aircraft may be used in all phases of fire management operations. All aircraft must be Office of Aircraft Services (OAS) or Forest Service approved. An OAS Aviation Policy Department Manual will be strictly adhered to for all Fire Management activities. In addition all Helicopter operations will follow the 1998 Interagency Helicopter Operations Guidelines IHOG. The Services 2000 Fire Management Handbook is a reference for additional aviation regulations and requirements.

All aviation resources are ordered and tracked by the LIFC Aviation desk. MTR's, flight following services and TFRs for larger incidents are all handled by dispatch.

Helicopters may be used for reconnaissance, bucket drops and transportation of personnel and equipment. Natural helispots and parking lots are readily available in most cases. Clearing for new helispots should be avoided where possible. Improved helispots will be rehabilitated following the fire.

Plan will be prepared by the Unit Aviation Officer/FMO.

REHABILITATION AND RESTORATION

Rehabilitation plans will be prepared for all fires where mechanized equipment has been used during suppression activities, vulnerability to erosion and water quality is increased, invasion of unacceptable plant species is likely and where protective structures such as fences have been damaged by suppression actions.

Rehabilitation site selection and planning will be accomplished through recommendations of staff biologists, Cultural Resources Staff, the Refuge Manager and the Fire Management Officer. Rehabilitation plans under $250,000 will be submitted to the Regional Director for approval. Plans over $250,000 require approval from Washington DC. Rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort and reducing the potential hazards caused by the fire. These actions may include:

1. Consultation with Regional archeologist and/or Cultural Resources surface inventory by qualified staff.
2. Backfill control lines, scarify, and seed.
3. Install water bars and construct drain dips on control lines to prevent erosion.
4. Install check dams to reduce erosion potential in drainages.
5. Restore natural ground contours.
6. Remove all flagging, equipment, and litter.
7. Completely restore camping areas and improved helispots.
8. Consider and plan more extensive rehabilitation or revegetation to restore sensitive impacted areas.
9. New guidance for FY 2001 allows for total restoration of the burned area. Please refer to the guidance in the 2000 Fire Management Handbook 3.2 17-19 for detailed information.

If emergency rehabilitation measures are needed or if rehabilitation is needed to reduce the effects of a wildland fire then the refuge can request appropriate funding through the Burned Area Emergency Rehabilitation (BAER) fund. EFR planning will begin with the Incident Commander and may continue by convening a multi-disciplinary team requested by the Refuge Manager. If revegetation or seeding is necessary, only native plant species will be used.

REQUIRED REPORTING

The DI-1202 Individual Fire Report has become an integral component of each fire event's fire history file. Each fire event (EVEN REALLY TINY FIRES? IS THERE A MINIMUM SIZE? file will contain at the minimum the DI-1202, RAWS observation data for the fire day, a 7.5 " quad map of the fire perimeter, general weather forecast for the fire day, fire weather and behavior data and an approved prescribed burn plan, when appropriate.

Daily situation reporting and ICS-209 Incident Status Report forms will be completed by Lakeview Interagency Fire Center dispatch personnel for all fire activity on the Refuge. This information will be forwarded to NWCC as required.

FIRE INVESTIGATION

Fire management or Law Enforcement personnel will attempt to locate and protect the probable point of origin and record pertinent information required to determine fire cause. They will be alert for possible evidence, protect the scene and report findings to the fireline supervisor.

Prompt and efficient investigation of all suspicious fires will be carried out. However, fire management personnel should not question suspects or pursue the fire investigation unless they are currently law enforcement commission qualified.

Personnel and services of other agencies may be utilized to investigate wildland fire arson or fire incidents involving structures. A resource order will be processed by LIFC Dispatch for a qualified fire investigator ASAP. Refer to 4.1-2 of the Fire Management Handbook (2000) for additional details.

PRESCRIBED FIRE ACTIVITIES

PRESCRIBED BURN PROGRAM OBJECTIVES

The Renewable Resources Management Plan for Sheldon NWR identifies the use of prescribed fire as a viable vegetation management technique.

The prescribed treatment of areas by vegetation type is designed to promote wildlife habitat richness by diversifying successional stages of all habitat types commonly found on the Refuge. It should be noted that wildland fire acres will also be counted towards acres treated with fire, by vegetation type. Generally, the minimum treatment objective for prescribed fire will be a 50% reduction of target species within a prescribed burn unit, emphasizing mosaic pattern burning.

In addition, a hazard fuel reduction objective is realized during implementation of these projects. When dense, woody fuels are burned on the Refuge, they are replaced by lighter or younger fuels which promote less severe subsequent fires and are easier to suppress. All prescribed burn plans that are written and executed on the Refuge will have a hazard fuel reduction objective.

Specific management needs for the refuge as a whole and for specific areas will be determined annually. Specific burn objectives, fire frequency rotation, firing methodology, and prescriptions will vary from year to year. Burn plans will be updated to reflect any variations. The Sheldon/Hart Mountain Complex Project Leader or Approved designee will approve prescribed fire plans.

Prescribed fires involve the use of fire as a tool to achieve management objectives. Research burning may also be conducted when determined to be necessary for accomplishment of research project objectives. Actions included in the prescribed burn program include: the selection and prioritization of prescribed burns to be carried out during the year, prescribed burn plans, burn prescriptions, burn operations, documentation and reporting, and burn critiques.

Complexity Analysis from FIREBASE is used to determine fire complexity. The refuge reserves the option to utilize an interagency team approach for complex burns carried out on the boundaries and close to developed areas or burns of large acreage. The most highly qualified and experienced personnel in the regional interagency community could be requested to serve on this team.

FIRE MANAGEMENT STRATEGIES

The general plan for prescribed fire implementation is to annually select burn sites by vegetation type. The sites must be defensible in terms of natural or artificial barriers, or control lines or specific environmental control conditions (eg:high relative humidity recovery and low temperatures at night) must be identified.

Prescribed fire will be used to reduce hazard fuel accumulation, restore fire to fire-dependent ecological communities, improve wildlife habitat, and to maintain cultural/ historic scenes where appropriate. All prescribed fire activity will comply with applicable Federal, state, and local air quality laws and regulations.

All prescribed fire projects will have a burn plan approved by the Sheldon-Hart Mtn. Complex Project Leader. Each burn plan will be prepared using a systematic decision-making process, and contain measurable objectives, predetermined prescriptions, and using an approved environmental compliance document. Appropriate NEPA documentation (Appendix C) exists for this Fire Management Plan. Therefore, additional NEPA documentation will be necessary only for prescribed fire projects not meeting the criteria outlined in this Plan.

Prescribed Fire Burn Plans must include components such as a GO/ No-Go Checklist, contingency actions to be taken in the event the prescription is exceeded, and the need for alerting neighbors and appropriate public officials to the timing and the planing of the burn. A burn plan format meeting all required needs is located in Appendix M.
Fire monitoring will be used to evaluate the degree to which burn objectives are accomplished. Monitoring can assist managers in documenting success in achieving overall programmatic objectives and limiting occurrence of undesired effects.

The prescribed fire implementation strategy at the Refuge has been controversial with ranchers and local citizens, and is viewed with some skepticism. A strong fire effects monitoring program will be the only viable mechanism available to the Refuge to defend landscape level prescribed fire.

The complexity of the prescribed fire program at the Refuge generally falls within the normal to high range of scores in the Prescribed Fire Complexity Analysis adopted by the FWS.

No new prescribed fire will be initiated under national and regional preparedness level V. Prescribed burns that are ongoing when preparedness levels move to level V will be declared wildland fires, if actively burning, and suppressed accordingly. In addition, local fire activity will also be analyzed. No prescribed fire will be initiated if LIFC is supporting one or more project fires on the Fremont National Forest or Lakeview District BLM. Initial attack actions are more random, require fewer resources and may not impact Refuge prescribed fire implementation.

Any number of active fires may be present in all of the FMUs on the Refuge at one time as long as sufficient resources are on site to manage the fires. Fuels and terrain conditions on the Refuge promote this type of prescribed fire activity. The extent of natural barriers and sparse fuels on the Refuge precludes the need to limit numbers of active fires during prescribed fire implementation as long as sufficient resources are on site to staff them.

Potential impacts of this plan have been examined in great detail in the Sheldon NWR Environmental Assessment. The most controversial socio-economic impact of the prescribed actions of this plan are the exclusion of cattle grazing on the Refuge and the use of fire as the subsequent vegetation management tool.

Application of prescribed fire may impact big game hunters during fall hunting seasons which coincide with fall burning. Every effort will be made to protect the once-in-a-lifetime California big horn sheep quality hunt, and during this period in September, burning will focus on other habitat types on the Refuge. For other types of big game hunting, prescribed fire signs and public notification through local press will inform the public on planned management activities.

Pre-burn documentation requirements, including NEPA and public review have been completed in the Sheldon NWR Fire Management Plan EA (Appendix C).

PRESCRIBED FIRE PLANNING

Prescribed fire planning is initiated by the Refuge Manager, Biologist, FMO, and PFS. The Manager and Biologist identify sites and determine objectives, monitoring strategy and intensity level, and the FMO and PFS determines whether sites are suitable and defensible for burning. The PFS or Burn Boss develops the prescribed burn plan. The burn plan should be reviewed by the Refuge Manager, biologist, FMO/AFMO, PFS, and Burn Boss. A Request for Cultural Resource Compliance (Appendix R) must be submitted prior to completion of a burn.

A prescribed burn plan will then be developed that addresses all aspects of ignition and control and prescribes conditions that will meet biological objectives as well as support managing the resulting fire within predetermined boundaries. Employee and public safety is central to the prescribed burn plan.

Execution of the prescribed fire plan will involve only qualified individuals on the burn site. A qualified Burn Boss I or II will lead implementation, and may have a trainee assigned as well. Prescribed fires implemented on the Refuge fall within the "normal" and occasionally “high” complexity score range, maintenance of Burn Boss I qualification is necessary. In addition, the formal positions of Task Force Leader and Ignition Specialist are required. Suitable training and qualification levels for the Refuge is: one Burn Boss I, one Burn Boss II, one Ignition Specialist, and two Task Force Leaders. In addition, a Fire Weather and Behavior Monitor will be used routinely to make fire weather and behavior observations during burn implementation. Each prescribed burn unit has a plan and each Burn Plan has a complexity rating which aids in determining qualification requirements.

The objectives for each prescribed burn unit are consistent with the overall objectives of implementing prescribed fire on the Refuge. The defined seasons for prescribed fire are opportunistic and generally encompass that part of the year when preferred species are in dormancy, while target species are vulnerable to fire. The burning season is therefore established based on the physical condition of the plants rather than a calendar season. Generally, this will occur beginning in late summer and carry through spring prior to forb and grass green up. Drought winters also offer a window of opportunity.

Annual Prescribed Fire Activities
The FMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary, personnel utilized, and fire effects.

Preparation for prescribed fire operations includes the following:

January	Proposed burn sites submitted to FMO for evaluation.
April-June	FMO/ PFS visits burn sites and makes recommendations to Refuge Manager.
	Pre-burn monitoring completed as scheduled.
	FMO distributes annual burn schedule to Refuge Staff.
	Post-burn growing season monitoring implemented.
July	Post-burn monitoring completed as scheduled.
August-September	Late summer burning begins.
October-November	Fall burning.
December-February	Winter burning.
March-April	Spring burning.
January- December	FMO/AFMO/PFS complete burn plans for the complex.

Prescribed Burn Plan
A prescribed burn plan will then be developed that addresses all aspects of ignition and control and prescribes conditions that will meet biological objectives as well as support managing the resulting fire within predetermined boundaries. The fire staff-person responsible for developing the burn plan will work closely with Refuge biological staff in all aspects of the planning process. Burn plans are on file and can serve as an example for visiting FMO/PFS. Employee and public safety is central to all PF burn plans.

The objectives for each prescribed burn unit need to be consistent with the overall objectives of implementing PF on the Refuge. The defined seasons for PF are opportunistic and generally encompass that part of the year when preferred species are in dormancy, while target species are vulnerable to fire. The burning season is therefore established based on the physical condition of the plants rather than a calendar season. Generally, this will occur begin in late summer and carry through spring prior to forb and grass green up. Drought winters also offer a window of opportunity.

After proposed projects have gone through a process designed to eliminate potential projects lacking merit, the Refuge Manager/Biologist forwards the proposal to the Complex fire staff. The FMO, AFMO, PFS, and/or Burn boss will conduct a field reconnaissance of the proposed burn location to discuss objectives, special concerns, and gather all necessary information to write the burn plan. After completing the reconnaissance, the FMO will designate a lead who will write the prescribed burn plan.

All prescribed fires will have approved prescribed burn plans. The prescribed burn plan is a site specific action plan describing the purpose, objectives, prescription, and operational procedures needed to prepare and safely conduct the burn. The treatment area, objectives, constraints, and alternatives will be clearly outlined. No burn will be ignited unless all prescriptions of the plan are met and the appropriate management signatures have been affixed to the Go/No-Go checklist. Fires not within those parameters will be suppressed. Prescribed Burn Plans will follow the format contained in Appendix M. The term “burn unit” refers to a specific tract of land to which a prescribed burn plan applies.

Strategies and Personnel
Execution of prescribed burns will only be executed by qualified personnel. The Prescribed Burn Boss will fill all required positions to conduct the burn with qualified personnel including all Trainee positions. All personnel listed in the burn plan must be available for the duration of the burn or the burn will not be initiated.

Weather and fuel moisture conditions must be monitored closely in planned burn units to determine when the prescription criteria are met. A belt weather kit may also be utilized to augment monitoring. Fuel moisture samples of 10- and 100-hour down and dead logs (where applicable) and of live plants may be monitored each week and percent moisture contents figured to help determine when the prescription criteria are met. Burn permits are required for burning on the Refuge at this time.

When all prescription criteria are within the acceptable range, the Prescribed Burn Boss will select an ignition date based on current and predicted weather forecasts. A thorough briefing will be given by the Prescribed Burn Boss and specific assignments and placement of personnel will be discussed. An updated spot weather forecast will be obtained on the day of ignition and all prescription elements will be rechecked to determine if all elements are still within the approved ranges. If all prescription elements are met, a test fire will be ignited to determine on-site fire behavior conditions as affected by current weather. If conditions are not satisfactory, the test fire will be suppressed and the burn will be rescheduled. If conditions are satisfactory the burn will continue as planned.

If a prescribed burn escapes the predetermined burn area, all further ignition will be halted except as needed for suppression efforts. Suppression efforts will be initiated, as discussed in the preburn briefing. The FMO will be notified immediately of any control actions on a prescribed burn. If the burn exceeds the initial suppression efforts, the burn will be declared a wildland fire and suppressed using guidelines established in this plan. A WFSA will be completed and additional personnel and resources ordered as determined by the Incident Commander. If the fire continues to burn out of control, additional resources will be called from the local cooperating agencies via the servicing dispatch. A management overhead team may be requested to assume command of the fire.

Late summer and fall burning generally is more complex in terms of holding and threat of escaped fires. As such, the normal complexity organization will be used during implementation. Winter and spring burning is much cooler, as days are shorter, temperatures are lower and relative humidities are higher. As a result a typical winter burn organization will usually be comprised of three to five people.

Prior to ignition of any prescribed burn, LIFC will contact all local cooperators in the burn area to inform them of the Refuge's burning plans. Signs will be posted along main roads to inform the public of smoke hazards.

The complexity of the PF program at the Refuge generally falls within the normal range with an occasional complex score using the 1992 Prescribed Fire Complexity Rating System. Most fires will rate within the following point categories of the analysis:

Potential for escape	1-9
Values at risk	1-7
Fuels/fire behavior	5-7
Fire duration	1-7
Smoke/Air quality	1-5
Ignition method	1-9
Management team size	1-9
Treatment objectives	1-9

The total ranges from 70 to 382 points. The break between normal and complex prescribed burns is 281 points. The occasional use of multiple ignition sources; Primo Mark III, Terra Torch will drive the score up, but the project may remain in the normal score range if all other complexity elements remain in the normal range.

No new PF will be initiated under national and regional preparedness level V. Prescribed fires that are ongoing when preparedness levels move to level V will be declared wildland fires, if actively burning, and suppressed accordingly. In addition, local fire activity will also be analyzed. No PF will be initiated if LIFC is supporting one or more project fires on the Fremont National Forest or Lakeview District BLM. Initial attack actions are more random, require fewer resources and will not impact Refuge PF implementation.

Any number of active fires may be present in all of the FMUs on the Refuge at one time as long as sufficient resources are on site to manage the fires. Fuels and terrain conditions on the Refuge promote this type of PF activity. The extent of natural barriers and sparse fuels on the Refuge precludes the need to limit numbers of active fires during PF implementation as long as sufficient resources are on site to staff them.

Pre-burn documentation requirements, including NEPA and public review have been completed in the Refuge EIS and Comprehensive Management Plan.

Monitoring and Evaluation
Monitoring of prescribed fires is intended to provide information for quantifying and predicting fire behavior and its ecological effects on refuge resources while building a historical record. Monitoring measures the parameters common to all fires: fuels, topography, weather and fire behavior. In addition,

ecological changes such as species composition and structural changes will be monitored after a fire. This information will be very useful in fine-tuning the prescribed burn program.

All fires may be monitored regardless of size. The FMO will establish specific fire information guidelines for each fire to update intelligence about the fire. Highest priority for monitoring will be assigned to large fires or fires which threaten to leave the refuge.

The monitoring plan (Appendix N) identifies two fire effects monitoring strategies, at two levels of monitoring intensity. The two strategies are conventional and adaptive. The conventional strategy involves collecting all pre-burn monitoring data prior to ignition. The adaptive strategy consists of placing plots after the fire event. Sagebrush quite often will not support a "clean" burn, leaving unburned fingers and islands**.** These unburned areas will be used as comparison sites for burned and unburned, and the adaptive strategy overall will preclude missing data because random sites did not burn.

Fire effects monitoring intensity level I is the establishment of permanent photo points. Level I is the least intense monitoring at the Refuge. Level II includes all level I activities, as well as inventory of vegetation before and after burning.

Live fuel moisture will be monitored following the guidelines in Appendix Q.

Required Reports

All prescribed burn forms will be completed as outlined by the Prescribed Burn Boss under the guidance of the PFS. A monitor will be assigned to collect all predetermined information and complete all necessary forms prior to, during, and after the burn. All records will be archived in the refuge's fire records for future use and reference.

The Prescribed Burn Boss will prepare a final report on the prescribed burn. Minimum project documentation includes a DI-1202 Individual Fire Report, a map of the completed project, fire weather and behavior observation forms, the prescribed burn plan, pre-burn and post-burn photos and the spot weather forecast for the project site. The project map and observed burning conditions will be digitized into the complex geographic information system (GIS) as time and expertise permits. This fire history data will be used in the future to refine burning prescriptions based on actual conditions and resulting fire effects.

A post fire critique should be held for each burn completed. The critique should be held as soon as possible after the burn has been completed. At a minimum, the following elements should be discussed:

1. How well were the basic burn objectives/resource objectives met?
2. Were there any safety related concerns? If so, how can these be mitigated in the future?
3. What prescription related information was gathered in order to refine future prescriptions?

Any Wildland PF will be reviewed in accordance with the Fire Management Preparedness and Planning Handbook. The Regional Fire Management Coordinator may lead a review team that examines the planning and implementation of the Wildland PF, and makes recommendations to the Refuge in terms of how to avoid escapes in the future.

AIR QUALITY / SMOKE MANAGEMENT GUIDELINES

Burn permits are required for all prescribed burning operations (Appendix D). The Nevada Division of Environmental Protection NDEP contact person is Curtis Payne (775) 687-4670. Additional information can be found on the NDEP Website http://www..state.nv.us/ndep/bao/smoke2.htm .

The Nevada Division of Environmental Protection, Air Quality Board (for that portion of the Refuge lying within Humboldt County), and the Washoe County District Health Department, Air Quality Management Division (for the western portion of the Refuge lying within Washoe County) are responsible for managing air quality. The following Class I airsheds exist within 225 kilometers of the Refuge; the Gearhart Wilderness Area, 80 miles northwest, and Lava Beds National Monument, 125 miles due west. Other Class II sensitive smoke targets include the settlement of Adel, OR, 25 miles northwest, Cedarville, California, 45 miles west-southwest, Denio, Nevada, 14 miles east, Lakeview, OR, 60 miles west, U.S. Highway 395, 60 miles northwest, State Highway 140, traversing the northern portion of the Refuge, and Burns, OR, 90 miles north-northwest. The use of southerly, westerly and northerly transport winds, in addition to the overall distance from targets, will minimize smoke impacts to these areas. Transport winds from these directions would avoid smoke intrusions in Adel, 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.

Campgrounds, trails and roads are all subject to smoke intrusion. Signs along travel corridors will be posted during burning operations to advise individuals of burning operations.

Drift smoke from the Refuge is not anticipated to create significant impacts when combining with drift smoke from forestry management burning in other parts of the state. Average burn acres per day will be 500 acres or less for 15 days per year when The Refuge experiences frequent public recreational use. 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 originating from the Refuge.

The State of Nevada has adopted a new Smoke management Plan (SMP) for 2001. It requires open burn variance permits for all burns on federal lands. The four federal agencies; USFWS, USFS, USPS and BLM will each pay an annual fee of $5,000.00 to the Nevada Division of Environmental Protection for emissions. The SMP and MOU are on file in the FMO’s filing system under Smoke Management Nevada (Appendix D).

FIRE RESEARCH

The Refuge supports fire related research, as budget and staff time allow. Currently, Oregon State University and the Refuge are collecting data on ungulate diet changes in response to prescribed burning. A fire history research project is also underway at the Refuge, where samples of burn scars have been collected from aspen and Western Juniper to reconstruct fire history before European settlement. The Pacific Northwest Research Station, Seattle, Washington has included Sheldon RX burn units into an ongoing Fuels Consumption research project funded by the Joint Fire Science Program.

A variety of fire related research opportunities are present at the Refuge, and will be explored as funding and staff time allows.

SAFETY

Safety is of primary concern during the planning and execution of the fire management program. All documents associated with fire, incident action plans, wildland fire situation analysis, prescribed burn plans, and project plans will address public and employee safety. The potential effects of all projects on public and employee safety will be considered.

Safety briefings will be conducted on all fire management projects. Monthly safety briefings are held at the Refuge. All vehicles and mechanical equipment will be properly maintained. All fire safety orders, situations that shout watchout, precautions and guidelines will be followed without exception. Lead Technicians, the Assistant Fire Management Officer and Fire Management Officer will ensure that personal protective and safety equipment is used and is in good condition.

The following specific areas will be considered on all fire management projects:

1. Potential for dehydration, heat exhaustion and heat stroke.
2. Impacts of smoke and associated gasses on employees working on projects.
3. Poisonous snakes in project area.
4. Shift length, fatigue and effects on employees.
5. Irregular terrain.
6. Potential for aviation-related accidents on projects.
7. Effects of smoke on employees, visitors, nearby towns, roadways and airports.
8. Potential of hazards to hikers, hunters and other backcountry users during wildland fires and prescribed burns.
9. Hazards of working around equipment and roadways in smoke.
10. Hazards from firing devices and flammable materials.

All significant fire related accidents will be reviewed by the Regional Safety Officer.

PUBLIC INFORMATION AND EDUCATION

The Refuge has a public outreach program to inform the public about fire activities. This program includes speaking to private interest groups, non-profit local organizations and county meetings to educate the public on the implementation progress of the Refuge Renewable Natural Resources Management Plan.

In addition, the local press is used to distribute this information on a wider scale. A press release will be completed prior to each prescribed fire implementation period that describes the general areas to be treated and treatment objectives.

Tours of the treatment sites may be employed and are designed to illustrate the long term change that the prescribed fire program is effecting on ground. While the tours are often the most powerful demonstration of how fire changes the structure of the vegetation communities of the Refuge, the most common participants are already proponents of the Refuge program, rather than the opponents, who would benefit the greatest from site visits.

A variety of visitor contacts are frequently made during prescribed fire implementation. These contacts are extremely important, and special emphasis is made to ensure that visitors understand what the Refuge is doing with fire. Quite often, the initial response from the uninformed visitor is hostile, focusing on smoke or wildlife mortality. However, after a positive and informative contact with a Refuge representative, the visitor at least understands the objectives of the prescribed fire.

FIRE CRITIQUES AND ANNUAL PLAN REVIEW

INITIAL ATTACK

The participants will discuss the incident after it is controlled and mopped up during a "tailgate session". If any problems, comments and suggestions surface, these will be communicated to the FMO.

EXTENDED ATTACK

All extended attack incidents will receive an in-Refuge review consistent with their complexity. Any significant comments will be included in the fire report. Multi-jurisdictional incidents will be reviewed by participants from involved agencies.

INCIDENT MANAGEMENT TEAMS

The IMT will meet and close out with the Refuge Line Officer and FMO to review the incident and close out all unfinished business. If regional or national review is warranted, it will be requested.

PRESCRIBED FIRES

Each prescribed fire will be reviewed by participants.

ANNUAL FIRE SUMMARY REPORT

The FMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary (prescribed burns and wildland fires), personnel utilized, and fire effects.

ANNUAL FIRE MANAGEMENT PLAN REVIEW

The Fire Management Plan will be reviewed annually. Necessary updates or changes will be accomplished prior to the next fire season. Any additions, deletions, or changes will be reviewed by the Refuge Manager to determine if such alterations warrant a re-approval of the plan.

The fire management plan will be reviewed annually, and updated as needed. Changes will be distributed as appendices.

CONSULTATION AND COORDINATION

The following agencies, organizations and/or individuals were consulted in preparing this plan.

Jenny Barnett, Biologist, Sheldon NWR, USFWS, Lakeview, OR.

Roddy Baumann, Prescribed Fire Specialist, Pacific Region, USFWS, Portland, OR.

Steve Clay, Deputy Project Leader, Sheldon-Hart NWRC, Lakeview, OR.

Chris Farinetti, FMO, Nevada Zone, USFWS, Lakeview, OR.

Andy Goheen, PFS, Nevada Zone, USFWS, Lakeview , OR.

Amanda McAdams, Fire Planner, Pacific Region, USFWS, Portland, OR.

Tom Romanello, AFMO, Nevada Zone, USFWS, Lakeview , OR.

Mark Strong, Refuge Manager, Sheldon NWR, Lakeview, OR.

Don Voros, Refuge Supervisor, Pacific Region, USFWS, Portland, OR.

APPENDICES

APPENDIX A: REFERENCES CITED

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APPENDIX B: DEFINITIONS

Agency Administrator. The appropriate level manager having organizational responsibility for management of an administrative unit. May include Director, State Director, District Manager or Field Manager (BLM); Director, Regional Director, Complex Manager or Project Leader (FWS); Director, Regional Director, Park Superintendent, or Unit Manager (NPS), or Director, Office of Trust Responsibility, Area Director, or Superintendent (BIA).

Appropriate Management Action. Specific actions taken to implement a management strategy.

Appropriate Management Response. Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate Management Strategy. A plan or direction selected by an agency administrator which guide wildland fire management actions intended to meet protection and fire use objectives.

Appropriate Suppression. Selecting and implementing a prudent suppression option to avoid unacceptable impacts and provide for cost-effective action.

Bureau. Bureaus, offices or services of the Department.

Class of Fire (as to size of wildland fires):
Class A - ¼ acre or less.
Class B - more than ¼ but less than 10 acres.
Class C - 10 acres to 100 acres.
Class D - 100 to 300 acres.
Class E - 300 to 1,000 acres.
Class F - 1,000 to 5,000 acres.
Class G - 5,000 acres or more.

Emergency Fire Rehabilitation/Burned Area Emergency Rehabilitation (EFR/BAER). Emergency actions taken during or after wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire. The scope of EFR/BAER projects are unplanned and unpredictable requiring funding on short notice.

Energy Release Component (ERC) A number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. It is generated by the National Fire Danger Rating System, a computer model of fire weather and its effect on fuels. The ERC incorporates thousand hour dead fuel moistures and live fuel moistures; day to day variations are caused by changes in the moisture content of the various fuel classes. The ERC is derived from predictions of (1) the rate of heat release per unit area during flaming combustion and (2) the duration of flaming.

Extended attack. A fire on which initial attack forces are reinforced by additional forces.

Fire Suppression Activity Damage. The damage to lands, resources and facilities directly attributable to the fire suppression effort or activities, including: dozer lines, camps and staging areas, facilities (fences, buildings, bridges, etc.), handlines, and roads.

Fire effects. Any consequences to the vegetation or the environment resulting from fire, whether neutral, detrimental, or beneficial.

Fire intensity. The amount of heat produced by a fire. Usually compared by reference to the length of the flames.

Fire management. All activities related to the prudent management of people and equipment to prevent or suppress wildland fire and to use fire under prescribed conditions to achieve land and resource management objectives.

Fire Management Plan. A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational procedures such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

Fire prescription. A written direction for the use of fire to treat a specific piece of land, including limits and conditions of temperature, humidity, wind direction and speed, fuel moisture, soil moisture, etc., under which a fire will be allowed to burn, generally expressed as acceptable range of the various fire-related indices, and the limit of the area to be burned.

Fuels. Materials that are burned in a fire; primarily grass, surface litter, duff, logs, stumps, brush, foliage, and live trees.

Fuel loadings. Amount of burnable fuel on a site, usually given as tons/acre.

Hazard fuels. Those vegetative fuels which, when ignited, threaten public safety, structures and facilities, cultural resources, natural resources, natural processes, or to permit the spread of wildland fires across administrative boundaries except as authorized by agreement.

Initial Attack. An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Maintenance burn. A fire set by agency personnel to remove debris; i.e., leaves from drainage ditches or cuttings from tree pruning. Such a fire does not have a resource management objective.

Natural fire. A fire of natural origin, caused by lightning or volcanic activity.

NFDRS Fuel Model. One of 20 mathematical models used by the National Fire Danger Rating System to predict fire danger. The models were developed by the US Forest Service and are general in nature rather than site specific.

NFFL Fuel Model. One of 13 mathematical models used to predict fire behavior within the conditions of their validity. The models were developed by US Forest Service personnel at the Northern Forest Fire Laboratory, Missoula, Montana.

Prescription. Measurable criteria which guide selection of appropriate management response and actions. Prescription criteria may include safety, public health, environmental, geographic, administrative, social, or legal considerations.

Prescribed Fire. A fire ignited by agency personnel in accord with an approved plan and under prescribed conditions, designed to achieve measurable resource management objectives. Such a fire is designed to produce the intensities and rates of spread needed to achieve one or more planned benefits to natural resources as defined in objectives. Its purpose is to employ fire scientifically to realize maximize net benefits at minimum impact and acceptable cost. A written, approved prescribed fire plan must exist and NEPA requirements must be met prior to ignition. NEPA requirements can be met at the land use or fire management planning level.

Preparedness. Actions taken seasonally in preparation to suppress wildland fires, consisting of hiring and training personnel, making ready vehicles, equipment, and facilities, acquiring supplies, and updating agreements and contracts.

Prevention Activities directed at reducing the number or the intensity of fires that occur, primarily by reducing the risk of human-caused fires.

Rehabilitation (1) Actions to limit the adverse effects of suppression on soils, watershed, or other values, or (2) actions to mitigate adverse effects of a wildland fire on the vegetation-soil complex, watershed, and other damages.

Suppression. A management action intended to protect identified values from a fire, extinguish a fire, or alter a fire's direction of spread.

Unplanned ignition. A natural fire that is permitted to burn under specific conditions, in certain locations, to achieve defined resource objectives.

Wildland fire. An unwanted wildland fire.

Wildland Fire. Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Situation Analysis (WFSA). A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economical, political, and resource management objectives as selection criteria.

Wildland/urban interface fire A wildland fire that threatens or involves structures.

APPENDIX C: COMPLIANCE

Threatened or Endangered Species and Section 7 Consultation

No federally listed threatened or endangered animal or plant species are known to be permanent residents of the Refuge. Bald eagles and peregrine falcons frequent the Refuge as transitory species. As a result, no Section 7 Consultation is necessary. The following analysis examines animal and plant species which occur on the Refuge that warrant consideration.

The U.S. Fish and Wildlife Service is charged with administration of the Endangered Species Act of 1973. 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.

The scope of this analysis deals only with wildlife species classified in one 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;

Eleven of 302 wildlife species are classified as sensitive (Table C-1). Seven species breed on the Refuge and the remainder are classified as transients and winter residents (Table C-2). Five are considered fairly common, and six are considered uncommon.

Analysis of species richness disclosed trends consistent with the larger analysis done for 302 vertebrates. 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 five sensitive species that breed or feed in uplands currently dominated by shrubs and juniper.

In wetlands, management directed to reduce erosion of stream channels, restore water tables, and increase the distribution of wetland vegetation (e.g., late and very late progression stages) will increase habitat suitability for 9 of 11 sensitive species that depend on healthy riparian areas for breeding or feeding purposes. Two 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 C-1. Annotated list of sensitive species of vertebrate wildlife at Sheldon NWR. Unreferenced comments based on analysis of Refuge records.

Species	Status[1]	Comments
Alvord chub	C2/V	Occurs in Virgin Creek. Population fluctuates in response to

		availability of perennial water supply in low gradient reaches.
Sheldon tui chub	C2/C	Occurs Swan Creek, Horse Creek and Fish Creek. Population limited by absence of sufficient water supply during drought periods.
White-faced ibis	C2/V	Refuge wetlands used for feeding purposes.
Bald Eagle	LT/LT	Small numbers associated mainly with low gradient wetlands during spring and fall migration, particularly Bog Hot Valley.
Ferruginous hawk	C2/C	The one known nest was active in 1992.
Northern goshawk	C2/C	One nest was located on Badger Mountain in 1984, the first found on the Refuge.
Peregrine falcon	LE/LE	Small numbers occur in association with alluvial floodplains and the habitat of the escarpment during winter.
Black tern	C2/-	Possibly may nest in small numbers at Swan Lake during wet years.
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/-	Four specimens were trapped on the kRefuge in 1993. Probably occurs regularly in communities composed of mesic shrubs and riparian wetlands.
Pygmy rabbit	C2/V	Thought to be widespread, however, no systematic surveys have been conducted. 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.

1 Federal designations include legally endangered (LE); legally threatened (LT); category 2 candidate for threatened and endangered listing (C2); and no designation (-).

Table C-2. Classification of sensitive species of vertebrate wildlife by status, breeding-feeding assemblage, range, abundance by season, and versatility index, Sheldon NWR.

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Permanent residents									
Alvord chub	1-1	1	f	f	f	f	NE[2]		
Sheldon tui chub	1-1	1	u	u	u	u	10	10	20
Preble's shrew	9-2	1	r	r	r	r	8	19	27
Pygmy rabbit	4-2	4	c	c	c	u	10	26	36
Loggerhead shrike	5-8	2	f	f	u	r	25	43	4
Summer residents									
Ferruginous hawk	5-2	5	u	u	u	-	8	21	29
Northern goshawk	5-10	2	r	x	r	r	8	24	32
Transients									
White-faced ibis	0-1	1	fc	u	r	-	0	9	0
Black tern	0-1	7	r	x	r	-	0	10	0
Bald eagle	0-7	7	r	-	r	-	0	15	0
Peregrine falcon	0-3	7	x	-	x	-	0	17	0

1 Refer to legend for description of codes (Appendix K).
2 Not estimated, incomplete analysis.

Environmental Assessment

APPENDIX D: AIR QUALITY BURN PERMIT

STATE of NEVADA - AIR QUALITY

Request for Authorization for

OPEN BURN VARIANCE

Name: ______________________________

Street Address: ______________________________

Mailing Address: ______________________________

City, State, Zip Code: ______________________________

Phone: ______________________________

Fax: ______________________________

Location of Burn: ______________________________
(Be specific)

Acres to be burned: ______________________________

Date(s) of actual Burn: ______________________________

Duration (hours) of Open Burn: ______________________________

Reason for Open Burn: ______________________________
(For example: fire training, debris abatement, weed abatement, etc.

Material to be burned: ______________________________
(For example: wood, weeds, paper, etc.)

Volume of materials burned: ______________________________
(pounds, cubic feet, etc.)

Signature of Applicant: ______________________________ **Date:** ____________

(Applicant hereby certifies that alternative smoke management technics were considered and burning has been deemed most efficient and effective method to utilize while maintaining compliance with the requirements of the Clean Air Act.)

Return application to:

Nevada Division of Environmental Protection
Bureau of Air Quality
333 W. Nye Ln.
Carson City, NV 89706-0851

(702) 687-4670
FAX (702) 687-6396

To be completed by the Bureau of Air Quality

No. 99-

AUTHORIZATION

Under the provisions of Nevada Administrative Code 445B.381, permission is hereby granted to the applicant to conduct open burning as described above. This authorization is limited by the following conditions: 1) All open burning must be attended and controlled at all times to eliminate fire hazards (per NAC 445B.381.3); and, 2) This authorization is in effect from through This authorization does *not* prohibit in any way the extinguishing of any fire by local fire department if a fire hazard exists or develops during the course of burning. This authorization is subject to revocation at the discretion of the State Bureau of Air Quality, County Health Officer or Fire Marshal, or if a practical available alternate method for the disposal of the material to be burned is found. The applicant may be required to comply with additional State and local laws regarding air pollution and fire safety including obtaining required permits or approvals. *Notification must be made to the Bureau of Air Quality one (1) working day prior to each burn.* Prior notice may also be required by the local fire department or fire warden of the time and place of each fire. Prudent precautions should be taken in regard to safety and air pollution control.

FAILURE TO SATISFY ALL CONDITIONS OF THIS AUTHORIZATION WILL RESULT IN THE ISSUANCE OF A NOTICE OF ALLEGED VIOLATION

Date: ____________

By: ______________________________
Chester R. Sergent
Nevada Bureau of Air Quality

August, 199[illegible]

APPENDIX E: WFSA

APPENDIX F: DELEGATION OF AUTHORITY

<u>Delegation of Authority</u>

Chris Farmetti FMO and Tom Romanello AFMO are assigned as Incident Commander of all Type III Incidents on Sheldon-Hart Mountain Complex for the U.S. Fish and Wildlife Service, effective January 1,2001.

You have full authority and responsibility for managing the fire suppression activities within the framework of the law and Fish and Wildlife Service policy and direction as provided by this office.

Resource Management Plans and other appropriate documents will be provided by the Resource Advisor.

Your primary responsibility is to organize and direct your assigned resources for efficient and effective suppression of the fire.

Refuge Managers, Biologist and other designated staff will be assigned to you as Resource Advisors. He/She or the Refilge Managers should be consulted in situations where natural resource decisions or tradeoffs are involved.

The Fire Management Officer should take appropriate suppression actions on all fires originating on Fish and Wildlife Lands.

The Incident Commander has full approval to issue press releases that are specific to the Fire. Approval and release authority for other public and fire information matters is reserved for the Project Leader or Designee.

Specific direction and fire suppression priorities for fire are as follows, and are in priority order:

1. Protect life, property, and resources from unwanted fire.
2. Firefighter safety.
3. Utilize natural barriers and roads if possible for burnout operations.
4. Use of dozers requires resource advisor approval prior to shift plan implementation. The widening of existing roads and two tracks is not restricted.

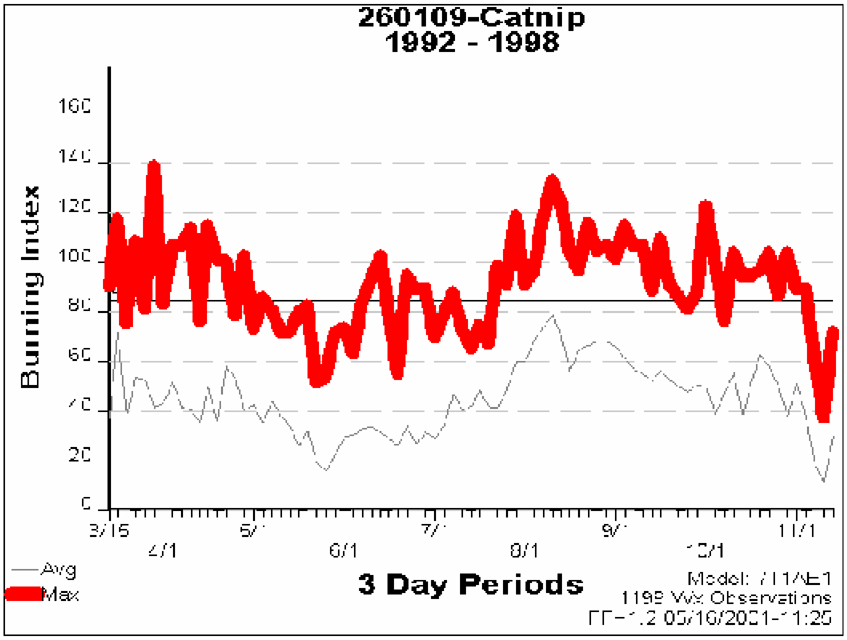
Project Leader,____________________________Sheldon-Hart Mtn. Complex, January 1, 2001

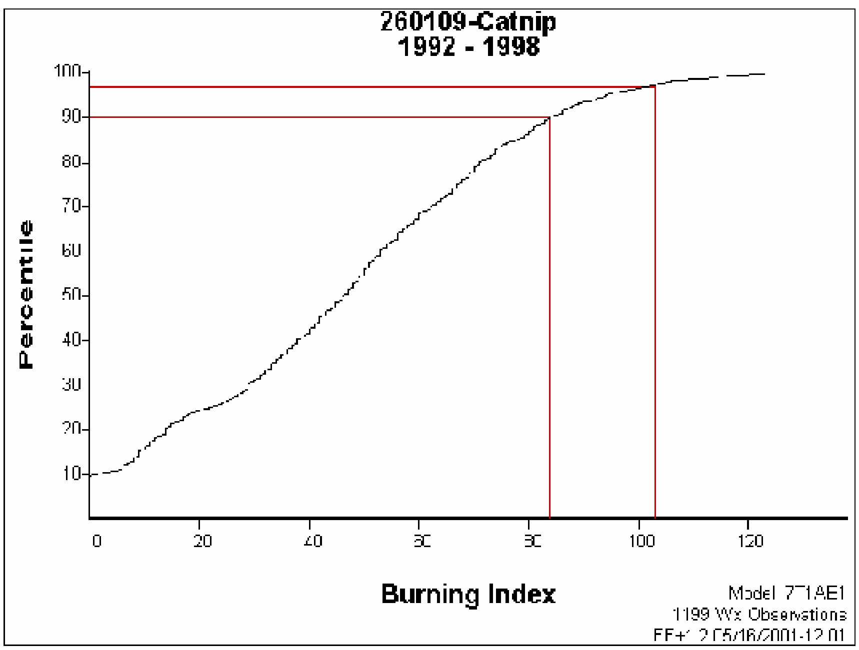
APPENDIX G: COOPERATIVE AGREEMENTS

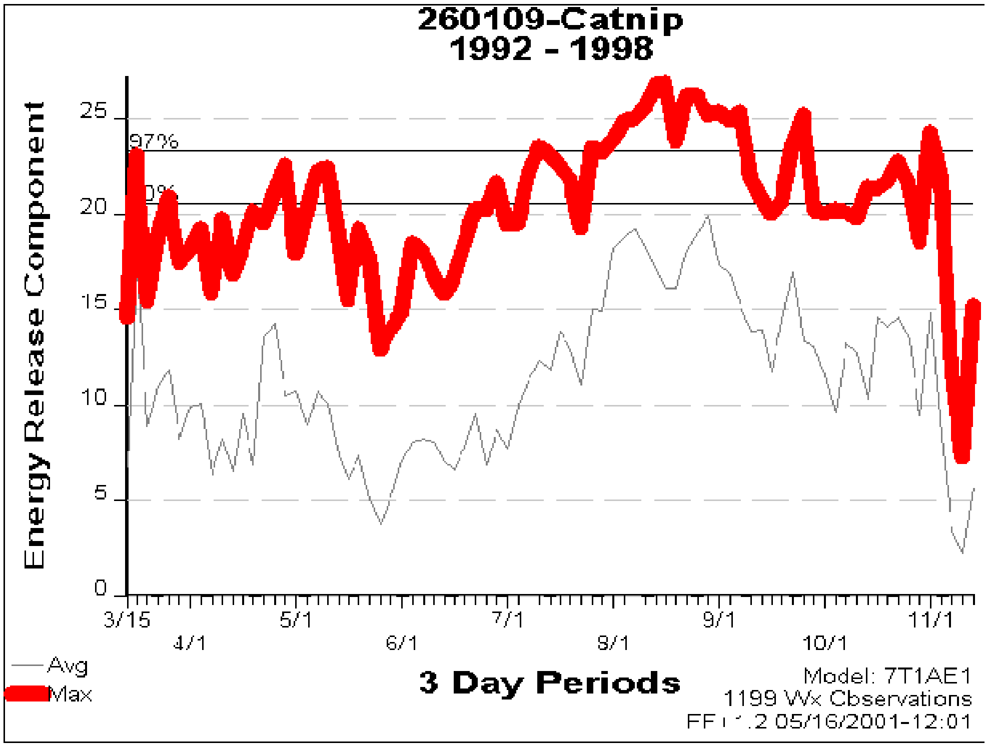
APPENDIX H: DISPATCH PLAN

APPENDIX I: WEATHER DATA

Catnip



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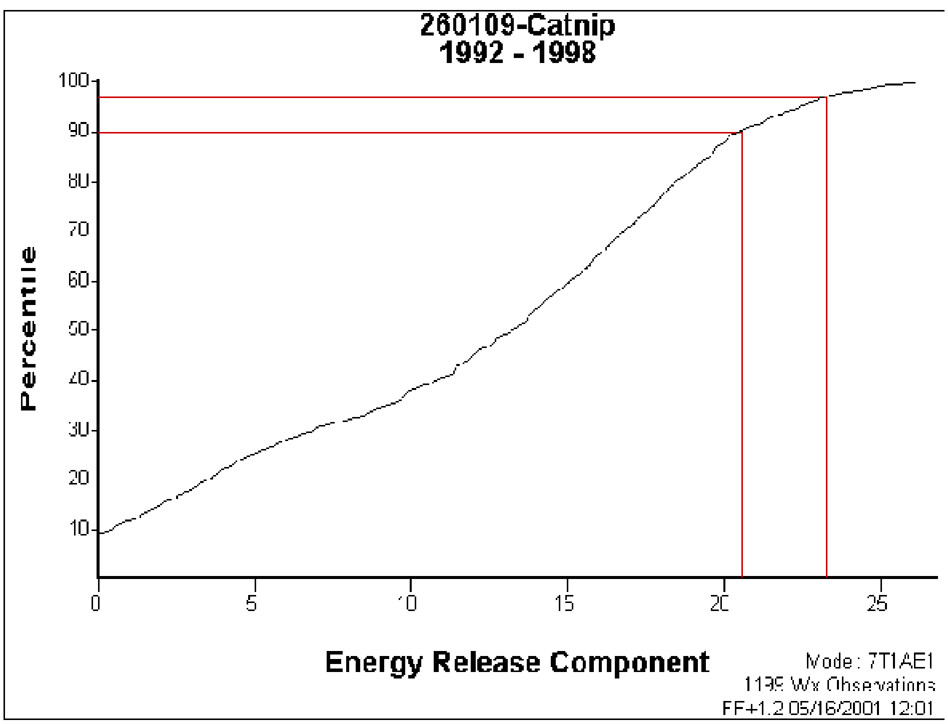
1992 - 1998
Energy Release Component
25
20
15
10
5
0
97%
3/15
4/1
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Avg
Max
3 Day Periods
Model: 7T1AE1
1199 Wx Observations


260109-Catnip
1992 - 1998
Percentile
100
90
70
60
50
20
10
0
5
15
25
Energy Release Component
FF+1.2 05/16/2001 12:01

APPENDIX J: NORMAL UNIT OF STRENGTH INVENTORY

SHELDON/HART COMPLEX MINIMUM FIRE CACHE STOCKING			
DATE:			
Item Description	**Notes**	**Size**	**Minimum Stocking**
Back-pack pump		cloth	30
Brass, adapter		1 ½" NST - 1 ½" NH	10
Brass, Ball valve shutoff		1" NPSH	25
Brass, double female		1 ½" NH	10
Brass, double female		1" NPSH	10
Brass, double male		1 ½" NH	10
Brass, double male		1" NPSH	10
Brass, foot valve		1 ½" NH	10
Brass, foot valve		1" NPSH	2
Brass, foot valve		2" NPSH	10
Brass, Gated Y		1 ½" NH	40
Brass, Gated Y		1" NPSH	40
Brass, increaser		3/4" NPSH - 1" NPSH	10
Brass, pressure relief valve		1 ½" NH	8
Brass, reducer		1 ½" NH - 1" NPSH	50
Brief case (GSA grey)			10
Brush Jacket (Wajax)		L	15
Brush Jacket (Wajax)		M	5
Brush Jacket (Wajax)		XL	10
Canteen, 1 quart			100
Canteen, 4 quart			40
Fire shelter			30
Fire shelter (practice)			10
First aid, exposure			4
First aid, personal			30
Foam generator (FP-50)			2
Foam, Phos-check WD88		5 gallon tub	25

Gloves (GSA)		L	30
Gloves (GSA)		M	30
Gloves (GSA)		S	10
Gloves (GSA)		XL	20
Goggles			30
Hard hat		Blue	30
Headlamp			30
Hose (100 ft)		1 ½" NH	100
Hose (100 ft)		1" NPSH	100
Hose (100 ft)		3/4" NPSH (garden hose)	200
Hose (25 ft)		1 ½" NH	8
Hose (50 ft)		1 ½" NH	16
Hose (50 ft)		3" Hose with 2 ½" NH fitting	4
Hose (suction)		1 ½" NH x 8 ft	5
Hose (suction)		2" NPSH x 8 ft	12
Hose clamp			20
Hose pack (Cascade)			10
Hose pack (FSS, green)			40
Hydrant wrench			6
Line gear			30
MRE		case	10
Nomex pants		26-30 x 29	4
Nomex pants		28-32 x 29	4
Nomex pants		28-32 x 33	2
Nomex pants		30-34 x 33	10
Nomex pants		32-36 x 29	2
Nomex pants		32-36 x 33	16
Nomex pants		34-38 x 33	20
Nomex pants		36-40 x 33	4
Nomex, pant		34-38 x 29	1
Nomex shirt		L	30
Nomex shirt		M	10
Nomex shirt		S	5
Nomex shirt		XL	20
Nomex shirt		XL-L	5
Nomex, shrowd			30
Nozzle, adjustable		3/4" NPSH	25
Nozzle, foam (10 gpm)		1' NPSH	10
Nozzle, forester		1"	40
Nozzle, KK		1 ½" NH	20
Nozzle, KK		1" NPSH	20

Nozzle, KK (plastic)		1" NPSH	5
Pad, foam			30
Pad, therma-rest		Long	15
Pump, Hand primer		1 ½" NH	12
Pump, Homelite			2
Pump, Honda		Volume	1
Pump, Mini Mark			1
Pump, Wajax Mark III			5
Pump, Waterous Floto			1
Red bag (FSS)			30
Sleeping bag (Slumber-jack)			30
Spanner wrench		10"	10
Spanner wrench		5"	30
Tent			30
Tools, pulaski			20
Tools, shovel			20
Tools, McCleod			10
Tools, Flapper			10

APPENDIX K: COMMUNICATIONS PLAN

US Fish & Wildlife Service King EPH & LPH Frequency List (Rev 3/00)

GROUP 1: **EPH and LPH**

CH#	ASSIGNMENT	NAME	RX	TX	Code	Guard	COMMENTS
1	FWS	FW DIR	168.575	168.575	0	---	Copper
2	FWS	FW RPT	168.575	168.650	3	107.2	Hart
			"	"	6	123.0	Badger
3	LV BLM	LV BLM	166.325	166.325	0	---	Direct
4	LV BLM RPT	LV RPT	166.325	166.925	1	100.0	Hart
			"	"	3	107.2	Yainax
			"	"	5	114.8	Green Mt
			"	"	6	123.0	Hamaker
5	Fremont NF	FS ORG	172.350	172.350	2	103.5	FS Fire
6	Fremont NF	FS GRN	170.500	170.500	0	---	FS SOA
7	Fremont NF	FS YEL	171.700	171.700	2	103.5	FS Admin2
8	Cederville BLM	CDV BLM	166.4875	166.4875	0	--	Direct
9	Cederville BLM	CDV RPT	166.4875	167.075	4	110.9	Fox Mt
			"	"	6	123.0	49 Mt
			"	"	7	127.3	Likely
			"	"	8	146.2	Yellow Pk
10	Winnemucca BLM	WIN SOA	171.675	171.675	0	---	SOA
11	Winnemucca BLM	WIN BLM	170.025	170.025	0	---	Direct
12	Winnemucca BLM	WIN RPT	170.025	168.375	5	114.8	Granite
			"	"	9	151.4	Blue Lake
13	Burns BLM	BURNS	166.350	166.350	0	---	Direct
14	Burns BLM	BRNS RPT	166.350	166.950	3	107.2	Wagontire
			"	"	5	114.8	Steens

GROUP 2: **EPH Only**

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	FWS	FW DIR	168.575	168.575	---	Direct
2	FWS Hart	FW HART	168.575	169.650	107.2	
3	FWS Badger	FW BADGR	168.575	169.650	123.0	
4	LV BLM Direct	LKV BLM	166.325	166.325	---	White
5	LV BLM SOA	BLM SOA	166.775	166.775	---	Blue
6	Fremont NF	FS ORG	172.350	172.350	103.5	Orange
7	Fremont NF	FS GRN	170.500	170.500		Green
8	LV OSDF	OSDF LV	154.115	154.115	131.8	Gray
9	LV OSDF SOA	OSDF SOA	151.340	151.340	---	Red
10	USFS	TAC 2	168.200	168.200	---	Incident Tac
11		CH 11				
12		CH 12				
13		CH 13				
14		CH 14				

Note: Group 2 tones are dedicated to the associated channel.

Fremont N.F. King EPH and Midland Frequency List Rev 3/99

GROUP 1: FREMONT FREQUENCIES (FRE)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	FREMONT	ADMIN1	170.600	170.600	103.5>	CH's 1,2,3 direct
2	FREMONT	ADMIN2	171.700	171.700	103.5>>	to LIFC, mobiles,
3	FREMONT	FIRE	172.350	172.350	103.5>	district offices.
4	FREMONT	PROJCT	170.500	170.500		Scene Of Action
5	GRIZZLY	RPT 11	170.600	168.725	110.9	Admin Repeater
6	GRIZZLY	RPT 21	171.700	168.725	167.9	Admin Repeater
7	GRIZZLY	RPT 31	172.350	168.725	136.5	Fire Repeater
8	ROUND PASS	RPT 12	170.600	168.725	123.0	Admin Repeater
9	ROUND PASS	RPT 22	171.700	168.725	118.8	Admin Repeater
10	ROUND PASS	RPT 32	172.350	168.725	146.2	Fire Repeater
11	DEAD INDIAN	RPT 13	170.600	168.725	131.8	Admin Repeater
12	DEAD INDIAN	RPT 23	171.700	168.725	127.3	Admin Repeater
13	DEAD INDIAN	RPT 33	172.350	168.725	156.7	Fire Repeater

GROUP 2: SOUTHERN AREA AGENCIES (SAA)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	FREMONT	ADMIN1	170.600	170.600	103.5>	CH's 1,2,3 direct
2	FREMONT	ADMIN2	171.700	171.700	103.5>>	to LIFC, mobiles,
3	FREMONT	FIRE	172.350	172.350	103.5>	district offices.
4	FREMONT	PROJCT	170.500	170.500		Scene Of Action
5	USFS	TAC 2	168.200	168.200 L		INCIDENT TAC
6	BLM DIR	BLM	166.325	166.325	100.0	*
7	OSDF DIR	OSDF K	151.205	151.205	131.8	Klamath Unit *
8	MODOC	MODOC	168.750	168.750	110.9	*
9	WINEMA	WINEMA	169.925	169.925	103.5	*
10	DESCHUTES	DSCHTS	170.475	170.475		*
11	WLKR RG	WLKRRG	151.145	151.145		*
12	KRFD 911	KC 911	154.070	154.070	192.8	*
13	USFW DIR	FW DIR	168.575	168.575		*

GROUP 3: LIFC (LFC)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	FREMONT	BROWN	170.600	170.600	103.5>	CH's 1,2,3 direct
2	FREMONT	YELLOW	171.700	171.700	103.5>>	to LIFC, mobiles,
3	FREMONT	ORANGE	172.350	172.350	103.5>	district offices.
4	FREMONT	GREEN	170.500	170.500		Scene Of Action
5	USFS	GOLD	168.200	168.200 L		INCIDENT TAC
6	BLM DIR	WHITE	166.325	166.325	100.0	*
7	BLM SOA	BLUE	166.775	166.775		*
8	OSDF KLAMATH	SILVER	151.205	151.205	131.8	Direct *
9	OSDF LAKE	GRAY	154.115	154.115	131.8	Direct *
10	OSDF SOA	RED	151.340	151.340		*
11	NAT'L AIR	AIRTAC	169.150	169.150 L		FREMONT AIR TAC
12	GRIZZLY	RPT 31	172.350	168.725	136.5	Fire Repeater
13	ROUND PASS	RPT 32	172.350	168.725	146.2	Fire Repeater
14	DEAD INDIAN	RPT 33	172.350	168.725	156.7	Fire Repeater

GROUP 4: OTHER AGENCY REPEATERS (OAR)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	BLM HART	BLM HT	166.325	166.925	100.0	*
2	BLM YAINAX	BLM YX	166.325	166.925	107.2	*
3	BLM GREEN	BLM GN	166.325	166.925	114.8	*
4	OSDF KMTH YX	ODFKYX	151.205	151.475	131.8	Yainax-Klamath*
5	OSDF LAKE YX	ODFLYX	154.115	159.255	151.4	Yainax-Lake *
6	OSDF LAKE RP	ODF RP	154.115	159.255	179.9	Round Pass *
7	OSDF LAKE BC	ODF BC	154.115	159.255	131.8	Black Cap *
8	USFW HART	UFW HT	168.575	169.650	107.2	*
9	USFW BADGER	UFW BG	168.575	169.650	123.0	*
10	WLKR RG BALD	WR BLD	151.145	151.400	146.2	*

GROUP 5: NIRSC DEPARTMENT OF AGRICULTURE FREQUENCIES (DAF)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	NIRSC USFS	TAC 1	168.050	168.050 L	110.9	1 -----
2	NIRSC USFS	TAC 2	168.200	168.200 L	123.0	2 |
3	NIRSC USFS	TAC 3	168.600	168.600 L	131.8	3 |
4	NIRSC USFS	C1 DIR	168.700	168.700 L	136.5	4 King EPH
5	NIRSC USFS	C1 RPT	168.700	170.975 L	146.2	5 tones
6	NIRSC USFS	C2 DIR	168.100	168.100 L	156.7	6 |
7	NIRSC USFS	C2 RPT	168.100	170.450 L	167.9	7 |
8	NIRSC USFS	C3 DIR	168.075	168.075 L	103.5	8 -----
9	NIRSC USFS	C3 RPT	168.075	170.425 L		
10		WEATHR	162.550			(See note below
11	GOV'T WIDE	TAC A	163.100	163.100 L		and instructions
12	GOV'T WIDE	TAC B	168.350	168.350 L		on last page.)
13		WEATHR	162.400			
14	GOV'T WIDE	AGUARD	168.625	168.625 L		Air Guard

GROUP 6: NIRSC DEPARTMENT OF INTERIOR FREQUENCIES (DIF)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	NIRSC USDI	TAC 1	166.725	166.725 L	110.9	1 -----
2	NIRSC USDI	TAC 2	166.775	166.775 L	123.0	2 |
3	NIRSC USDI	TAC 3	168.250	168.250 L	131.8	3 |
4	NIRSC USDI	C4 DIR	166.6125	166.6125L	136.5	4 King EPH
5	NIRSC USDI	C4 RPT	166.6125	168.400 L	146.2	5 tones
6	NIRSC USDI	C5 DIR	167.100	167.100 L	156.7	6 |
7	NIRSC USDI	C5 RPT	167.100	169.750 L	167.9	7 |
8	NIRSC USDI	C6 DIR	168.475	168.475 L	103.5	8 -----
9	NIRSC USDI	C6 RPT	168.475	173.8125L		
10		WEATHR	162.550			(See note below
11	GOV'T WIDE	TAC A	163.100	163.100 L		and instructions
12	GOV'T WIDE	TAC B	168.350	168.350 L		on last page.)
13		WEATHR	162.400			
14	GOV'T WIDE	AGUARD	168.625	168.625 L		Air Guard

Note: Group 5 and 6 frequencies match groups 1 and 3 respectively of the National Incident Radio Support Cache(NIRSC-Boise) VHF frequency scheme with the exception of channels 10 and 13.

GROUP 7: INITIAL MULTIPLE INCIDENT (IMI)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	FREMONT	BROWN	170.600	170.600	103.5	
2	FREMONT	YELLOW	171.700	171.700	103.5	
3	FREMONT	ORANGE	172.350	172.350	103.5	
4	FREMONT	GREEN	170.500	170.500		
5	USDA	TAC 1	168.050	168.050 L		
6	USDA	TAC 2	168.200	168.200 L		
7	USDA	TAC 3	168.600	168.600 L		
8	NAT'L AIR	AIRTAC	169.150	169.150 L		FREMONT AIR TAC
9	NIIMS	LOGIST	168.550	168.550		LOGISTICS

GROUP 8: AUTOMATIC NUMBER IDENTIFICATION (ANI)

CH#	ASSIGNMENT	NAME	RX	TX	TONE	COMMENTS
1	WEATHER	ANI	162.550	NONE		
2	USFS	COMM	164.9625	164.9625		

* For use only to communicate with the licensee in emergency situations.

Accessing NIRSC Tone Control Command Repeaters:

EPH King Radios:
Press the number on the keypad corresponding to the tone required

in the incident plan to access the Command Repeater. Tones are listed under "TONE" in group 5 and 6. Does not affect other groups. The channel name of the tone selected will appear momentarily during transmit.

Midland Mobiles:

On the control head, press [FUNC], [1], then key in the desired code (see table below) and press [ENT]. This does affect the other groups. In order to use the Fremont radio system the radio must be reset to the original settings. To cancel the override code: press [FUNC], [1], then [DEL].

CODE	TONE
15	110.9
18	123.0
20	131.8
21	136.5
23	146.2
25	156.7
27	167.9
13	103.5

One of these tones will be stated in the incident frequency plan if the incident is using a tone protected Command Repeater.

<u>Frequency List for BLM King LPH (14 Channel) Portable Radios</u>
Rev 1/01

CH#	ASSIGNMENT	NAME	RX	TX	COMMENTS
1	BLM-OR-010	DIRECT	166.325	166.325	Direct also WHITE, Location: Round Pass
2	BLM-OR-010	----------	166.325	166.925	Repeater-Indicate which repeater*
3	BLM-OR-010	BLUE	166.775	166.775	Scene of Action
4	BLM-OR-010	VIOLET	166.150	166.150	Scene of Action
5	NIRSC-USFS	GOLD	168.200	168.200	Incident Tactical
6	FS FREMONT	BROWN	170.600	170.600	Administrative
7	FS FREMONT	YELLOW	171.700	171.700	Engineering, Secondary Fire
8	FS FREMONT	ORANGE	172.350	172.350	Fire
9	FS FREMONT	GREEN	170.500	170.500	Project, Scene of Action
10	OSDF KLAMATH	SILVER	151.205	151.205	Klamath County Unit
11	OSDF LAKE	GRAY	154.115	154.115	Lake County Unit
12	OSDF	RED	151.340	151.340	OSDF Scene of Action
13	USFW	DIRECT	168.575	168.575	Direct
14	USFW	----------	168.575	169.650	Repeater-Indicate which repeater*

*Press the number on the radio keypad corresponding to the tone assignment below to access base/repeater:

KEYPAD NUMBER	TONE	ASSIGNMENT
1	100.0	BLM Hart Mt
2	107.2	BLM Yainax Bt, USFW Hart Mt
3	114.8	BLM Green Mt
4	123.0	BLM Hamaker Mt, USFW Badger Mt
5	103.5	FS Fremont
6	131.8	OSDF Klamath and Lake Units

APPENDIX L: CLASSIFICATION OF VERTEBRATE WILDLIFE SPECIES

Classification of vertebrate wildlife species by status, breeding-feeding assemblage, range, abundance by season, and versatility index, Sheldon NWR.[a]

	Assemblages		Abundance by season				Versatility index		
Status and species	Br-Fe	Range	Sp	Su	Fa	Wi	Br	Fe	To
Permanent residents									
Alvord chub	1-1	1	f	f	f	f	NE[b]		
Sheldon tui chub	1-1	1	u	u	u	u	10	10	20
Alvord cutthroat trout	1-1	1	u	u	u	u	NE		
Lahontan cutthroat trout	1-1	1	f	f	f	f	NE		
Rainbow trout	1-1	1	f	f	f	f	6	6	8
Guppy	1-1	1	u	u	u	u	NE		
Bluegill	1-1	1	r	r	r	r	NE		
Pumkinseed	1-1	1	r	r	r	r	NE		
Largemouth bass	1-1	1	f	f	f	f	NE		
White crappie	1-1	1	f	f	f	f	NE		
Yellow perch	1-1	1	f	f	f	f	NE		
Great Basin spadefoot toad	1-7	2	c	u	h	h	9	16	25
Pacific treefrog	1-7	2	f	c	u	h	10	21	31
Bullfrog	1-7	1	c	c	c	h	NE		
Desert collared lizard	3-2	1	f	f	f	h	NE		
Long-nosed leopard lizard	4-2	4	f	f	f	h	NE		
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 whiptail	4-2	4	u	u	u	h	NE		
Southern alligator lizard	4-8	1	x	x	x	h	NE		
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
Night snake	4-2	4	u	u	u	h	NE		
Western rattlesnake	4-2	3	u	f	u	h	18	41	59
Northern harrier	4-2	5	c	c	c	u	13	44	57
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
American kestrel	10-2	5	c	c	c	r	9	49	58
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	1	c	c	u	r	7	18	25
Western screech-owl	10-2	2	c	c	c	c	2	15	17
Long-eared owl	5-2	2	f	f	f	f	8	15	23
Short-eared owl	4-2	2	f	u	f	r	20	29	49
Great horned owl	5-2	2	c	c	c	c	11	29	40
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
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
Marsh wren	2-7	1	f	f	f	x	2	4	6
Rock wren	3-2	6	c	c	f	x	2	36	38
Canyon wren	3-2	1	u	u	u	r	2	17	19

Status and species	Br-Fe	Range	Assemblages: Sp	Su	Fa	Wi	Versatility index: Br	Fe	To
American robin	5-8	2	c	c	f	u	19	45	64
Loggerhead shrike	5-8	5	f	f	u	r	25	43	68
European starling	10-2	2	c	c	r	r	5	12	17
Sage sparrow	4-2	6	c	c	u	r	9	24	33
Song sparrow	4-7	1	c	c	f	u	3	11	14
Western meadowlark	4-2	6	c	c	f	u	37	51	88
Cassin's finch	5-8	4	c	c	c	u	18	19	37
Merriam's shrew	9-2	6	u	u	u	u	30	58	88
Vagrant shrew	9-2	1	r	r	r	r	15	38	33
Preble's shrew	9-2	1	r	r	r	r	8	19	27
American pika	3-2	1	u	u	u	x	2	7	9
Pygmy rabbit	4-2	4	c	c	c	u	10	26	36
Mountain cottontail	4-2	6	c	c	c	f	28	42	70
Black-tailed jackrabbit	4-2	6	c	c	c	c	20	52	72
White-tailed jackrabbit	4-2	4	f	f	f	f	14	22	36
Least chipmunk	9-2	6	c	c	c	r	21	48	69
Yellow-bellied marmot	3-2	4	c	c	u	h	3	17	20
White-tailed antelope squirrel	9-2	4	c	c	u	x	4	6	10
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
Townsend's ground squirrel	9-2	6	c	c	u	h	10	36	46
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
Dark kangaroo mouse	9-2	4	f	f	f	u	4	9	13
Chisel-toothed kangaroo rat	9-2	4	f	f	f	u	22	35	57
Ord's kangaroo rat	9-2	6	c	c	c	u	28	30	58
American beaver	2-3	1	f	f	f	r	6	7	13
Deer mouse	9-2	6	c	c	c	u	67	82	149
Pinyon mouse	10-8	1	u	u	u	r	6	23	29
Northern grasshopper mouse	9-2	4	r	r	r	r	22	35	57
Bushy-tailed woodrat	3-2	4	c	c	c	u	12	34	46
Desert woodrat	3-2	4	c	c	c	u	2	11	13
House mouse	3-2	1	u	u	u	r	NE		
Long-tailed vole	9-2	1	f	f	f	r	26	32	58
Montane vole	9-2	4	c	c	c	u	13	18	31
Sagebrush vole	9-2	6	c	c	c	r	16	35	51
Common porcupine	3-8	3	c	c	c	f	15	47	62
Coyote	9-2	6	c	c	c	c	25	82	107
Kit fox	9-2	4	u	u	u	u	NE		
Common raccon	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
Western spotted skunk	3-2	3	u	u	u	r	7	31	38
Striped skunk	9-2	2	r	r	r	x	2	16	18
Mountain lion	3-2	3	x	x	x	x	2	34	36

Bobcat	3-2	2	f	f	f	f	2	53	55
Feral burro	4-2	4	f	f	f	f			
Feral horse	4-2	6	c	c	c	c	11	21	32
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									
Pied-billed grebe	2-1	1	u	r	u	-	8	10	18
Eared grebe	2-1	1	c	f	u	-	8	10	18
Western grebe	2-1	1	u	r	x	-	2	10	12
Clark's grebe	2-1	1	u	r	x	-	2	10	12

Status and species	Assemblages Br-Fe	Range	Abundance by season Sp	Su	Fa	Wi	Versatility index Br	Fe	To
Black-crowned night heron	2-1	1	u	u	u	-	1	10	11
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
Canvasback	2-1	1	u	x	u	-	2	10	12
Redhead	2-1	1	u	r	u	-	6	10	16
Lesser scaup	2-1	1	u	r	r	-	0	10	0
Ruddy duck	2-1	1	u	u	r	-	5	10	15
Turkey vulture	3-2	3	c	c	f	-	2	59	61
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
Ferruginous hawk	5-2	5	u	u	u	-	8	21	29
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	1	u	x	x	-	8	17	25
Wilson's phalarope	2-1	2	c	f	u	-	7	10	17
Mourning dove	4-2	4	c	f	r	-	21	33	54
Burrowing-owl	9-10	4	r	r	r	-	9	17	26
Northern saw-whet owl	10-2	1	r	r	r	-	1	21	22
Common nighthawk	4-3	6	r	c	r	-	23	55	78
Common poorwill	4-3	4	u	c	c	-	14	21	35
White-throated swift	3-3	1	c	c	r	-	0	42	0
Red-naped sapsucker	8-5	1	r	r	r	-	2	6	8
Dusky flycatcher	6-3	1	f	f	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	r	r	r	-	2	3	5
Western kingbird	5-3	1	u	u	r	-	3	6	9
Tree swallow	10-3	1	x	x	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	1	u	u	r	-	2	20	22
Scrub jay	5-8	1	f	f	f	-	8	22	30
House wren	10-4	1	u	u	u	-	7	26	33
Blue-gray gnatcatcher	5-4	1	f	f	r	-	3	7	10
Mountain bluebird	10-8	1	u	u	u	-	6	26	32
Sage thrasher	4-2	6	c	c	u	-	26	37	63
Warbling vireo	6-5	1	u	u	r	-	3	9	12
Orange-crowned warbler	4-4	1	c	r	f	-	6	25	31
Yellow warbler	6-5	1	c	c	f	-	5	9	14
Black-throated gray warbler	5-4	2	c	f	u	-	10	25	35
Common yellowthroat	2-7	1	c	c	u	-	2	6	9
Lazuli bunting	6-8	1	f	c	u	-	2	13	15

Status and species	Assemblages		Abundance by season				Versatility index		
	Br-Fe	Range	Sp	Su	Fa	Wi	Br	Fe	To
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	c	c	u	-	17	17	34
Black-throated sparrow	4-2	2	u	f	r	-	9	10	19
Savannah sparrow	4-2	1	c	c	f	-	14	23	37
White-crowned sparrow	4-2	1	c	r	c	-	19	50	69
Red-winged blackbird	2-2	2	c	c	u	-	11	17	28
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	1	f	f	r	-	31	25	56
Northern oriole	6-6	1	f	u	r	-	2	9	11
House finch	5-2	4	u	r	r	-	5	15	20
Transients									
Horned grebe	0-1	7	r	-	x	-	0	8	0
American white pelican	0-1	7	x	x	x	-	0	10	0
Double-crested cormorant	0-1	7	r	r	r	-	0	8	0
Great blue heron	0-1	7	r	r	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
White-faced ibis	0-1	7	r	r	x	-	0	9	0
Tundra swan	0-1	7	u	-	u	-	0	10	0
Greater white-fronted goose	0-7	7	u	-	r	-	0	3	0
Snow goose	0-7	7	x	-	x	-	0	3	0
Wood duck	0-7	7	x	-	x	-	0	10	0
American wigeon	2-7	7	f	r	c	-	0	11	0
Ring-necked duck	2-1	7	u	r	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
Common merganser	0-1	7	f	-	r	-	0	10	0
Bufflehead	0-1	7	f	r	f	-	0	10	0
Osprey	0-1	7	r	-	x	-	0	9	0
Bald eagle	0-7	7	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
Peregrine falcon	0-3	7	x	-	x	-	0	17	0
Greater yellowlegs	0-1	8	f	f	u	-	0	10	0
Lesser yellowlegs	0-1	8	f	f	u	-	0	10	0
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
Long-billed dowitcher	0-1	8	f	f	f	-	0	7	0
Red-necked phalarope	0-1	8	-	r	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
Black tern	0-1	7	r	x	r	-	0	10	0
Calliope hummingbird	0-8	1	r	r	x	-	8	10	0
Broad-tailed hummingbird	0-8	2	u	x	x	-	0	17	0
Rufous hummingbird	0-2	8	-	c	-	-	0	9	0
Belted kingfisher	0-1	7	x	x	x	-	0	6	0
Lewis's woodpecker	0-9	7	r	r	r	-	0	16	0
Olive-sided flycatcher	0-3	7	u	x	u	-	0	18	0
Western wood peewee	0-3	7	u	x	r	-	0	18	0
Willow flycatcher	0-3	7	u	x	r	-	0	9	0

	Assemblages by season						Abundance		Versatility index
Status and species	Br-Fe	Range	Sp	Su	Fa	Wi	Br	Fe	To
Bank swallow	0-3	7	r	r	-	-	0	16	0
American crow	0-2	7	x	x	x	-	0	16	0
Red-breasted nuthatch	0-4	8	c	r	c	-	0	27	0
Brown creeper	0-6	8	r	-	r	-	0	16	0
Bewick's wren	0-4	7	x	x	x	-	0	12	0
Winter wren	0-5	7	r	x	r	-	0	7	0
American dipper	0-1	7	x	x	x	-	0	2	0
Ruby-crowned kinglet	0-4	8	c	x	c	-	0	29	0
Western bluebird	0-8	7	u	x	u	-	0	16	0
Swainson's thrush	0-2	7	r	r	x	-	0	6	0
Hermit thrush	0-2	7	u	r	u	-	0	21	0
Varied thrush	0-2	7	r	-	u	-	0	15	0
American pipit	0-1	7	u	r	c	-	0	23	0
Solitary vireo	0-4	7	u	r	u	-	0	27	0
Nashville warbler	0-4	7	u	x	r	-	0	27	0
Yellow-rumped warbler	0-9	7	c	f	c	-	0	27	0
MacGillivray's warbler	0-5	7	f	c	f	-	0	10	0
Wilson's warbler	0-5	7	f	r	u	-	0	9	0
Western tanager	0-4	7	c	u	r	-	0	27	0
Black-headed grosbeak	0-5	7	f	u	r	-	0	8	0
Fox sparrow	0-2	7	f	f	u	-	0	17	0
Lincoln's sparrow	0-7	7	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
Dark-eyed junco	0-2	8	u	x	f	u	0	31	0
Pine siskin	0-4	7	u	r	r	-	0	6	0
Lesser goldfinch	0-2	7	x	x	-	-	0	2	0
American goldfinch	0-2	7	x	x	x	-	0	9	0
Winter residents									
Rough-legged hawk	0-2	9	f	-	f	u	0	13	0
Golden-crowned kinglet	0-4	8	u	-	f	u	0	29	0
Townsend's solitaire	0-8	7	u	r	f	c	0	31	0
Northern shrike	0-10	9	r	-	u	u	0	25	0
American tree sparrow	0-2	7	-	-	x	r	0	7	0
Lapland longspur	0-2	7	-	-	-	r	0	15	0
Rosy finch	0-2	9	-	-	x	r	0	15	0

[a] Refer to legend for description of codes.
[b] Not estimated, incomplete analysis.

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	--
H	(aestivation/hibernation)	--	--

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.

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.

APPENDIX M: BURN PLAN FORMAT

PRESCRIBED FIRE PLAN

Refuge or Station

Unit

Prepared By:_________________ **Date:**
Prescribed Fire Specialist

Reviewed By: _________________ Date:
Refuge Biologist

Reviewed By: ________________ **Date:**
Prescribed Fire Burn Boss

Reviewed By:_________________ Date:
FMO/AFMO

Reviewed By:_________________ Date: _______ Biological Investigation Unit

Reviewed By: ________________ Date:
Refuge Manager

The approved Prescribed Fire Plan constitutes the authority to burn, pending approval of Section 7 Consultations, Environmental Assessments or other required documents. No one has the authority to burn without an approved plan or in a manner not in compliance with the approved plan. Prescribed burning conditions established in the plan are firm limits. Actions taken in compliance with the approved Prescribed Fire Plan will be fully supported, but personnel will be held accountable for actions taken which are not in compliance with the approved plan.

Approved By: ________________ Date:
Complex Project Leader

PRESCRIBED FIRE PLAN

Refuge:____________ Refuge Burn Number:

Sub Station: _________ **Fire Number:**

Name of Area: ____________   **Unit No.**

Acres To Be Burned:___ Perimeter Of Burn:

Legal Description: Lat. ___ Long. ___ T_ R_ S
County & State:

Is a Section 7 Consultation being forwarded to Fish and Wildlife Enhancement for review ? Yes__No__ (check one).

(Page 2 of this PFP should be a refuge base map showing the location of the burn on Fish and Wildlife Service land)

The Prescribed Fire Burn Boss/Specialist must participate in the development of this plan.

I. GENERAL DESCRIPTION OF BURN UNIT

Physical Features and Vegetation Cover Types (Species, height, density, etc.):

Primary Resource Objectives of Unit (Be specific. These are management goals):

1)

2)

3)

Objectives of Fire (Be specific. These are different than management goals):

1)

2)

3)

Acceptable Range of Results (Area burned vs. unburned, scorch height, percent kill of a species, range of litter removed, etc.):

1)

2)

3)

[*Attach Project Map Here*]

[*Attach Project Pre-Burn Photos Here*]

II. PRE-BURN MONITORING

Vegetation Type **Acres** **%** **FBPS Fuel Model**

Total

Habitat Conditions (Identify with transect numbers if more than one in burn unit.):

Type of Transects:

Photo Documentation (Add enough spaces here to put a pre-burn photo showing the habitat condition or problem you are using fire to change/correct. A photo along your transect may reflect your transect data.):

Other:

III. PLANNING AND ACTIONS

Complexity Analysis Results: (Attach a completed copy of the Complexity Analysis worksheet to this plan.)

Site preparation (What, when, who & how. Should be done with Burn Boss):

Weather information required (who, what, when, where, how, and how much):

Safety considerations and protection of sensitive features (Adjacent lands, visitors, facilities, terrain, etc., and needed actions. Include buffer and safety zones. Be specific, indicate on a burn unit map. Map should be a USGS quadrangle if possible, so ridges, washes, water, trails, etc. can be identified.)

Special Safety Precautions Needing Attention (Aerial ignition, aircraft, ignition from boat, etc.):

Media Contacts (Radio stations, newspaper, etc., list with telephone numbers):

Special Constraints and Considerations (Should be discussed with Burn Boss):

Communication and Coordination on the Burn (Who will have radios, frequencies to be used, who will coordinate various activities.):

IV. IGNITION, BURNING AND CONTROL

Planned or Proposed Actual

Scheduling: Approx. Date(s)

Time of Day

Acceptable Range

FBPS Fuel Model	Low	High	Actual
Temperature			
Relative Humidity			

Wind Speed (20' forecast)			
Wind Speed (mid-flame)			
Wind Direction			
ENVIRONMENTAL CONDITIONS			
Soil Moisture			
1 hr. Fuel Moisture			
10 hr. FM			
100 hr. FM			
Woody Live Fuel Moisture			
Herb. Live Fuel Moisture			
Litter/Duff Moisture			
FIRE BEHAVIOR			
Type of Fire (H,B,F)	B	H	
Rate of Spread (ch/hour)			
Fireline Intensity			
Flame Length			
Energy Release Component NFDRS Fuel Model __L_____			

<u>Note</u>: Attach BEHAVE Runs as an appendix to the end of this plan.

Cumulative effects of weather and drought on fire behavior:

Ignition Technique (Explain and include on map of burn unit. Use of aerial ignition must be identified in this plan. Last minute changes to use aircraft will not be allowed and will be considered a major change to the plan. This will require a resubmission):

Prescribed Fire Organization (See Section VII, Crew and Equipment Assignments. All personnel and their assignments must be listed. All personnel must be qualified for the positions they will fill.)

Other (If portions of the burn unit must be burnt under conditions slightly different than stated above, i.e., a different wind direction to keep smoke off of a highway or off of the neighbors wash, detail here.)

Prescription monitoring (Discuss monitoring procedure and frequency to determine if conditions for the burn are within prescription):

V. <u>SMOKE MANAGEMENT</u>

Make any Smoke Management Plan an attachment. Also attach pertinent smoke variances (if any) and all SASEM runs.

Permits required (who, when):

Distance and Direction from Smoke Sensitive Area(s):

Necessary Transport Wind Direction, Speed and Mixing Height (Explain how this information will be obtained and used):

Visibility Hazard(s) (Roads, airports, etc.):

Actions to Reduce Visibility Hazard(s):

Residual Smoke Problems (Measures to reduce problem, i.e., rapid and complete mop-up, mop-up of certain fuels, specific fuel moistures, time of day, etc.):

Particulate emissions in Tons/Acre and how calculated (This should be filled in after the burn so more precise acreage figures can be used):

VI. FUNDING AND PERSONNEL

Activity Code:

Costs

	Equipment & Supplies	**Labor**	**Overtime**	**Staff Days**	**Total Cost**
Administration (planning, permits, etc.)					
Site Preparation					
Ignition & Control					
Travel/Per Diem					
Total					

VII. BURN-DAY ACTIVITIES

Public/Media Contacts on Burn Day (List with telephone numbers):

Crew & Equipment Assignments (List all personnel, equipment needed, and assignments. The following is not an all inclusive list for what you may need.)

Crew Briefing Points (Communications, hazards, equipment, water sources, escape fire actions, etc. To be done by Burn Boss. Refer to Safety Considerations in Planning Actions and points listed below):

Ignition Technique (Methods, how, where, who, and sequence. Go over what was submitted in Section IV and any changes needed for the present conditions.) Attach ignition sequencing map if necessary:

Personnel Escape Plan:

Special Safety Requirements:

Go-No-Go Checklist:

GO-NO-GO CHECKLIST

____
Unit

_____ Is burn plan complete and approved?

_____ Are all fire prescriptions specifications met?

_____ Are all smoke management prescriptions met?

_____ Is the current and projected fire weather forecast favorable?

_____ Have all air quality considerations and smoke requirements been met?

_____ Have all required cultural resource protection objectives been met?

_____ Are all personnel required in the prescribed burn plan on-site and are they all qualified for their assigned duties?

_____ Have all personnel been briefed on the prescribed burn plan requirements?

_____ Have all personnel been briefed on safety hazards, escape routes, and safety zones?

_____ Is all required equipment in place and in working order?

_____ Are available (including back-up) resources adequate for containment of escapes under the worse-case conditions?

_____ Are answers to all of the above questions "YES"?

_____ In your opinion, can the burn be carried out according to the plan and will the burn meet planned objectives?

_____ Is there an adequate contingency plan developed and proofed?

All 14 questions have been answered "YES".

______________________________ ____________
Burn Boss Date

______________________________ ____________
Refuge Manager or Designee Date

Holding and Control:

Critical Control Problems:

Water Refill Points:

Other:

Contingency Plan for Escaped Fire (Are there crews standing by to initial attack or will people doing other jobs be called upon to do initial attack, who must be called in case of an escape, what radio frequencies will be used, etc.)

Mop Up and Patrol:

Rehabilitation Needs:

DI 1202 Submission Date:

Special Problems:

VIII. CRITIQUE OF BURN

Were burn objectives within acceptable range of results? (Refer to Section I):

What would be done differently to obtain results or get better results?

Was there any deviation from plan? If so, why?

Problems and general comments:

IX. POST-BURN MONITORING

Date:____________ Refuge Burn Number:

Length of Time after Burn:

Vegetative Transects:

Comments on Habitat Conditions, etc.:

Photo Documentation:

Other:

X. FOLLOW-UP EVALUATION

Date: ____________ Refuge Burn Number:

Length of Time after Burn:

Vegetative Transects:

Comments on Habitat Conditions, etc.:

Photo Documentation:

Other:

DAILY FIRE BEHAVIOR MONITORING SHEET

Refuge:

Project Name:___________________________ **RX Fire Number:**
Date of Burn:

Ignition Time: Start:________ **Finish:**

Weather Observations During Burn:
Time of Weather Observations

Dry Bulb Temp							
Wet Bulb Temp							
RH							
Wind Speed							
Wind Direction							
Cloud Cover %							

Comments Concerning Weather:

Last Live Fuel Moisture Measurement:________ **1-Hour Fuel Moisture:**

10-Hour Fuel Moisture (from fuel stick): ________ **Haines Index**:

Test Fire Results:

Firing Pattern:

Fire Behavior Characteristics (Rate of Spread, Flame Length, Fire Spread Direction, etc.)**:**

Acres Treated:

Smoke Dispersal Narrative (venting height, transport wind speed & direction, visibility, holding problems, problem spots, complaints, etc.)**:**

Burn Severity
Effects to Vegetation Narrative:

Ground Char (%): **Unburned _____** **Light_____** **Moderate_____** **Deep**

Soil Moisture on Day of Burn:

Were Resource Objectives Met? (If burn was successful, what conditions made it possible, ie: low live fuel moisture, high winds, etc.)

Photos of Fire Area: **Preburn Yes _____ No**
During Burn Yes _____ No
Postburn Yes _____ No

Daily Burn Cost: **Vehicles Used:**

Personnel Cost: $________
Equipment Cost: $________
Fuel Cost: $________
Total: $________

Cost per Acre: $_________

Burn Organization:

Burn Boss:

Ignition Specialist: _________________ **Holding Specialist: _________________** **Lighting Crew: _________________** **Holding Crew:**

Burn Evaluation Prepared By:_________________ **Date:**

**Attach pertinent Spot Weather Forecast,WIMS/NFDRS, Smoke Mgt Variance, etc. information for burn day to back of sheet.

APPENDIX N: FIRE EFFECTS MONITORING STANDARDS

LEVEL 1. Minimum Monitoring Standards (MMS) For Prescribed Burn Sites.

Monitoring objectives: To provide documentation and evaluation of area before burning and at periodic intervals after prescribed burning.

BEFORE BURNING

1. Request a project number from the FMO.

2. Obtain maps that describe the geographic location, size, and vegetation types in that project area.

3. On sites readily accessed from the ground, establish one or two permanent photo points to describe landscape change of vegetation in the project area. Establish additional permanent photo-points within dominant vegetation type and fuel type for which burn objectives were established.

Photographs should be taken during the time of day that avoids shadows and oriented parallel to slope in a direction that avoids glare from direct sunlight. Photographs taken during the peak of the growing season are preferred if the burn objective calls for change in forb cover. Photos taken out of the growing season are acceptable if burn objectives relate primarily to change in tree, shrub, or grass cover.

4. Establish a witness post at photo-point sites. Witness posts should be comprised of: (a) a five foot steel fence post where late successional vegetation comprises tall shrubs and trees. (b) a four foot rebar section in vegetation types comprised of short stature. Mark witness post with aluminum tags that indicate date of establishment and plot number, delineate plot locations on a map of the project area, and record the compass bearing of the photo to facilitate future monitoring.

Photographic equipment should consist of a 35 mm camera fitted with a 50 mm lens and 64 ASA slide film. Take one picture from the witness post. Photos should capture a scene that consists of 2/3 land and 1/3 sky. Maximize depth of field by adjusting to the largest possible f-stop number (smallest aperture) at 1/60th second shutter speed. All photographs, except panoramic overview shots, should include a cover-pole and photo-board marked with the project number, vegetation type, plot number, and date set approximately 5 m from the witness post. Photographs including cover-boards are optional. If they are used, place the 0.5 x 2.0 m board at a standard 10 m distance from the witness post. All photo points are to be mapped and included in the project file.

DURING BURNING

1. Use the standard fire weather and behavior monitoring sheet to record fire weather and behavior observations such as wind speed, wind direction, RH, and temperature, throughout the burn period. Try to attribute fire behavior to weather, topography, frequency of fuels, and fuel type. Be aware that fire behavior predictions and observations frequently cannot predict fire effects, (e.g., a smoldering fire can generate considerable heat and significant fire effects but is not part of the fire behavior prediction system).

2. Observations should be recorded every 30 minutes during ignition and hourly after ignition. In addition, an observation should be taken whenever there is an observable change of conditions on the burn site.

3. Estimate average rate of spread and flame-lengths where possible.

4. Take live fuel moisture samples following the standard methods and procedures for Sheldon and Hart Mt. Refuges.

5. Log this information into the project file for that burn site.

AFTER BURNING

1. Map the fire on mylar overlaid onto the appropriate four inch to the mile photo (1991) or 7.5" quad. Detail in mapping is very important (e.g., include areas within the perimeter that did not burn; few fires burn completely. Maps will facilitate estimation of interspersion and monitoring using Global Information System technology. Mapping of prescribed burns on sites of uniform topography will be facilitated with use of aerial photography or a Global Positioning System. Consult with the Fire Management Officer about site-specific mapping protocol.

2. The following procedures should be used to determine frequency of photo-monitoring:

A. Take pictures from photo-points before the next growing season initiates and preferably, within one week after the fire to describe fire severity, vegetation consumption, char level, and pattern of burn.

B. Take pictures from photo-points at selected years post-burn at the same time of year that the pre-burn photo was taken. Frequency of sampling will depend on the length of succession development for a vegetation type (e.g., 30 years in mountain big sagebrush). As a guideline, take pictures that portray vegetation development during early, mid, and late succession stages. Consult with the biologist for information regarding site-specific monitoring schedules.

3. Log this information into the project file for that burn site.

LEVEL II. Moderately Intensive Fire Effects Monitoring.

Monitoring objectives: A. To assess the area before and after prescribed burning and: B. To determine the relationship between site conditions (e.g., fuel load, fire behavior) before and during prescribed burning and vegetation response after prescribed burning.

BEFORE BURNING

1. Level I MMS.

2. Quantitative physical measurements; selection based on objectives of the project.
An example includes: Flow rate of spring.

3. Quantitative vegetation measurements; selection based on vegetation management objectives of the project. Examples include:

Fine fuel loading (immediately prior to burn).
Cover and composition of herbaceous plants.
Frequency of grasses and forbs.
Intercept cover and composition of shrubs.
Shrub and tree density.
Vegetation density (cover-board).

4. Establish 5-15 plots/vegetation type for sampling vegetal characteristics.

DURING BURNING

1. Make repeated measurements of fire weather during the burn period. Try to attribute fire behavior to weather, topography, frequency of fuels and fuel type. Be aware that fire behavior readings frequently cannot predict fire effects (e.g., a smoldering fire can generate considerable heat and significant fire effects but is not part of the fire effects prediction system).

2. Pace and time rate of spread. Estimate average flame-lengths.
Additional measurements may include:

Live and dead fuel moisture (fuel sizes <0.64 cm diameter).
Soil surface moisture.

AFTER BURNING

1. Measure consumption of shrub fuels by fire in time-lag classes. This entails randomly selecting burned shrubs and measuring the diameter of the smallest stems. Estimate level of ground char as low, moderate, and severe using the characteristics described (Ryan and Noste, 1985) in table XII-1.

2. Repeat Level I post-burn monitoring.

3. Repeat Level II physical and vegetation measurements at permanent plots.

4. Monitor post-fire management (e.g., weather and livestock grazing pressure, etc.). Post-fire response of vegetation can be substantially influenced by drought or extensive grazing of the burn site.

PROTOCOL FOR MONITORING FIRE EFFECTS IN DRAINAGES WITH TALL SHRUBS

Use for the following vegetation types:

Basin Big Sagebrush (93)
Black Greasewood (203)
Degraded Dry Meadow (281-282)
Degraded Wet Meadow (261-262)

1. Get map of project area.

2. Review habitat objectives for burn:
   a. Which principle vegetation types are being targeted for treatment?
   b. What are the most important variables to monitor?

3. Develop sample strategy based on assessment of response of the most important variable affected by prescribed burning (e.g., shrub cover, native grasses, etc.).

4. Get vegetation map of area:
   a. Make xerox copies of vegetation type map for the project area.
   b. Line out the perimeter of the project area with a highlighter on the xerox map.

5. Identify distribution of basin big sagebrush sites within project area.

6. Examine 4":1 mile photographs for small areas of basin big sagebrush (typically narrow corridors) that were not described on the vegetation map (intermittent drainages of low gradient).

7. Using a highlighter, describe as a line the unmapped areas on the xerox.

8. Find out from the FMO whether all or some of these sites are targeted for burning; exclude areas not targeted from further consideration for sampling.

9. Number the drainages in the project area consecutively (e.g., drainage 1 (1-25); drainage 2 (26-48); etc). Randomly draw 5-15 locations; in pencil, circle the sites.

```
             2   4   6   8  ...........
DRAINAGE -----------------------------------
           1   3   5   7   9 ..........
```

10. Drainages and habitat width vary from 5-150 meters, consequently, plots located in valleys <20m wide will have plots located within the vegetation type; in valleys >20m wide, randomly select a location along an imaginary line oriented at a right angle to the valley azimuth. Valley bottom edges can usually be identified by change in soil and vegetation.

PROTOCOL FOR MONITORING FIRE EFFECTS IN UPLAND VEGETATION TYPES

Use for the following vegetation types:

Mountain Shrub (43)
Mountain Big Sagebrush (73)
Big Sagebrush-Bitterbrush (83)
Low Sagebrush (103)
Wyoming Big Sagebrush (123)

1. Get map of project area.

2. Review habitat objectives for burn:
   a. Which principle vegetation types are being targeted for treatment?
   b. What are the most important variables to monitor?

3. Develop sample strategy based on assessment of response of the most important variables to prescribed burning (e.g., reduce shrub cover, increase cover of native grasses, etc.).

4. Get vegetation map of area:
   a. Grid (UTM--km^2) the project area in pencil on vegetation maps.
   b. Make xerox copies of vegetation type map for the project area.
   c. Line out the perimeter of the project area with a highlighter on the xerox map.

5. Find out from the FMO what specific geographic area is being targeted and has the highest probability of burning; draw this perimeter on the xerox map.

6. Overlay xerox map with vellum; number grids that fall within the target area in consecutive order.

7. Randomly select 15 km^2 blocks in the principle vegetation type slated for burning. An individual square may be selected more than once.

8. Within selected squares randomly choose a coordinate on the vertical axis (00-10) of a UTM grid; repeat process for horizontal axis. Find the crossection of points and identify that point as a sample plot on the xerox map.

9. Repeat the process for the remaining plots/vegetation type.

10. Important: Examine 4":1 mile photographs to verify occurrence of the target vegetation type in the vicinity of the sample plot. Reject plots where vegetation type does not exist.

11. Number sample plots (1-15) in pencil on xerox map.

PROTOCOL FOR MONITORING FIRE EFFECTS IN ASPEN

1. Randomly select plots for sampling based on current and potential geographic distribution of stands (valley bottom, side-slope, etc.) or stand condition (e.g., decadent, etc.). Using a flagged fence stake, toss stake over shoulder to randomize position of witness post.

2. Establish witness post (initially a wood lathe and stake) on edge of stand. Fasten an aluminum tag to post marked with plot number. At a later date, but before burning, replace wood posts with metal fence posts.

3. At witness post, select transect bearing that is perpendicular to the stand edge. Record compass bearing of transect.

4. Establish 2 transects, each 1 x 10 meters in length, two meters from the witness post, and parallel to the transect bearing.

5. Measure shrub intercept-cover by species under the lines (10m) of both transects (measure from canopy edge to canopy edge; include gaps within shrub if gap <20cm). A total of 20-m transect will be sampled.

6. Measure aspen density by height class in a 1-m belt of each transect. Center the 1-m belt over the transect line and count only stems rooted within the belt. A total of 20-m transect will be sampled.

7. Measure aspen density by height class in 0.5 m quadrants systematically established on the right side of transect tapes at the following intervals: 1, 3, 5, 7, 9 m.

8. From the baseline of each transect, estimate how much vegetation obscures each interval of the cover-board held at a vertical angle 1.5 m away. Take the reading from a standard 1.5 m height.
   A. Map stands, number stands, randomly select stands for sampling.
   B. Number edge of stands selected, randomly select number along transect.

9. Take two photos from the witness post centered along the plot compass bearing. Establish header plaque and pole five steps from the witness stake. Record (1) area (2) plot #, and (3) date on header plaque. For the photo, frame land and sky at a 2/3 to 1/3 ratio. Back the focus down from infinity slightly to increase depth of field (make sure the header plaque is in focus).

10. Locate the next witness post and repeat measurements.

MATERIALS REQUIRED FOR FIRE EFFECTS MONITORING

1. Site map.

2. Compass.

3. Clipboard.

4. Pencils.

5. Data forms.

6. Waterproof marker.

7. Dry-erase marker and dry-erase board.

8. Cover board.

9. Two 0.10m2 Daubenmire quadrate.

10. Range pole marked in decimeter increments and header plaque.

11. Flagging to temporarily mark plot location.

12. Two 15-meter tapes.

13. 35mm camera with 50mm lens.

14. 64 ASA film.

15. Four stakes for securing ends of tapes.

16. Rebar to mark permanent plot locations.

17. Metal fence post and post pounder.

18. Hammer for stake establishment.

19. 2m rod.

20. 1m stick.

21. Aluminum tags and wire for marking plot locations on metal stakes.
22. All wheel drive pickup.

Insert fire weather and behavior monitoring form.

INFORMATION TO ENGRAVE ON ALUMINUM TAGS

Purpose______ (Fire Effects Plot)

Location_______ (e.g., Project Name)

Vegetation Type_______ (e.g., Mt. Big Sage)

Plot #______ (1,2,3,...)

Date___________

LITERATURE CITED

Ryan, Kevin C.; Noste, Nonan V. 1985. Evaluating prescribed fires. In: Proceedings- symposium and workshop on wilderness fire; 1983 November 15-18; Missoula, MT. Gen. Tech. Rep. INT-182. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 230-238.

APPENDIX **O: F**IRE **E**FFECTS **I**NFORMATION

The following discussion addresses fire effects on soils, plants and animals common to the Refuge.

Effects on Soil
Prescribed burning may directly affect soil by altering soil physical properties, soil chemical properties, nutrient amounts, post-fire soil temperature, microorganism population, and erosion potential. Prescribed burning affects soil physical characteristics 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 stage influence 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 combustion, 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). Within vegetation type, the greater the severity of a fire, the greater the reduction of carbon and primary plant nutrients through combustion (DeBano 1990, Kilgore 1981).

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). Short-term decline in infiltration after fire is followed by a long-term increase in infiltration associated with change in ground cover and vegetation structure (e.g., shrub to grass dominated) (Tiedemann et al. 1990, Sturges 1993). Similarly, short-term increase in wind and water erosion potential after fire are followed by long-term decline in wind and water erosion associated with vegetation succession, enhanced vegetation vigor, increased vegetal cover, and increased ecological condition (Blaisdell 1953, Tiedemann et al. 1990, Sturges 1993).

Potential for cheatgrass invasion after burning is determined by the interaction of the soil disturbance (i.e., consumption of organic matter, change in levels of micronutrients), occurrence and amount of cheatgrass seed in the post-burn seed pool, and cover and density of perennial bunchgrasses (Hedrick et al. 1966, Young and Evans 1974, Evans et al. 1978). Burned sites without a seed source of cheatgrass will maintain dominance of native herbaceous species, notwithstanding variation in burn severity and site ecological condition (Bunting et al. 1987, Refuge files).

Sites with a source of cheatgrass seed react differently than sites devoid of the species (Young and Evans 1973, Bunting et al. 1987). On aridisol sites occupied by big sagebrush, pre-burn ecological condition and amount of cheatgrass in the seed pool are principal determinants of the post-burn composition of cheatgrass, burn severity notwithstanding (Young and Evans 1973, Young et al. 1976). For example, probability of increased cheatgrass cover rises with increased amounts of cheatgrass seed in the post-burn seed pool (Young and Evans 1973, Young et al. 1976). However, potential for cheatgrass increase is diminished on aridisol sites rated in high to very high ecological condition as perennial bunchgrasses survive in sufficient densities to out-compete cheatgrass (Young et al. 1976, Bunting et al. 1987). On mollisol sites dominated by basin big sagebrush and mountain big sagebrush, severe burns can lower ecological condition and reduce bunchgrass densities, which results in increased composition of cheatgrass in the post-burn community (Sapsis 1990). Reseeding such sites with perennial grasses the year after burning may be appropriate if the site had low cover of perennial grasses before burning and after burning (<10%) (Evans et al. 1978, Bunting et al. 1987).

Adverse effects of prescribed burning on soil can be lessened by development of a burn prescription specific to the type of soil and vegetation, and evaluation of the relationship between burn parameters and habitat response after burning (Bunting et al. 1987). Prescription factors that will influence soil response to fire include: (1) ignition technique, (2) fuel, organic layer, and soil moisture at 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, USDI-BLM 1991:3-37).

Effects on Forbs

Young and Evans (1978) examined response of forbs over four years after three late-July and early-August wildland fires in Wyoming big sagebrush/Thurber's needlegrass habitats near Reno, Nevada (Table III-4). At one site, density of perennial forbs, including balsamroot and lupine, increased 100% between the first and fourth years after burning. Cover of perennial forbs, largely tap-rooted species, increased the second and third years after fire, but declined in the fourth year. Four years after fire, annual forbs declined slightly. Forb richness declined 70% over three growing seasons after fire. Decline of annual forbs and limited response of perennial forbs were attributed chiefly to interspecific competition from cheatgrass (Young and Evans 1978). The authors inferred that fire in lowland communities with cheatgrass altered dynamics of plant succession, promoted dominance of cheatgrass, and reduced survival of species intolerant of cheatgrass competition.

Peek et al. (1979) examined responses of vegetation for one year before and three years following September prescribed burns on seven study sites located within sloping terrain that comprised winter range of bighorn sheep and mule deer in east central Idaho. Frequency of perennial forbs showed no significant change after fire. Significant increases in frequency of annual forbs the second year post-fire was probably a consequence of above-average fall precipitation and not burning.

insert table III-4

Wambolt and Payne (1986) assessed basal cover and reproduction of perennial forbs and production of annual forbs for ten years after five treatments (September) of Wyoming big sagebrush/bluebunch wheatgrass in southwestern Montana. Cover of perennial forbs was significantly greater 6-14 years after burning compared with cover on control plots. Burns yielded more cover of perennial forbs than all other modification techniques, including spraying, plowing, roto-cutting, and rest from grazing (control).

Blaisdell (1953) and Harniss and Murray (1973) evaluated forb production 1, 3, 15, and 30 years after light, moderate, and severe fires were conducted in mountain big sagebrush/grass during late summer in southeastern Idaho (Table 9). Net effects were as follows:

(1) Forbs were most productive on sites subject to light burns (consumption of 1-hour woody sagebrush fuels) and moderate burns (consumption of 10-hour woody sagebrush fuels), and;

(2) Forbs maintained significantly greater productivity for 15 years after burning in one area and for 12 years on severe burns (consumption of 100-hour woody sagebrush fuels) in another area. Thirty years after burning, forbs were still slightly more productive on the severely burned site.

Response in forb yield was evaluated one and three years after August burning, spraying, roto-beating, railing, and chaining in a mountain big sagebrush/grass habitat in southeastern Idaho (Mueggler and Blaisdell 1958). Forb production increased on all treatments and years except on the spray plot. Three years after treatment, forb production increased 61% on burned plots, 50% on beat plots, and 20% on railed plots, and declined 39% on sprayed plots.

Blaisdell et al. (1982) reported forb response after April prescribed fires in mountain big sagebrush/grass habitat in southeastern Idaho. Forb production declined 43% in the first growing season, but almost tripled in the second growing season after fire.

Effects of spring burning were studied in mountain big sagebrush habitats in Montana by Nimer and Payne (1978). Forb basal cover slightly increased after low severity fires and significantly decreased after high severity fires. Regressions of basal cover against sampling date revealed that forbs initiated growth later, and maintained cover and green growth longer on burned than unburned study plots.

Pyle (1993) examined short-term (two years post-fire) response on mountain big sagebrush/bitterbrush communities to low and moderate severity spring and fall prescribed burns in southeastern Oregon. Forb response was characterized by a non-significant slight to moderate decline in cover and frequency during the first growing season with magnitude of change related to severity of fire. During the second season, however, annual and perennial forbs increased significantly in cover and frequency on spring and fall burned sites. Among individual taxa, cover of blue-eyed Mary increased significantly the second year after spring burning and Cichorieae (taxa of the dandelion tribe) frequency increased significantly the second year after fall burning.

Long-term (1-90 years) succession after fire was evaluated in 21 pinyon-juniper stands in Nevada and California by Koniak (1985). Collectively, cover of annual forbs was significantly greater on (1) drier south and west aspects, and (2) during early stages of succession. Cover of perennial forbs significantly differed between early, mid, and late succession stages on wetter slopes. Overall, cover of annual and perennial forbs appeared to diminish as succession progressed from early to later stages.

Long-term (2-36 years) succession after fire also was assessed for habitats dominated by big sagebrush/Utah juniper in southeastern Idaho (Humphrey 1984). Cover and richness of perennial forbs were inversely related to shrub cover and time since a location had burned. Average cover of perennial forbs increased for ten years after burning, then progressively declined.

General response of forbs to fire is summarized in Table III-4.

Effects on Graminoids
Grasses, rushes and sedges (i.e., graminoids) are a critical component of the shrubsteppe ecosystem. They serve many functions including cover and forage for wildlife; a fuel component that determines the occurrence, intensity and rate of fire spread; sources of litter and soil development; and management indicators of site potential (i.e., ecological condition). Outcomes of plant succession after fire are regulated primarily by the amount and type of graminoids and shrubs that occur on a site. Initial responses of grasses determines (1) the ability of a site to resist invasion of alien grasses over the course of fire-induced succession, (2) the rate of succession by shrubs, and (3) the amount of shrubs that will occur in late-successional communities (provided that the site is not re-burned or grazed intensively by livestock). Consequently, restoration of ecological condition, wildlife habitat, and ecosystem health depends substantially upon the amount of perennial graminoids in the post-burn community (Anderson 1982, Blaisdell et as. 1982, Winward 1991, USFWS 1994).

A diversity of native graminoids and alien grasses occur on Sheldon-Hart Mountain Refuges. Response of graminoids to prescribed fire is related to three key factors: (1) species composition, (2) ecological condition, and (3) fire severity.

Species Composition
Response of graminoids to fire is related to life history and growth form characteristics (Wright et al. 1979). Classes include (1) annuals, (2) rhizomatous perennials, and (3) tap-rooted perennials (Table III-5). Occurrence of taxa within classes is associated with variation in environmental factor gradients and site potential across the Refuge landscape. Introduced annuals, for example, occur mainly in association with Wyoming big sagebrush and salt desert shrub vegetation types with mesic and frigid soils and average annual precipitation of <30 cm (12 in.) per year. Rhizomatous perennials constitute a larger group of species. Collectively, they are associated primarily with upland and wetland sites with deep soils (typically mollisols) and high annual soil moisture levels (USSCS 1993). They are a dominant component of meadows on both Refuges (Ibid).

insert Table III-5

As a class, tap-rooted perennial grasses comprise a diversity of species which occupy the full range of environmental settings on the Refuges (Table III-5). The class consists mainly of perennial bunchgrass taxa which characterize the "steppe" component of shrubsteppe. Examples include widely distributed, ecologically prominent taxa in uplands such as bluebunch wheatgrass and Idaho fescue (Winward 1980, USSCS 1993). Conversely, Nevada bluegrass and squirreltail are important species in upland and wetland vegetation types (Ibid). Among taxa with tap-roots, diversity of composition generally increases on a gradient of increased soil moisture (USSCS 1993). For example, upland and dry meadow sites of lower elevations support fewer species than upland and dry meadow sites of higher elevations (Ibid).

The goal of fire management, in part, is to increase dominance of perennial graminoids on sites in good condition, restore perennial graminoids on sites in poor-fair ecological condition, and limit increase in cheatgrass distribution and abundance on all sites (USFWS 1994). Cheatgrass, an introduced annual, poses a major challenge to long-term management of salt desert shrub, Wyoming big sagebrush, and frigid-soil mountain big sagebrush types (Young and Evans 1973, Young et al. 1976, Evans et al. 1978, Young and Evans 1978, USSCS 1993). The challenge consists of maintenance and restoration of native plant communities where cheatgrass occurs (Evans and Young 1978). Substantial reduction in shrub cover by wildland fire, prescribed fire, or other means can vastly increase cheatgrass abundance and distribution, which can result in long-term degradation of site ecological condition and management potential (Young and Evans 1978, Young et al. 1976, Evans and Young 1978). Currently, a majority of acreage of these vegetation types is classified as being in poor-fair ecological condition characterized by (1) presence of cheatgrass, (2) low abundance of perennial grasses, and (3) excessive amounts of shrubs (USFWS 1994).

Although cheatgrass is widely distributed on the Refuges, its abundance is limited on many sites because vegetation is in a late succession shrub-dominated state where sagebrush is the main factor regulating the amount of annual and perennial grass in the understory (Young et al. 1976, Laycock 1991, USFWS 1994). This situation has resulted largely from direct suppression of fire, indirect suppression of fire with livestock grazing (e.g., in mountain big sagebrush), reduction in fire spread due to depleted grass supplies on sites in poor to fair ecological condition, and the low incidence and area of vegetation types of the desert shrub biome affected by wildland fire and prescribed fire (Kauffman 1990, USFWS 1994, Gruell 1995).

The threat of increased cheatgrass abundance and distribution is well documented for plant communities which occur in arid zones of the intermountain region (Evans and Young 1973, Young et al. 1976, Young and Evans 1978, Bunting et al. 1987). Additionally, results from these reports are consistent with field observations of response of vegetation to wildland fire and prescribed fire on the Refuges (Refuge files). For example, an August, 1985 wildland fire expanded distribution and vastly increased cover of cheatgrass in low sagebrush (<5% to 40% in 10 years after burning) and mountain big sagebrush sites (<5% to 25% in 10 years after burning) at Hart Mountain NAR (Chart III-6)(Refuge files). Reduction in ecological condition on this wildland fire site was attributed mainly to the interaction of several factors including presence of a cheatgrass seed source, poor to fair ecological condition of pre-burn communities, and extreme loadings of shrubby fuels fostering severe burns resulting in high bunchgrass mortality (Refuge files).

On another site, a prescribed burn was conducted in Wyoming big sagebrush in fair ecological condition at Hart Mountain NAR in August, 1985 (Refuge files). Field observations disclosed a substantial increase in cover of grass (mainly cheatgrass) during the first ten years post-fire (Ibid). It is uncertain whether native perennial grasses will increase on this site with the advance of succession and the absence of further disturbance (B. Kauffman, per. commun.). Contrastingly, cheatgrass has not substantially increased in distribution and abundance on ten Wyoming big sagebrush sites (Rodero and Badger Creek) burned with prescribed fire at Sheldon NWR (Refuge files). This response is attributed mainly to an interaction between soil type and the occurrence and abundance of cheatgrass in the seed pool (Young and Evans 1973). Although these burned sites were considered representative of fair condition Wyoming big sagebrush, soil composition differed substantially (e.g., lighter-textured) compared with the wildland fire site burned at Hart Mountain NAR (Refuge files). Additionally, pre-burn sampling indicated that there was more uniform distribution of cheatgrass on the burn site at Hart Mountain NAR as compared to the burn sites at Sheldon NWR (Refuge files).

Chart Table III-6

The previous discussion discloses the importance of cheatgrass as a management factor. In summary, the presence of cheatgrass has increased the uncertainty of successional outcomes in vegetation types that characterize the desert shrub biome (Young and Evans 1973, USFWS 1994). Because fire management can control the distribution and severity of prescribed fire, it is suggested that prescribed fire be used to restore and maintain ecological condition (USFWS 1994). However, success of restoration will depend, particularly on desert biome sites, on intensive management and seeding of grasses immediately after fire to establish perennial grass in sufficient amounts to limit cheatgrass abundance (Evans et al. 1978, USFWS 1994).

Fire response of perennial grasses relates to several factors including the vigor of individual plants, fire severity, growth form, and season of burning (Wright et al. 1979, Wright 1985). Vigorous plants have a higher probability of survival after fire than plants of low vigor (Conrad and Poulton 1966, Bunting et al. 1987). The greater the fire severity, which is related to season of burning, the more complete the consumption of the graminoid, and the higher the probability of survival (Wright and Klemmedson 1965, Britton et al. 1990). Mode of rooting and type of leaf morphology are two growth form characteristics that differ among species and result in differential response to fire (Rowe 1983, Wright et al. 1979, Wright 1985). Collectively, species with rhizomes (e.g., Nebraska sedge, creeping wildrye) interconnecting plants demonstrate high survival after fire, which contributes to their prominence in early succession communities (Rowe 1983, Wright 1985).

Perennial graminoids with taproots are influenced differentially based on differences in leaf morphology (Wright 1985). Fine-leaved species such as Idaho fescue show greater consumption and higher mortality compared to coarse-leaved species like squirreltail (Ibid). Field observations indicated that although most mature plants of fine- and coarse-leaved species survive fires of low to moderate severity, and fires of higher severity result in increased difference in mortality, with higher survival among coarse-leaved species (Refuge files). Although the technical literature largely indicates that species such as Idaho fescue and Thurber's needlegrass are fire-sensitive (Young and Evans 1978, Wright et al. 1979, Wright 1985), few studies have compared mortality of these species among fires of different severity under field conditions (Sapsis 1990). Monitoring data collected by refuge staff indicates that most mature Idaho fescue and Thurber's needlegrass plants not only survive fires of low to moderate severity, but also increase in abundance during early succession after burning, particularly where cheatgrass is not present in the pre-burn community (Refuge files).

Ecological Condition

Ecological condition differs within and among vegetation types of the Refuges (USFWS 1994). Poor-fair ecological conditions are characteristic of most late successional vegetation types in uplands (Ibid). In riparian areas, erosion, channel deformation, and lowering of water tables has resulted in decline in prevalence of poor-fair ecological conditions on alluvial floodplains of low gradient (Ibid). On most sites, response of vegetation to wildland fire and prescribed fire is closely associated with ecological condition of the site prior to burning, factors such as cheatgrass occurrence notwithstanding (Bunting et al. 1987).

Vegetation types with tall shrubs support higher fuel loadings than those with low shrubs and grass (Anderson 1982, Bunting et al. 1987). Consequently, tall shrub types are subjected to higher fireline intensities than low shrub types when they burn (Anderson 1982, Brown 1982, Bunting et al. 1987). Upland sites in poor-fair ecological condition may burn more intensely and severely than sites in good-excellent condition because of the greater prevalence of woody fuels on poor-fair condition sites and the more extreme fire behavior required for fire spread (Bunting et al. 1987). Survival of perennial herbaceous species, including bunchgrasses, is usually inversely related to fire severity (Blaisdell 1953, Wright 1985).

Field observations by Refuge staff indicate that fire type (wild vs. prescribed) and fire severity (moderate vs. high) can determine the difference between long-term restoration or degradation of site potential on sites in poor, fair, and good ecological condition (Refuge files). For example, response of perennial grasses and ecological condition differed between 2 wildland fires that occurred in sagebrush/bitterbrush of the same ecological condition, but slightly different geographic position (Ibid). Twenty-two years post-burn, ecological condition increased and a vigorous stand of perennial grasses and shrubs dominated 1 wildland fire site. At the other site, ecological condition declined after burning, resulting in a stand dominated by a mixture of cheatgrass, perennial grasses, and shrubs (Chart III-6). The difference in response is attributed to difference in fire severity as influenced by season of burning and fire weather (Refuge files). The implications of these observations are that the difference between success and failure in management of fire on some degraded sites with high fuel loadings is related to the ability to control fire severity (and season of burning) with prescribed fire (Wright 1985, Bunting et al. 1987, USFWS 1994).

Mountain big sagebrush on cryic soils is an exception to the example that response of a vegetation type to fire is related to site ecological condition (Refuge files, USSCS 1993). These sites, which occur above 1981m. (6500 ft.) (USSCS 1993), typically increase in ecological condition after burning no matter what the condition of the pre-burn site was (at least for the range of conditions represented on the Refuges)(Refuge files). This consistent response is based on observations collected on a large variety of mountain big sagebrush sites subject to prescribed fire and wildland fire at Hart Mountain NAR in different seasons and years.

Fire Severity

Grass species are differentially influenced by the heat outputs associated with different fire types

(Anderson 1982, Wright and Klemmedson 1965, Wright 1985). Given equal fuel loadings, fireline intensity and severity can be manipulated in a prescribed burn by selection of certain weather conditions during burning (e.g., light vs. moderate wind), alteration of ignition methods (e.g., handfiring vs. helitorch), and type of fire (e.g., backing fire vs. head fire). Backing fires are generally more severe due to increased residence time (Wright 1974, Brown 1982, Sapsis 1990).

Effects on Shrubs

Knowledge of shrub response to fire is essential for understanding the dynamics of vegetation types, which is the focus of Refuge and fire management goals and objectives (USFWS 1994). The goal of maintenance and restoration of native plant communities seeks to strike a balance between (1) the amount of shrubs and herbaceous species within late successional vegetation types and (2) relative proportions of different succession stages dominated by shrubs, herbs, or mixtures of both within and among vegetation types (Thomas et al. 1976b, Winward 1991, USFWS 1994). Because shrubs can dominate community interactions of uplands (Laycock 1991), fire management objectives usually specify reduction of shrub cover as a principal prescription objective (Bunting et al. 1987). For example, substantial reduction of sagebrush biomass, cover, and density on sagebrush-dominated sites induces successional response by herbaceous species (Wright et al. 1979, Bunting et al. 1987).

A diversity of shrub species occur on the Refuges. Species include those which potentially dominate biomass and cover on a site, and, consequentially, biomes and vegetation types are named for their cover and aspect dominance during late successional stages (e.g., mountain big sagebrush within the shrub-grassland biome) (Winward 1980, Blaisdell and Holmgren 1984, USFWS 1994). Other species assume sub-dominant status in terms of biomass, cover, and density within plant communities (Blaisdell et al. 1982, Young 1983, Blaisdell and Holmgren 1984). These species function as a component of biodiversity and wildlife habitat, however, they do not assume the same importance in regulation of community interactions and succession dynamics (Young 1983). Knowledge of species response is sufficient to generalize response patterns for the majority of shrub species which occur on the Refuges. The following discussion focuses on the 3 primary factors which influence response of shrub species to fire including: (1) life history traits; (2) site ecological condition; and (3) fire severity.

Life History Traits

There are 3 primary life history strategies exhibited among shrub species which determine their response to fire and their successional role in plant communities of the Refuges. The 3 strategies consist of (1) persistence on a site via resprouting after fire; (2) resprouting and establishment from seed after fire; and (3) establishment from seed (Table III-7).

The majority of shrub species which occur on the Refuges respond to fire by resprouting, and resprouting and seeding. Because these species are present after burning and reproduce soon thereafter, the post-burn response is characterized by an increase in their cover and density (Humphrey 1984). As a group, obligate resprouters are represented by species which occur over that range of Refuge environments including uplands and wetlands (USFWS 1994). Those which occur in riparian zones (e.g., willow, currant, rose) have the greatest similarity of response, based primarily on field observations after wildland fire and prescribed fire (Refuge files). In uplands, the amount of resprouting shrubs in the post-burn community is largely determined by site ecological condition and, consequently, density of shrubs in the pre-burn community. Sites below 1829m. (6000 ft.) in poor-fair ecological condition typically have a greater proportion of resprouting shrubs (i.e., rabbitbrush) compared to sites in good-excellent condition (USSCS 1993, Refuge files). A few years after fire, resprouting shrubs increase in cover and assume cover dominance during early to mid successional stages (Humphrey 1984, Refuge files). The magnitude of cover increase is related primarily to shrub density in the pre-burn community and fire severity (Bunting et al. 1987).

Another class of species reestablish by resprouting and/or development from seed to maintain and increase cover on burned sites. Fire severity tends to differentially influence mortality because species differ in susceptibility to damage from heat, based on the location of root crowns which house the living tissue required for plant regeneration and resprouting (Rowe 1983, Humphrey 1984). As a consequence, shrubs which resprout facultatively can be subdivided in groups based on the overall tendency for mature plants to survive fire (Table III-7). Species such as snowbrush ceanothus demonstrate a high rate of resprouting and widespread establishment from seed (e.g., germination is induced by heat stratification)(Noste 1985). Contrastingly, species such as bitterbrush usually exhibit high mortality and a weak resprouting response (Bunting et al. 1987, Pyle 1993). Amount of bitterbrush mortality is related to fire severity and fuel loading (Bunting et al. 1987). Mortality decreases as fuel loading and fire severity are reduced. Bitterbrush on burned sites on the Refuges apparently maintains its populations primarily through establishment from seed, which develops from caches which survive fire and are established on burned sites after transport from unburned sites (Bunting et al. 1987, Pyle 1993). Because bitterbrush seed is readily killed by fire, response of bitterbrush to fire depends heavily on fire severity, characteristics of the seed pool, and growing conditions after burning (Bunting et al. 1987). Consequently, bitterbrush seldom constitutes a conspicuous element of early and mid successional stages after fire on sites where plants establish mainly from seed (Bunting et al. 1987, Refuge files).

A limited number of shrub species respond to fire completely by establishment from seed. Response of this group is best characterized by sagebrush species that occur in uplands (Winward 1980, Young 1983). None of the woody species which occur on the Refuges demonstrate any propensity for resprouting, except silver sagebrush (Ibid).

Although seed is generally plentiful on sites prior to fire, most is killed by fire when sites burn (Wright et al. 1979, Young 1983). Colonization and establishment of plants on burned sites therefore requires that seeds be transported by wind from adjacent unburned sites (Humphrey 1984). Consequently, amount of seed, rate of sagebrush establishment, and sagebrush densities on burned sites are related to the burn size and pattern, and densities of sagebrush adjacent to burned sites as it affects colonization of the burned site by sagebrush (Johnson and payne 1968, Bunting et al. 1987).

Establishment and survival of seedling shrubs is heavily influenced by environmental conditions such as annual soil moisture (Young 1983, Bunting et al, 1987). Hence, Wyoming big sagebrush tends to establish at slower rates on burned sites compared to mountain big sagebrush due to lower annual soil moisture availability, and therefore favor plant establishment and survival less consistently (Kauffman 1990, USSCS 1993). Field observations on multiple burn sites in mountain big sagebrush are consistent with observations reported in the technical literature (Refuge files). Although sagebrush were killed by fire, sagebrush seedlings were readily observed on burned sites by the 2nd and 3rd years post-fire (Refuge files).

Ecological Condition

Ecological condition describes the status of vegetative condition in terms of plant composition and structure (RISC 1983). It is a key parameter for management as it discloses the ratio of shrubs to understory herbaceous species, which is used to determine ecological status of a site (Blaisdell et al. 1982, RISC 1983, Bunting et al. 1987). For example, upland and wetland sites in good-excellent condition are quite diverse (Blaisdell et al. 1982, Blaisdell and Holmgren 1984, Kovalshick 1987). Biomass, cover, and density of shrubs and herbaceous species occur in relative ecological balance; competition between shrubs and understory species occurs and is maintained at low levels (Laycock 1991, Winward 1991). On upland sites in poor-fair condition the balance has shifted, favoring ecological dominance of species, typically sagebrush or cheatgrass, which competitively exclude other plants, typically native herbaceous species (Evans and Young 1973, Winward 1991). Competitive exclusion of native herbaceous species by shrubs, mainly sagebrush, was identified as a core resource management problem at Hart Mountain NAR because a large proportion of ecological sites and types are in poor-fair ecological condition (USFWS 1994).

Ecological condition affects shrub response to fire (Bunting et al. 1987). On burned sites, shrub establishment after burning is facilitated where ecological condition is poor-fair due to general depletion of competitive herbaceous plants, an artifact of ecological condition, not fire (Ibid). Conversely, shrub establishment is inhibited on burned sites in good-excellent condition due to competition with herbaceous plants (Blaisdell et al. 1982, Bunting et al. 1987).

Pyle (Refuge files) examined 10-year response of mountain big sagebrush/bitterbrush to wildland fire at Hart Mountain NAR. Rate of shrub establishment and level of shrub cover were inversely related to cover of perennial grasses on sites in fair-good ecological condition, but positively related to cover of cheatgrass on sites in poor-fair condition (Chart III-6). Monitoring data collected since 1990 on prescribed burn sites at Hart Mountain NAR also demonstrated a consistent inverse relationship between rate of shrub establishment and cover of native perennial grasses (Refuge files). The exception to this pattern apparently occurs in mountain big sagebrush at high elevations (e.g., the top of Hart Mountain) where burned sites show a uniform response of increase in native grasses and slow establishment of sagebrush, ecological condition of site notwithstanding (Ibid). Rate of shrub establishment on such sites appears governed mainly by (1) amount of residual live seed that survives burning; (2) distance of the burned site from a sagebrush seed source, which affects dispersal and; (3) densities of sagebrush on unburned sites that act as a seed source, which influences the amount of seed available for dispersal (Johnson and Payne 1968, Young 1983, Bunting et al. 1987).

Historic decline in ecological condition of mountain big sagebrush sites excluded from fire has resulted in increased densities of sagebrush and increased amount of sagebrush seed available for dispersal into burned sites (USFWS 1994, Gruell 1995). Consequently, the rate of sagebrush establishment has perhaps increased and the duration of herbaceous dominance has diminished on burned sites due to the increased amount of sagebrush dispersing from unburned to burned sites.

Fire Severity

Fire severity interacts with site ecological condition to influence outcome of secondary succession after fire (Blaisdell 1953, Harniss and Murray 1973). On big sagebrush sites there exists an apparent threshold where fire severity determines the difference between advance or decline in ecological condition based on differential influence in post-fire plant community composition (Laycock 1991). For example, fire of low severity may result in an increase in ecological condition of sites in poor-fair condition (e.g. high shrub biomass, low bunchgrass biomass)(Bunting et al. 1987, J. Holechek, pers. commun.). However, a high severity fire on the same site may result in reduction of ecological condition, and increased rate of shrub establishment due to reduced bunchgrass competition (Young 1983, Bunting et al. 1987, Refuge files). Such a fire severity threshold apparently occurs in mountain big sagebrush and mountain big sagebrush/bitterbrush sites on frigid soils, which are classified as poor-fair ecological condition at Hart Mountain NAR (USSCS 1993, USFWS 1994, Refuge files).

Comparison of successional responses of vegetation to separate fires on 2 sites of similar ecological condition (i.e., poor-fair) at Hart Mountain revealed that occurrence of low severity fire on one site resulted in maintenance of native vegetation, dominated by native herbs during early succession, and slow establishment of shrubs (Refuge files). High severity fire on the other site resulted in rapid reestablishment and increase of shrubs, high mortality of native grasses, and increase in cheatgrass (Chart III-6, Refuge files). The same interaction between fire severity and ecological condition apparently occurs in Wyoming big sagebrush where ecological conditions range from poor to fair at Hart Mountain NAR and cheatgrass occurs in the seed pool (Evans and Young 1973, USFWS 1994, Refuge files).

Effects on Trees

Collectively, deciduous and conifer woodlands and forests comprise only 1% of the land area at Sheldon NWR (USFWS 1994, Refuge files). The woodlands and forest, primarily aspen, juniper, mountain mahogany and ponderosa pine, occur in the more productive environments of higher elevations where they afford food and cover for a diversity of wildlife species, and serve as a key source of biological and ecosystem diversity (Mewaldt 1982, USFWS 1994, Dobkin 1995). The following section reports on the influence of fire exclusion in the ecology of principal tree species, and discusses factors associated with plant responses to fire.

Fire Exclusion

The effects of fire on trees of the Refuge cannot be fully considered without evaluation of the effects of fire exclusion. An assessment of the historical influence of fire disclosed that most woodland and forest environments of the Refuges have undergone profound change in abundance and distribution as a result of intensive livestock grazing and fire exclusion since Euro-American settlement (Vale 1975, Pyle 1991, Gruell 1995). For example, average tree size has increased but total stand area has declined in aspen forests due to fire exclusion (Kauffman 1990, Gruell 1995). Western juniper has increased in density; new stands have established in a wide variety of shrubsteppe sites, which formerly had few trees because surface and stand replacement fires kept sites mostly devoid of trees (Dealy et al. 1978, Gruell 1995). Gruell (1995) reported an average fire return interval of 13 years for the period 1760-1860 in ponderosa pine at Hart Mountain NAR. The dramatic increase in the size and area occupied by pine stands was attributed mainly to fire exclusion after 1860 (Gruell 1995).

Role of Fire in Western Juniper

Fire is the principal factor which historically regulated abundance and distribution of western juniper (Dealy et al. 1978). Historically, western juniper woodlands were subject to 2 main fire regimes (Young and Evans 1981, Wright et al. 1979, Gruell 1995). Frequent low intensity surface fires characterized the fire regime in juniper/low sagebrush savannah, and infrequent (>250 years) high intensity stand replacement fires characterized the fire regime in woodland with big sagebrush in tree interspaces (Young and Evans 1981, Gruell 1995). The low incidence of fire in old-growth is attributed to (1) the presence of natural barriers such as rock outcrops, which restricted fire spread and (2) the occurrence of shallow soils and associated plant cover dominated by herbaceous graminoids and low shrubs, which supported low intensity surface fires, fostering survival of old trees and maintenance of juniper savannah characterized by low tree densities (Ibid).

Tall shrub (i.e., big sagebrush) sites without natural fire breaks typically burned at shorter intervals (e.g. 10-30 years in mountain big sagebrush)(Burkhardt and Tisdale 1976). Due to the relatively thin bark of juniper, it usually is readily killed by moderately intense fire (Wright et al. 1979). Exclusion of fire has resulted in increased juniper densities in savannah, converting some to woodlands, and the establishment of new woodlands on many big sagebrush sites which were historically unoccupied by juniper (Burkhardt and Tisdale 1976, Young and Evans 1981). Consequently, fire regimes which once characterized juniper have changed due to higher tree densities on low and tall shrub sites (Gruell 1995).

Rate of establishment of juniper is diminished on burned sites due to juniper's inability to resprout, and its slow rate of seed dispersal (compared to species such as aspen with wind-dispersed seeds). Dissemination of seeds is regulated by tree density and use of juniper sites by berry-feeding birds (ODFW 1994). Rate of seed dispersal is apparently affected not only by birds but by the distance between burned and unburned stands (Gruell 1995). Historical analysis of photos revealed that establishment and development of juniper at both Refuges is associated mainly with burned site proximity to unburned old-growth stands and time since the last fire (Gruell 1985).

Increase in juniper density on big sagebrush sites can reduce understory shrubs, grasses, and forbs where juniper has exceeded a threshold density of trees, which differs among ecological sites (Dealy et al. 1978, Wright et al. 1979, Laycock 1991, Vaitkus and Eddleman 1991). Visual aspect of such sites, which occur on both refuges, consists of forest more than woodland (Wright et al. 1979). Expected fire regime on these sites is that of infrequent, high intensity stand-replacement fires (Ibid). This differs substantially from the historic fire regime (e.g., moderately intense stand-replacement fire involving shrub/grass fuels) that resulted in long-term juniper exclusion, maintenance of site potential, and retention of native forb, grass, and shrub species (Burkhardt and Tisdale 1976, Gruell 1995). On altered sites encroached by juniper, fire can result in site retrogression, including soil erosion and increased abundance of exotic grasses, due to depletion of mature perennial herbs (Evans 1988, L. Eddleman, pers. commun.).

Role of Fire in Quaking Aspen
Short-term response of aspen to fire has been described for the northern Rocky Mountains, but descriptions of response in the northern Great Basin are lacking (Kauffman 1990). Fire ecology description provided in this section is primarily based on results from study of aspen in the northern Rocky Mountains. Initial results of monitoring burned aspen sites at Hart Mountain NAR are discussed.

Like juniper, aspen is readily killed by fire, due to the absence of protective mechanisms such as thick cork (Jones and DeByle 1985). Unlike juniper, aspen resprouts after the mature boles are killed by fire (Brown 1985, Brown and Simmerman 1986). Killing of the bole apparently alters the hormone balance of the tree, destroys apical dominance in the bole, and releases formerly suppressed root buds for vegetative growth (Schier 1975, Schier et al. 1985). In addition to vegetative growth after fire, aspen responds to fire by establishment of new trees from seed (Jones and DeByle 1985).

Severity of fire and vigor of aspen clones are additional factors determining vegetative response to fire (Schier 1975, Schier and Campbell 1978, Brown 1985). Sucker density is greatest after moderate intensity fires in which all trees of a clone are killed (Brown 1985). Fewer suckers regenerate after fires of low or high severity (Schier and Campbell 1978, Brown 1985), indexable by relative amounts of fuels consumed by time-lag class and char characteristics on the soil surface (Ryan and Noste 1985). Sucker density appears inversely related to stand vigor (Brown 1985, Brown and Simmerman 1986). Decadent clones comprised of few trees produce fewer suckers after fire than do healthy ones (Ibid). Additionally, monitoring results from burned aspen sites at Hart Mountain NAR indicate that regeneration of decadent stands after fire is limited if any mature trees survive (Refuge files). This response is attributed to continued inhibition of suckers by maintenance of apical dominance in the live tree (Schier et al. 1985).

Aspen seed is viable for a very limited time period and requires a moist mineral substrate for establishment (McDonough 1985). Periodic establishment of new stands is probably related to establishment of seedlings on suitable mineral substrates (Ibid), which increase in availability during the initial years after fire (Jones and DeByle 1985). Although aspen periodically reestablishes from seed, most stands appear to be maintained by vegetative regeneration from root suckers (Jones and DeByle 1985, Schier et al. 1985), which is consistent with results of monitoring of burned aspen sites at Hart Mountain NAR (Refuge files).

Technical information and site monitoring results indicate a fairly consistent initial response of vegetative reproduction by aspen after fire (Schier and Campbell 1978, Brown 1985, Brown and Simmerman 1986, Refuge files). The long-term outcome of succession after fire is less understood (Bartos and Mueggler 1981, Mueggler 1988), particularly in the northwestern Great Basin (Kauffman 1990). Herbivory by insects and ungulates, including mule deer, elk, and domestic livestock, can regulate survival and growth of young aspen stands (Bartos and Mueggler 1981, DeByle 1985c). Technical reports and field observations by Refuge staff indicate that stand extinction is possible where burned stands are subject to intensive grazing (by wildlife or livestock) in the initial years after fire (Bartos and Mueggler 1981, DeByle 1985c, USFWS 1994). Highest probability of extinction occurs where herbivory is concentrated in small, isolated burned stands of low-moderate vigor which occur on sideslopes of mountain valleys (Bartos and Mueggler 1981, Refuge files). Influence of herbivory on regenerating aspen can be reduced by direct manipulation of herbivore numbers (e.g., big game hunting, control of livestock distribution) and indirect control of animal use (e.g., reduction of big game cover by burning large blocks)(DeByle 1985c, USFWS 1994).

Role of Fire in Ponderosa Pine

The predominant historical fire regime in ponderosa pine is that of frequent, low intensity surface fires (Kilgore 1981). Gruell (1995) reported an average return interval of 13 years for the period 1760-1860 at Blue Sky, Hart Mountain NAR, which is consistent with those reported for other sites in the Pacific Northwest (Biswell 1972, Hall 1990). Although high intensity surface fires did occur, frequency was less because short interval surface fires maintained low overall fuel levels and tree densities, compared to higher contemporary levels and densities (Parsons and DeBenedetti 1979, Hall 1990).

Since Euro-American settlement, fire regimes in pine have altered dramatically due to changes in vegetal composition and fuel characteristics associated with a policy of fire exclusion (Kauffman 1992). Changes in fuel characteristics include increased density of pine, encroachment by other conifers such as western juniper into pine stands, increase in shrubs on sites adjacent to pine stands, and litter increase under pines (Kilgore 1981, Hall 1990, Kauffman 1992, Gruell 1995). Changes in vegetal composition in and adjacent to the pines of Hart Mountain NAR are consistent with changes at the regional level (Hall 1990, Kauffman 1992, Gruell 1995). Consequently, changes in vegetal composition have influenced potential fire regimes and fire effects in pine (Biswell 1972, Parsons and DeBenedetti 1979, Hall 1990, Kauffman 1992, Gruell 1995).

Pine is described as a fire-adapted species (Biswell 1972). Mature trees with thick corky bark are well adapted for survival of low intensity surface fires (Kilgore 1981, Hall 1990, Kauffman 1992). This fire regime also increases the rate of seed establishment on mineral substrates (Biswell 1972, Hall 1990, Kauffman 1992). Young trees are readily killed by surface fire either by direct consumption or by radiant heat (Kauffman and Martin 1989, Hall 1990). Changes in fire regimes during the historic period have increased mortality of mature pine because surface fires are more intense and stand-replacement events more frequent (Hall 1990, Kauffman 1992). Whereas increased intensity of surface fires is attributed to increase in litter and duff, increase in stand replacement events is attributed to increased density of pine and associated species (e.g., western juniper) which facilitate spread of fire from ground to crown, and crown to crown (Biswell 1972, Parsons and DeBenedetti 1979, Kauffman 1992). Additionally, probability of stand-replacement events is increased and facilitated by conversion of fuels adjacent to pine stands (Parsons and DeBenedetti 1979, Kauffman 1992). At Hart Mountain NAR, fuels adjacent to pine have changed from grass to shrub and tree dominated over the last 130 years (Gruell 1995).

Effects on Wildlife

Fire and climate are the principal ecological processes influencing succession and progression in vegetation types, and thus, the main factors determining quantity and quality of wildlife habitat (Gruell

1986, Kauffman 1990, Leonard et al. 1992, Gruell 1995). General influences of fire on wildlife habitat include alteration of vegetation structure (i.e., habitat structure), plant species composition (i.e., habitat composition), plant diversity (i.e., species, community, and landscape diversity), and forage quality and quantity. Since Euro-American settlement, habitat conditions changed in response to several interacting factors including fire exclusion, livestock grazing, and introduction of alien grasses and forbs (Blaisdell et al. 1982, Kovalchik 1987, Kauffman 1990, Laycock 1991). Reports indicate that these same factors determined historic and current habitat conditions of the Refuges (Deming 1961, Pyle 1991, USFWS 1994, Gruell 1995). The scope of this review is limited to discussion of several taxonomic categories including selected featured species (i.e., pronghorn, bighorn sheep, sage grouse) and wildlife community diversity.

Effects on Pronghorn

Although pronghorn habitats were historically subject to periodic fire (Gruell 1995), few reports discuss pronghorn response to fire. The bulk of this limited knowledge consists of observations of pronghorn use in and adjacent to wildland fire sites (Deming 1961, Yoakum 1980). For example, increase in fawn ratios was attributed to effects of a wildland fire in low sagebrush in Drakes Flat, Oregon (Deming 1961). Pronghorn use appeared to increase after fire reduced shrub and tree cover, and increased grass and forb cover in Long Valley, California (Yoakum 1980) and Abert Rim, Oregon (Deming 1961). At Hart Mountain NAR, monthly surveys of antelope distribution during 1991-1993 disclosed consistent use of a 4450ha. (11,000ac.) wildland fire site during fall and winter where fall rains had occurred and winter snowpack was light (Pyle and Yoakum 1994), but it was not determined if the burned site was used selectively.

No study has examined the response of pronghorn to prescribed fire in the northern Great Basin, despite concensus among wildlife professionals that it may serve as a key management method for native summer range in the northern Great Basin (Pyle and Smith 1990, USFWS 1994, Pyle and Yoakum 1994). This assumption is based on the premise that key pronghorn habitats historically burned on a periodic basis (Gruell 1995), forbs increased in abundance after burning in mesic vegetation (Bunting et al. 1987), response by forbs occurred consistently in key pronghorn habitats where pronghorn summer (Pyle and Smith 1990), and pronghorn subsisted primarily on forbs on summer ranges (Yoakum 1990).

Despite limited information, biologists generally concur that prescribed fire has high potential as a tool for improvement of pronghorn foraging, fawning, and fawn-rearing habitat on summer ranges (Deming 1961, Kindschy et al. 1982, O'Gara and Yoakum 1992, USFWS 1994, Pyle and Yoakum 1994). Where, when, how much and how often to apply fire depend on many factors including habitat type, fuel loads, type of animal use associated with a habitat, and risk of escape (Bunting et al. 1987). Objectives for burning any area should be evaluated in light of the following questions (Deming 1961, Kindschy et al. 1982, O'Gara and Yoakum 1992):

(1) History of pronghorn use associated with habitats?
(2) Key forbs represented in understory?
(3) Shrub canopy cover > 20%?
(4) Shrub height > or < than 76 cm (30 in.)?
(5) Cheatgrass a dominant understory component?
(6) Western juniper encroachment on site?
(7) >75% probability that ecological condition will be maintained or increased after treatment?

Pronghorn spend most of the year associated with upland sagebrush habitats, particularly low sagebrush (Pyle and Yoakum 1994). Reduced availability of low sagebrush is not a limiting factor of winter and summer ranges at Hart Mountain NAR or Sheldon NWR as it is elsewhere (Deming 1961, Deming 1963, Pyle 1991, USFWS 1994, Refuge files). However, availability of high quality supplies of forbs and browse possibly are limited (Pyle and Yoakum 1994, J. Holechek, pers. commun.). Nonetheless, the need for retention of patches of sagebrush cover wherever manipulations in winter habitat are planned cannot be overstated (O'Gara and Yoakum 1992).

Evaluation of prescribed fire in pronghorn habitat should be based on response of foods and creation of habitat interspersion (Deming 1961, Salwasser 1982, O'Gara and Yoakum 1992). Generally, large burns which maximize interspersion or juxtaposition of habitats are most consistent with requirements of pronghorn and other wildlife, including sage grouse (e.g., linear strips). Otherwise, area of burned patches within a burn site should seldom exceed 250-405 ha. or 617-1000 ac. (Salwasser 1982, Kindschy et al. 1982), although this guideline has not been empirically tested. For the overall treatment area, sagebrush-dominated cover should be retained in 5-25% of the area (Kindschy et al. 1982, Salwasser 1982).

Effects on Bighorn Sheep
Information on the effects of prescribed fire on bighorn sheep is based on evaluation of the Rocky Mountain subspecies which differs somewhat from the California subspecies with respect to geographic distribution and habitat use. No study has evaluated the relationship between fire and the California subspecies which occurs on and adjacent to the Refuges. The assumption that fire will increase productivity and population size based on (1) the tendency of fire to increase preferred habitat, generally consisting of open, grass-dominated habitats insterspersed with cliffs and rock outcrops (Geist 1971, Risenhoover and Bailey 1985); and (2) dietary preference for grasses and forbs (Hansen 1982). Because general forage requirements correspond between regions (Peek et al. 1979, Hansen 1982), information from study of fire in Rocky Mountain bighorn habitat was used in this review of fire in California bighorn sheep habitat where similarity exists in habitat composition within the Ranges. Also included are field observations of California bighorn use of burned sites made by Refuge staff.

Reports indicate that bighorn selectively use burned sites for foraging (Peek et al. 1979, Bentz and Woodward 1985, Arnett 1990). Peek et al. (1979) attributed differences in use of burned and unburned Wyoming big sagebrush/bluebunch wheatgrass winter range to increased production and palatability of grasses, primarily bluebunch wheatgrass. Bentz and Woodward (1985) reported that increased bighorn use of burned sites was related to increase in quality of herbaceous plants and reduction of trees. Wakelyn (1987) compared habitat characteristics among 36 populations in Colorado, concluding that decline and extinction of 17 populations was associated with long-term reduction in fire frequency and succession-induced changes in grasses (decline), shrubs (increase), and trees (increase). Arnett (1990) examined habitat and dietary selection of bighorn on burned and unburned mountain big sagebrush/bluebunch sites in Colorado. He found that bighorn selectively used burned sites in fall, winter, and spring, but not in summer. Difference in habitat use was associated with difference in dietary quality, being higher in crude protein and lower in fiber on burned sites vs. unburned sites in fall, winter, and spring.

On the Refuges, intensive sheep use has been observed on summer-fall range between July and October 1-3 years after prescribed burning of low sagebrush and big sagebrush on south Hart Mountain (Refuge files). Similar behavior was observed on year-round range after a 1984 wildland fire occurred on north McGee Mountain, Sheldon NWR (B. Reiswig, pers. commun.).

Burning can improve production and palatability of key grasses for bighorn (Blaisdell 1953, Willms et al. 1981, Patton et al. 1988, Wamboldt and Payne 1986, Cook et al. 1994), initiate earlier growth of grasses in spring (Klebenow 1985, Peek et al. 1979), and maintain green growth longer in summer (Nimer and Payne 1978, Cook et al. 1994) compared with unburned sites. Hobbs and Spowart (1984) and Arnett (1990) found an increase in dietary protein of sheep feeding on a burned big sagebrush/bluebunch wheatgrass site.

Burning shrubs on bighorn winter range may reduce competition from deer by promoting grasses and reducing shrubs which deer feed on (Peek et al. 1979).

Bighorn are associated with grass-dominated habitats (Geist 1971). Grassland areas in the northwest Great Basin increasingly are encroached by shrubs and western juniper due to livestock overgrazing and fire exclusion (Graf 1971, Gruell 1995). Prescribed fire can reduce tree and sagebrush cover, and increase grass and forb cover (Wright et al. 1979, Bunting et al. 1987). On bighorn ranges, burning is usually the least expensive and most efficient habitat improvement method (Peek et al. 1979). Natural fire breaks and slope can facilitate use and control of fire (Graf 1971, Wakelyn 1987, Arnett 1990).

Because grasses and forbs comprise key forage of bighorns, habitat management should stress maintenance or increased abundance and quality of these forage classes (Peek et al. 1979, Hansen 1982). Fire management and site burn plans should identify limiting habitat factors, describe objectives, and discuss expectations of wildlife response (Peek et al. 1979). Habitat composition and bighorn use are negatively affected where fire diminishes abundance of perennial grasses and reduces site ecological condition (Peek et al. 1979, Blaisdell et al. 1982).

Fire planning considerations on bighorn range include:

(1) Pre-burn abundance and condition of food species (Peek et al. 1979). Minimal response can be expected of native forbs and grasses from burning of range in poor-fair ecological condition (e.g., where site supports predominately cheatgrass and sagebrush).

(2) Response of food species to fire (Arnett 1990). Magnitude of sheep response will be related in part to short-term change in forage quality and long-term change in species composition (i.e., increase in perennial grasses and forbs on sagebrush and juniper dominated sites)(Blaisdell et al. 1982, Arnett 1990).

(3) Burns less than 1.6 km. (1 mi.) from escape terrain will receive more use (Arnett 1990). Burn sites proximate to large cliffs and rock outcrops will facilitate use by ewes (Ibid).

(4) Burn areas with cover of young juniper (>25%) or tall shrubs (>60cm.)(24in.) to create increased security from predators and to facilitate habitat use (Peek et al. 1979, Wakelyn 1987).

(5) Location of burn sites in relation to key seasonal habitats (Arnett 1990). Key components include south slopes and ridges in winter; habitats proximate to lambing cliffs and lamb-rearing areas (i.e., drainages) in spring and early summer; and north slopes and high elevation escarpment ridges during summer-fall (Van Dyke et al. 1983, Seip and Bunnel 1985, Payer 1992).

(6) Limiting factors:

(a) Burned sites which disperse population will likely reduce lungworm incidence (Peek et al. 1979).
(b) Burns may attract forage competitors such as deer and elk. Interspersion of burned and unburned areas may reduce competition by offering foraging alternatives to sympatric ungulates (Peek et al. 1979, Spowart and Hobbs 1985).

(7) Pattern and size of burn:

(a) Magnitude of influence of fire on bighorns is related to the increase of key forbs and grasses, and duration of increased forage availability among key habitats (Peek et al. 1979, Cook et al. 1994).
(b) Maintenance of interspersion of burned and unburned habitat is not a large concern with sheep habitat. Requirements of other wildlife species need to be evaluated, however, with respect to interspersion of burned and unburned habitat (USFWS 1994).
(c) No minimum or maximum limit has been established for burning on bighorn ranges. Size and pattern of individual burns is determined primarily by choice of firing technique, fuels, fire weather and topography (Brown 1982, Bunting et al. 1987).

Effects on Sage Grouse
Although habitat requirements of sage grouse are well understood, no study has examined population response to fire of the western subspecies (C. u. phaios) whose range includes Washington, Oregon, California, and Nevada (Aldrich 1963). Consequently, recommendations for increased use of prescribed fire to improve habitat condition and increase populations are based on reports describing historic habitat conditions and fire regimes (Kauffman 1990, Gruell 1995), knowledge of current habitat conditions and successional processes (Blaisdell et al. 1982, Winward 1991), understanding of the species' requirements for a mixture of habitat components (Gregg et al. 1994, Drut et al. 1994), and inference of fire effects on habitat and bird population status (Klebenow 1972, Crawford et al. 1992, Pyle 1993).

The assumption that fire can improve habitat condition **and** improve population size must be critically evaluated because, to date, such a relationship has not been demonstrated (Crawford et al. 1992, Drut 1994). Contrastingly, many studies have indicated that reduction of sagebrush can adversely impact sage grouse (Braun et al. 1976). Such information has tended to substantiate concerns of some biologists about potential negative impacts of fire in sage grouse habitat (Autenrieth et al. 1982, Willis et al. 1993). However, this concern is based mainly on lack of information, poorly-designed, short-term research, and widespread supposition that sage grouse respond to fire as they do to large-scale application of 2,4-D (Braun et al. 1977, Call and Maser 1985).

Apparently, periodic fire was associated with the maintenance of sagebrush ecosystems and sage grouse habitats (Klebenow 1972, Kauffman 1990, Gruell 1995). Historically, fire return intervals differed among sites, ranging from 15-75 years in colder, wetter communities of mountain big sagebrush to >75 years in warmer, drier communities of Wyoming big sagebrush (Wright et al. 1979, Kauffman 1990). Apparently, increased densities of western juniper in Oregon and Idaho are related to fire exclusion from low sagebrush and mountain big sagebrush communities (Burkhardt and Tisdale 1976, Shinn 1980, Young and Evans 1981, Gruell 1995). To date, research has focused mainly on the effects of fire on spring and summer habitat of sage grouse.

Fire can differentially affect spring habitat of sage grouse. Establishment of new leks after wildland fire was reported where availability of open sites for use as leks was limited by the size and density of Wyoming big sagebrush (Connelly et al. 1981, Gates 1985). A similar response was observed after prescribed burning of Wyoming big sagebrush at Hart Mountain NAR (Refuge files). This lek occurs in a 1.6km. (1mi.) by 30m. (100ft.) burned strip and is dominated by cheatgrass. Since establishment the year after burning, peak annual attendance ranged from 40-50 males/year between 1986-1994 (Refuge files). Duration of use of burned sites for leks is undetermined, however, it is likely related to rate and density of big sagebrush reestablishment. The effect of fire on nesting habitat has not been tested. However, it is known that some sites burned 25-40 years ago currently are valued as nesting habitat (J. Connelly, pers.

commun.). At Hart Mountain NAR, 2 sites historically subject to fire (1958, 1972) are now considered optimal for nesting use due to the balanced mix of sagebrush and perennial grasses (M. Gregg, pers. commun.). Use of prescribed burning to restore nesting habitat has been advocated but not tested(Crawford et al. 1992, Drut 1994, USFWS 1994).

Key factors of summer habitat include availability of key forbs and concealment cover for broods (Klebenow 1969, Martin 1970, Drut et al. 1994). Studies of fire effects are limited to evaluation of response of upland habitats, mainly mountain big sagebrush (Klebenow 1969, Martin 1970, Pyle 1993). Response of forbs and cover in uplands is determined by many factors including species composition in the pre-burn community (Bunting et al. 1987), fire severity (Blaisdell et al. 1982, Martin 1970, Pyle 1993), and land use after burning (Wright et al. 1979, Bunting et al. 1987). Type and magnitude of response differs among key foods used by hens during the pre-laying period, and those used by hens and broods during the brood-rearing period (Pyle 1993, Barnett and Crawford 1994). Key forbs which exhibited consistent significant short-term increases in abundance (i.e., cover, frequency, or production) after burning included yarrow and mountain dandelion (Countryman and Cornelius 1957, Nimer and Payne 1977, Martin 1970, Pyle 1993). Although response to fire of other key taxa varied among studies, no significant declines were reported after the 1st year post-burn (Blaisdell 1953, Martin 1970, Pyle 1993). Martin (1970) compared concealment cover among brood locations and found significantly greater cover on burned sites than unburned sites.

Evaluation of technical literature implies that prescribed fire can be used to create leks (Gates 1985), and restore cover of bunchgrasses and key forbs in habitats used for nesting and brood-rearing (Martin 1970, Crawford et al. 1992, Pyle 1993, Drut 1994, USFWS 1994). Primary habitats with high potential for improvement of sage grouse habitat with prescribed fire include mountain big sagebrush, low sagebrush, and meadows encroached by sagebrush. Objectives of burn plans and prescriptions need to be tailored to accommodate the range of site-specific seasonal requirements of sage grouse. Objectives for burning should be evaluated in light of the following questions (Blaisdell et al. 1982, Autenrieth et al. 1982, Mangan and Autenrieth 1985, Call and Maser 1985, Young and Evans 1978, Pyle 1993, Drut et al. 1994):

(1) History of bird use on project sites (e.g., proximity to leks, winter or summer habitat)?
(2) Is it believed that existing habitat conditions limit sage grouse use of project site?
- (a) Cover of key forbs limited?
- (b) Bunchgrass cover limited by sagebrush cover (i.e., >12% in Wyoming big sagebrush; >25% in mountain big sagebrush)?
- (c) Tree cover (i.e., Juniper) increases probability of avian predation?

(3) Are the primary uses (e.g., nesting, brood-rearing) of project site described?
(4) Will site ecological condition be maintained or increased by burning (e.g., indicated by initial increase in native herbaceous species)?
(5) Will site ecological condition be degraded by burning (e.g., indicated by increase in cheatgrass)?

Sage grouse spend most of the year associated with upland sagebrush habitats. In all probability, the quantity of low sagebrush and Wyoming big sagebrush are not limiting factors on winter ranges of sage grouse at Hart Mountain NAR and Sheldon NWR (J. Crawford, pers. commun.). Availability is likely limited, however, of open sites in Wyoming big sagebrush for use as leks; cover of key food forbs in mountain big sagebrush, low sagebrush; and nesting cover comprised of tall grass mixed with sagebrush (Crawford et al. 1992, USFWS 1994). Evaluations of prescribed fires should be based upon evaluation of response of key habitat components including size and pattern of burned sites (Pyle 1993). Large burns with high rates of interspersion (e.g., 40-60% burned/unburned) apparently maximize cost-efficiency and are compatible with requirements of sage grouse and other wildlife species (Bunting et al. 1987, USFWS

1994).

Effects on Wildlife Diversity
The purpose of managing for wildlife species richness (i.e., community diversity) is to "maintain the highest possible number of wildlife species in viable populations" (Maser and Thomas 1983). Management for species richness requires information on what native wildlife occur on the Refuges, how they are associated with habitat, the status of those habitats, and how wildlife species respond to changes in habitat conditions (Maser et al. 1984a, 1984b). The recent Comprehensive Management Plan for Hart Mountain NAR prescribes the use of fire as a principal method for restoration and maintenance of wildlife diversity (USFWS 1994).

Evaluation of species richness for this plan involved development of a wildlife-habitat relationship model based on analysis of 31 wildlife habitats and 302 wildlife species which occur at Hart Mountain NAR (see USFWS 1994:152 for description of methods and Appendix K for list of species). Evaluation of model results indicate that wildlife species richness in upland vegetation types is highest where a mixture (i.e., mosaic) of succcession stages occur (Table III-8). For example, in a particular area in the Wyoming big sagebrush type, we might find approximately 27 species of wildlife using the area for feeding if the entire area is in a late, shrub-dominated stage of succession. Contrastingly, 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 36 species of wildlife consistently using the area for breeding purposes and 66 species consistently using the area for feeding purposes (Table III-8). This is because some species require grassland-like habitat, while others require grass-shrub or shrub-dominated habitat (Maser et al. 1984a, 1984b). Other species such as sage grouse require more than one stage of succession in a small area to satisfy seasonal and annual life history requirements (Crawford et al. 1992, Drut 1994).

At present, about 96% of the Wyoming big sagebrush vegetation type is in a late successional stage while only 2% is in an early stage at Sheldon NWR. The remaining 2% is in a very late successional stage, meaning it is dominated by sagebrush and juniper. Therefore, the vast majority of the Wyoming big sagebrush type supports a relatively small number of wildlife species relative to site potential. This assumes healthy conditions within successional stages (e.g., dominance by native species in all stages; balance of grass, forb, and shrub species in late succession stages). This assumption is not met, however, throughout most of the Refuge uplands due to 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" stage are actually higher than what currently exists.

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, 1979b, 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 is usually associated with sites where a diversity of vegetation types occurs in combination with a diversity of succession stages within vegetation types (Ibid). In regards to species richness, implications to fire management consist of the following considerations (USFWS 1994):

(1) Fire is the primary force which historically influenced the condition of upland vegetation types, portions of succession stages within upland vegetation types, and patterns of wildlife species richness

of uplands of the Refuges (Kauffman 1990, USFWS 1994, Gruell 1995).

(2) Evaluation of existing habitat conditions discloses that species richness is far below potential because late succession stages dominate uplands of the Refuges, and the predominance of ecological conditions within late succession stages is poor-fair (USFWS 1994).

(3) Prescribed fire and fire exclusion are the primary options available to Refuge managers for manipulation of habitat conditions (e.g., proportion of succession stages and wildlife species richness in vegetation types of the desert shrub, shrub-grassland, montane shrub, and conifer forest biomes (USFWS 1994).

(4) The amount and pattern of prescribed fire can determine the type and magnitude of response of wildlife species richness within vegetation types and across the Refuge landscape.

Magnitude of species richness response is directly related to the extent by which prescribed fire influences the total Refuge landscape (USFWS 1994). Initially, influence will be limited to the vicinity of a few burned sites. Ultimately, richness will be influenced on a landscape scale as the acreage of different succession stages is increasingly equalized (USFWS 1994). Burn pattern is important because burned sites with low interspersion may result in diminishing returns because dominance of 1 succession stage is replaced by dominance of another succession stage, which maintains reduced species richness (Thomas 1979b, USFWS 1994).

The pattern of species richness differs between upland and wetland habitats. In wetland, maximum richness of breeding and feeding species is usually associated with occurrence of late or very late stages of progression characterized by high availability of water and site dominance by native wetland vegetation (Table III-9). 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 diversity and habitat complexity in vegetation types comprised of woody-riparian shrubs and trees (Kovalchik 1987, Busse 1989, Schulz and Leninger 1991, Leonard et al. 1992). More species are accommodated in very late stages compared to early stages of progression (Hanley and Page 1981, Schulz and Leninger 1991, Dobkin 1994).

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 communities apparently are more biologically productive based on increased amount and stability of water supply (Thomas et al. 1979c, Kovalchik 1987, Leonard et al. 1992). Species richness in lake basins differs from riparian areas. Late stages of progression average more breeding and feeding species compared to early stages in povertyweed-primrose and rush-spikerush-arnica. Differences among vegetation types are associated with differences in water (i.e. flooding) regimes and associated dominant vegetation (Cowardin et al. 1979).

Fire can play a critical role in long-term maintenance of riparian habitat used by wildlife (Britton et al.

1980, Jones and DeByle 1985, Starkey 1985, Young 1986, USFWS 1994). Periodic fire is considered essential for long-term maintenance of the distribution and abundance of aspen in the intermountain West (Schier 1975, Brown 1985, 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 (Erlich et al. 1988). These taxa are reduced in the short-term where decadent aspen is burned, trees are windthrown, and canopy area of aspen is reduced (DeByle 1985a, Erlich et al. 1988). Although the value of a burned site is temporarily diminished for vireos and sapsuckers (Erlich et al. 1988), 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 and their populations would increase because fire stimulated development of a new aspen stand with a greater number of trees, canopy cover, and distributional extent compared with pre-treatment conditions (DeByle 1985a, 1985b).

In dry meadows, periodic burning may enhance forb growth and availability to herbivorous wildlife (Britton et al. 1980, DeBenedetti and Parsons 1984, Hargiss 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 is also 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-gound vegetation in emergent wetlands causes a short-term reduction of herbaceous cover available to wildlife (Cornely et al. 1983, Kantrud 1990). Probability of impact would be reduced by burning during fall and winter when plants are dormant and wildlife breeding uses minimal (Young 1986, USFWS 1994). 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 affects 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.

Summary and implications of species richness modeling to fire management include the following considerations:

(1) Climate and fire were the primary forces that historically influenced the condition of wetland vegetation types, proportions of succession stages within wetland vegetation types, and patterns of wildlife species richness of wetland of the Refuges (Kauffman 1990, USFWS 1994, Gruell 1995).

(2) In contrast to uplands, species richness is not maximized by maintenance of a mosaic of structural (i.e., progression) stages within vegetation type. Instead, richness is maximized in wetlands by maintenance of very late progression stages in riparian areas and maintenance of late progression stages in lake basins (USFWS 1994).

(3) Evaluation of current habitat conditions indicates that wetland habitats and species richness are in need of restoration to site potential (USFWS 1994).

(4) Prescribed burning, rest from livestock use, and water manipulations are the primary options available to Refuge managers for manipulation of habitat conditions (e.g., proportion of progression stages) and wildlife species richness in wetland vegetation types of the deciduous forest, riparian

shrub, and interior marshland biomes (USFWS 1994).

(5) Burning may influence site progression, expedite recovery of ecological condition (i.e., advance of progression), and increase species richness in degraded riparian areas of the deciduous forest, riparian shrub, and interior marshland biomes (USFWS 1994, Refuge files). Since 1985, fire managers have demonstrated consistent success with prescribed burning in restoration of (a) wetland herbaceous cover in degraded alluvial floodplain sites on Sheldon NWR and Hart Mountain NAR and (b) degraded aspen and willow riparian sites in V-shaped canyons.

(6) The effects of burning on species richness in late and very late progression stages in meadow and lake basins has not been evaluated. If it is assumed that burning at 5-10 year intervals increases short-term plant productivity (Britton et al., 1980), then species richness may exhibit a corresponding increase because requirements of wildlife are satisfied more consistently (Cornely et al., 1983, Young 1986). On the other hand, reduction in cover may initially reduce richness (i.e., small mammals) (Cornely et al., 1983).

APPENDIX P: STEP-UP PLAN

Staffing Class	Burning Index	Step-Up Action
SC-1	0-15	Normal tour of duty for fire crews. Open fires allowed on Refuges in campgrounds in fire pits only. Engine crews complete weekly engine checks. Engine crews begin daily in-service contacts to servicing dispatch offices.
SC-2	16-30	Same as SC-1. Engine crews begin daily engine checks.
SC-3	31-60	All fire suppression equipment maintained in a state of fire readiness. Fire crews are not to leave Refuges or be split during normal tours of duty unless FMO approves.
		FMO may override BI to SC-4 if significant human activity is anticipated. KBDI > 180 and LFM < 120% should also coincide with this decision.
		FMO may override BI to SC-4 without anticipation of significant human activity if KBDI >200 and LFM < 100.
		No open fires allowed and Refuge Manager will post signs. Visitors are required to carry shovels in all vehicles. To be enforced by Refuge LE Officers.
SC-4	61-78	Same as SC-3 with addition of:
		FMO may access emergency preparedness funds to extend staffing period of normal work day and week to cover burning period or forecasted lightning events where fire crew would normally be off shift.
		All redcarded Refuge employees will carry PPE and handtools in work vehicles.
		Fire crew may patrol Refuge campgrounds and
		major routes of visitor transportation.
		Aerial detection flights over Refuges should be incorporated into cooperator detection flights.
		Lists of issued Back Country Permits will be provided to FMO so that visitors in back country can be monitored in the event of a wildland fire.
		Refuge work projects involving heavy equipment such as road graders and/or welding at field sites will be monitored by Refuge Managers, and workers will take precautions against accidental ignitions. Fire crews with engines may be pre-positioned to mitigate accidental ignition hazard.
SC-5	79-114	All SC-4 actions as well as:
		Temporary closures may be imposed on sensitive areas of the Refuge at the discretion of the Refuge Manager.
		Cooperator engines may be pre-positioned on the Refuges if available.
		All redcarded employees may be required to work extended shifts and/or days off to augment initial attack forces during periods of forecasted lightning activity.
		The FMO may request that Refuge LE Officers patrol front country and back country areas to enforce open burning restrictions. These patrols may be extended beyond normal tours of duty and be paid for with preparedness funding.

APPENDIX Q: LIVE FUEL MOISTURE

MEASURING LIVE FUEL MOISTURE CONTENT ON SHELDON AND HART MT. REFUGES: STANDARD METHODS AND PROCEDURES.

INTRODUCTION:

Valuable information will be obtained from measuring live fuel moisture content on Sheldon and Hart Mt. Refuges. This information will be used in developing a data base for monitoring trends in evaluation of live fuel moisture. Live fuel moisture trends will assist planning of burn unit prescriptions and aid in determining the severity of wildland fires. Live fuels are more volatile in the dormant stage than the growing stage. Naturally occurring changes in the moisture content of live plants are associated with physiological events in their annual life cycles. Noting the occurrence of these events each time a live fuel sample is collected gives useful information for describing their flammability (Norum and Miller 1994).

TIME OF SAMPLING:

Fuel moisture samples will be collected at 1400 hrs. during spring and summer months, and at 1300 hrs. during fall and winter months. This is usually the warmest time of day for these seasons. Sample time will change accordingly with daylight savings in the spring and fall.

Weekly sampling for live fuel moisture is adequate for shrubs due to the slower changes in moisture level of these fuels. Samples should be collected prior to prescribed burn projects and during wildland fire season.

SAMPLE SITES:

Direct sampling of the fuels in the burn site is the best method, but may not be cost effective or convenient. For these reasons a representative site can be selected.

Choose sites that are similar in the range of condition, elevation, position, and resulting effects on live fuel moistures (LFM) representative of the Refuges.

Sample sites should be distributed between 4400 ft. and 8000 ft. Three site locations with easy access should be selected for standard systematic sampling of LFM. At each site two samples will be collected, each from a north and south aspect (when possible). Variations in topography and neighboring vegetation that might influence fuel moisture content should be sampled such as sites exposed to the elements or blocked from the wind and direct sunlight.

Specific project sampling for other species such as low sage should follow these same sampling procedures as a guideline to standardized LFM sampling.

COLLECTING THE SAMPLE:

On the field data sheet record the general location, observer, date of collection, bag #, site number, specific location, elevation, topography & aspect, species, time of collection and phenological state for each fuel sample to be collected.

Each sample will be collected from either basin big sage, Wyoming big sage, mountain big sage, or low sage, whichever occurs at each site. Do not mix different species in the same sample bag. Label each bag for species, aspect, site #, and bag #. Samples should be taken from the new shoots only, not woody material. This will consist of leaves and green stems.
When sampling, cut off the shoots from no less than three different shrubs of the same species at each site. This in itself will average the live fuel moisture content at each site and will give a more accurate representation of the LFM content.

Collect only the new small diameter stems and their associated leaves when sampling shrubs. Eliminate dead twigs with diseased or insect-infested leaves. Do not include flower buds, flowers, seed pods, or berries in any stage of development (Norum and Miller 1984).

Do not collect samples if water drops are present on leaves or stems. Free surface water will cause large errors in calculated values of moisture content (Norum and Miller 1984). If rain prevents collection of certain samples, write rain in the space where the bag number for these samples would be recorded and collect samples the next day.

Keep samples cool and dry until they are weighed. Store samples in a lunch cooler or refrigerator until they are processed. This will help prevent sample errors. If the collected samples receive even moderate heat, moisture will evaporate, escaping the bag or decomposition could begin, causing a loss in weight (Norum and Miller 1984).

CALCULATING MOISTURE CONTENT:

A Compu-Trac drying/weighing oven is located at the U.S. Fish and Wildlife Service fire cache on North H street in Lakeview for use in measuring LFM. This machine is expensive and fragile, so be sure to get an orientation from fire management staff before using.

GUIDELINES FOR OBTAINING MAXIMUM ACCURACY

1. Place the machine on a reasonably level surface with minimum vibration.

2. Allow 20 minutes after turning power on before making a high accuracy test.

3. When loading sample, distribute it evenly to keep pan level.

4. After sample is loaded, close door gently to avoid air currents and vibration.

5. Make sure that sample pan and inside of box are clean, dry and cool.

6. When running consecutive texts, allow machine to cool with door open for three minutes between tests.

7. Cook on "LOW" - it is slower but more accurate than "HI".

When weighing the samples be sure to cut the samples up into **5mm segments**, then add the material to the aluminum tray. **Be sure to record the final reading.**

CAUTION: When adding the material to the tray, be sure it is completely in the pan and not touching the heating element. **If material is touching the element or the sensor on the element**, it may burn the element out, so use with caution.

OPERATION

FIRST **-** Place sample pan on its holder in the heat chamber. Press "START", wait until the "Add Material" indicator light is illuminated, then:

SECOND **-** Begin adding sample material, taking care to keep the load evenly distributed within the sample tray, until the "Stop/Close Door" indicator glows, and the audible alarm sounds. This is a non-critical step, but if too large a sample has been loaded, the "Remove Material" indicator will glow until sufficient material has been removed.

THIRD **-** Close the top cover gently, observe that the "Test in Progress" lamp is illuminated and that the "Heat On" lamp glows occasionally. An actual or preliminary moisture estimate will be displayed in three or four minutes which is improved in accuracy at approximately one minute intervals, until the test is completed. The instrument automatically terminates the test cycle, and illuminates the "final" and "remove material" indicators and sounds an audible alarm to announce completion. The final moisture value display is retained until a new test is started.
For determining the moisture content of fuel or soil samples make sure that the "predicted/actual" switch is on "actual" for the complete test cycle.

Refer to the "FS 2 -A MOISTURE ANALYZER USER'S MANUAL" for further reference.

LITERATURE CITED

Norum, Rodney A.; Miller, Melanie. Measuring fuel moisture content in Alaska: standard methods and procedures. Gen.Tech.Rep. PNW-171. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station; 1994. 34 p.

Winward, A.H. 1980. Taxonomy and ecology of sagebrush in Oregon. Oregon St. Univ. Agric. Exp. Stn. Bull. No.642. Corvallis, OR. 15pp.

Insert LFM field data sheet

Insert LFM lab sheet

Discuss funding procedures (and that no mechanism in place to fund from annual fire monies).

APPENDIX R: REQUEST FOR CULTURAL RESOURCE COMPLIANCE

Request for Cultural Resource Compliance

U.S. Fish and Wildlife Service, Region 1

Appendix Determination	**Date rec'd by CRT:**
____________________	____________________

Project Name:					**Program:** (Partners, Refuges, JITW, WSECP, etc.)	
State: CA, ID, HI, NV, OR, WA		**EcoRegion:** CBE, IPE,KCE, NCE			**FWS Unit: Org Code:**	
Project Location:	**County**	**Township**	**Range**	**Section**	**FWS Contact:** Name, Tel#, Address	
USGS Quad:					**Date of Request:**	
Total project acres/linear ft/m:		**APE Acres / linear ft/m (if different)**			**Proposed Project Start Date:**	

MAPS Attached	**Check below**		
Copy of portion of USGS Quad with project area marked clearly **(required)**			Project (sketch) map showing Area of Potential Effect with locations of specific ground altering activities **(required)**
Photocopy of aerial photo showing location **(if available)**			Any other project plans, photographs, or drawings that may help CRT in making determination **(if available)**

Directions to Project: (if not obvious)	

Description of Undertaking:	Describe proposed project and means to facilitate (e.g., provide funds to revegetate 1 mile of riparian habitat, restore 250 acres of seasonal wetlands, and construct a 5-acre permanent pond). How is the project designed (e.g., install 2 miles of fence and create approximately 25' of 3' high check dam)?

Area of Potential Effects (APE):	Describe where disturbance of the ground will occur. What are the dimensions of the area to be disturbed? How deep will you excavate? How far apart are fenceposts? What method are you using to plant vegetation? Where will fill be obtained? Where will soil be dumped? What tools or equipment will be used? Are you replacing or repairing a structure? Will you be moving dirt in a relatively undisturbed area? Will the project reach below or beyond the limits of prior land disturbance? Differentiate between areas slated for earth movement vs. areas to be inundated only. Is the area to be inundated different from the area inundated today, in the recent past, or under natural conditions? Provide acres and/or linear ft/m for all elements of the project.
Environmental and Cultural Setting:	Briefly describe the environmental setting of the APE. **A)** What was the natural habitat prior to modifications, reclamation, agriculture, settlement? **B)** What is land-use history? When was it first settled, modified? How deep has it been cultivated, grazed, etc.? **C)** What is land use and habitat today? What natural agents (e.g., sedimentation, vegetation, inundation) or cultural agents (e.g., cultivation) might affect the ability to discover cultural resources? **D)** Do you (or does anybody else) know of cultural resources in or near the project area?

APPENDIX Q: TOOL ANALYSIS

MINIMUM REQUIREMENTS AND MINIMUM TOOL ANALYSIS
Fire Management Plan- Sheldon National Wildlife Refuge

Minimum Requirements Analysis

The basic components of fire management (prescribed fire and wildfire suppression) on Sheldon NWR are required on some or all portions of the refuge that were proposed to Congress in 1974 for addition to the national wilderness system under the Wilderness Act. The 1974 wilderness proposal included 8 separate segments of the refuge with a total acreage of 341,000 acres out of the refuge's total area of 575,000 acres.

Sheldon NWR has a nearly 100 year history of livestock grazing and complete fire suppression that has caused significant degradation of its native plant communities. Most areas of the refuge are now covered with relatively old and decadent shrub stands with relatively diminished grass component than occurred naturally. The management goals and objectives of Sheldon NWR are to manage the refuge as a representative area of the high-desert shrub-steppe ecosystem for optimum populations of native plants and animals. This management requires active restoration of most existing plant communities by actively setting back plant succession, often through prescribed fire. Beneficial restoration also requires suppression of wildfires that threaten to burn large areas under hazardous conditions that would produce undesirable plant succession and could threaten structures and people. The areas proposed for wilderness are generally those locations at higher elevations that have a greater concentration of woody fuels from shrubs and trees. For this reason they have a greater need for wildfire suppression because of a greater potential for out-of-control catastrophic fires, and they have a more frequent need for prescribed fire because they have a more frequent natural fire return interval.

If the Service is to meet the purpose of the refuge by restoring and maintaining its habitat as a representative of the high-desert shrub-steppe ecosystem, it will be necessary to carry out fire management (prescribed fire and wildfire suppression) within the proposed wilderness. It is also the Service's policy that natural ecosystems and natural ecological processes are a wilderness value that should be restored or preserved in proposed or designated wilderness on refuges. Clearly, carrying out fire management within the proposed wilderness on Sheldon NWR is the minimum requirement action because there are no less intrusive actions available that will accomplish the required ecosystem restoration within the proposed wilderness while providing the necessary safety and protection for structures and people both on and off the refuge.

During the 25 plus years since this wilderness proposal successive Refuge Managers have kept open a minimal number of "2-track" or trail roads into and through segments of the wilderness proposal because doing so did not further degrade the wilderness values of the land and because their use by motorized equipment was considered the minimum tool for safe accomplishment of activities essential to refuge objectives. Fire management is likely the single most important refuge management activity that requires use of these existing primitive roads within the proposed wilderness.

Minimum Tool Analysis for Fire Management Projects in Proposed Wilderness

Alternative methods of fire management:

1. Wildland fire use for resource benefit.

Under a fire use for resource benefit program there would be no prescribed fire in the portions of the refuge that are proposed for wilderness, and all wild fires would be allowed to burn as long as they remained within the proposed wilderness boundary. This method would best protect the roadless character and solitude of the proposed wilderness on refuges.

This program would not provide for a systematic and active restoration of refuge plant and animal communities and would therefore not meet refuge purposes or management objectives. This program also has the potential to allow fire to burn the refuges plant communities in ways that create large scale or long-term damage to both plants and animals. Finally, this program has the potential to allow wild fires to get out of control with catastrophic results that could threaten structures and/or people either on the refuge or off. If catastrophic wild fires occurred, this policy would not meet the Service's legal and policy requirements to protect people and structures.

2. Restricted fire management.

Under the existing restricted fire management program the plant communities on the refuge are being gradually and systematically restored through an active prescribed fire program. Under this prescribed fire program, fire is introduced in a controlled manner that allows burning of a planned area under prescribed conditions to set back the ecological succession of the plant communities involved. Because of the heavy woody fuel that is often involved in the proposed wilderness areas, prescribed fire requires use of rubber-tired engines, a rubber-tired tractor with a brush-beater, and chain saws to effectively and safely prepare and control the fire boundaries and to maintain safe burning rates. This method would create a significant but temporary intrusion into the wilderness and would contribute to maintaining the existing primitive roads in their current condition but would not further detract from the wilderness character of the land.

Under the existing restricted fire management program, wildland fires are suppressed if they occur under weather and fuel moisture conditions that would allow them to get out of control, threaten structures or people either on the refuge or off, or burn in ways that create large scale or long-term damage to the plant communities involved. Fire suppression under these conditions normally requires use of air tankers with retardant, helicopters dumping retardant or water, rubber-tired engines operating both on and off the existing two-track roads, and crews creating fire lines with hand tools. This method would create a significant but temporary intrusion into the wilderness and would contribute to maintaining the existing primitive roads in their current condition but would not further detract from the wilderness character of the land.

Restricted fire management, as described above, is selected as the minimum tool that would effectively meet the refuge purposes and goals to restore and maintain healthy and natural plant and animal communities while meeting legal and policy requirements for safety and protection of structures and people both on and off the refuge.

Approved:

Michael L. Nunn, date

Project Leader, Sheldon-Hart Mountain NWRC