Department of the Interior
US Fish and Wildlife Service
Little Pend Oreille National Wildlife Refuge
1310 Bear Creek Road
Colville, Washington 99114

HABITAT MANAGEMENT PLAN

June 2005

Habitat Management Plan
Little Pend Oreille National Wildlife Refuge
June 2005

Submitted by: _____
Lisa Langelier, Project Leader
Little Pend Oreille National Wildlife Refuge

Concurred by: _____ 6/27/05
Forrest Cameron, Refuge Supervisor
Region 1

Approved by: _____ 6/27/05
Carolyn Bohan, Regional Chief of the National Wildlife Refuge System
Region 1

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1.0 INTRODUCTION

1.1 Scope and Rationale

In April 2000, the U.S. Fish and Wildlife Service (FWS) published the Final Comprehensive Conservation Plan for Little Pend Oreille National Wildlife Refuge (US Fish and Wildlife Service 2000). In May 2000, the Record of Decision was signed and the Environmental Impact Statement (EIS) for the Little Pend Oreille National Wildlife Refuge (LPONWR) comprehensive conservation plan (CCP) was completed. As part of the planning and National Environmental Policy Act (NEPA) processes associated with the CCP, the FWS evaluated the effects of implementing a broad range of fish, wildlife, plant, and habitat management programs and techniques to achieve refuge purposes, goals, and objectives; address FWS trust resource responsibilities; maintain and, where appropriate, restore biological integrity, diversity, and environmental health; and support achievement of the National Wildlife Refuge System (NWRS) mission.

This habitat management plan (HMP), which is a refinement of the LPONWR CCP, provides more specific guidance for habitat management to support legal mandates as well as the conservation, management, and, where appropriate, restoration of local, regional, and ecosystem fish, wildlife, plant, and habitat resources. This plan was prepared in accordance with guidance for developing HMPs provided by the FWS' Habitat Management Plans policy (620 FW 1). It also complies with all applicable laws, regulations, and policies governing the management of units of the NWRS.

The lifespan of this HMP coincides with the LPONWR CCP. HMPs are peer reviewed and revised every five years as necessary. The refuge manager may modify the CCP and/or HMP at any time if new information suggests these plans are inadequate or refuge resources would benefit from changes.

The following guiding principles (620 FW 1) were used to develop this HMP:

- Use best available biological information and ecological principles to provide the foundation for developing habitat goals, objectives, and subsequent management strategies and prescriptions. The conservation and restoration where appropriate, of fish, wildlife, and plant populations depends upon the integration of biological information into management decisions.
- Derive habitat objectives and management strategies from refuge purposes and NWRS mission that provides the foundation to conserve and protect functional communities of native fish, wildlife and plants, and explicitly link international, national, regional, state, and ecosystem goals and objectives, as appropriate. Additionally, ensure HMP consistency with other conservation plans such as threatened and endangered species recovery plans, Service ecosystems plans, the North American Waterfowl Management Plan, state conservation plans, Partners-in-Flight (PIF) plans, and assist in attaining the goals and objectives of those conservation efforts to the extent practicable.

- Consider the opportunities, constraints, and/or limitations posed by existing special designations (e.g., research natural areas) when implementing management strategies to achieve habitat objectives.
- Consider the highest measure of biological integrity, diversity, and environmental health as those intact and self-sustaining habitats and wildlife populations that existed under historic conditions (see Biological Integrity, Diversity, and Environmental Health policy [601 FW 3]). Individual refuges contribute to biological integrity, diversity, and environmental health at larger landscape scales, especially when they support populations and habitats that have been lost at an ecosystem, national, or international scale. However, refuge purposes may compromise these components at larger landscape scales. When evaluating the appropriate direction for a refuge, the refuge manager should consider his/her refuge contribution at multiple landscape scales.
- Consider a range of habitat management strategies to meet specific wildlife or habitat management goals and objectives. To select appropriate strategies, consider the natural/historic frequency and timing of processes such as flooding, fires, and grazing by native herbivores. Where it is not appropriate or feasible to restore ecosystem function, refuge management strategies will mimic natural processes to the extent practicable.
- Use adaptive management to evaluate and modify management strategies to achieve habitat objectives. Monitoring will be used to evaluate if the management strategies and prescriptions achieve desired outcomes (i.e., refuge habitat and wildlife objectives).
- Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species utilizing integrated pest management approaches.
- Ensure that all refuge uses, including refuge management economic activities, that are a component of the HMP are determined compatible (see 602 FW 3), and all other compliance requirements have been met.

1.2 Legal Mandates

Statutory authority for FWS management and associated habitat management planning on units of the NWRS is derived from the National Wildlife Refuge System Administration Act of 1966 (Refuge Administration Act), which was significantly amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act, 16 U.S.C. 668dd-668ee). Section 4(a)(3) of the Refuge Improvement Act states, "With respect to the System [NWRS], it is the policy of the United States that – (A) each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that refuge was established…" The Refuge Improvement Act established the following mission for the NWRS, "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." The Refuge Improvement Act also states that the

"…purposes of the refuge and purposes for each refuge mean the purposes specified in or derived from law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit."

On May 2, 1939, 36,007 acres of land within northeastern Washington, which had been acquired by the Farm Security Administration and previously under Public Domain, was set aside as LPONWR by Executive Order No. 8104. LPONWR was established under this Executive Order "as a refuge and breeding ground for migratory birds and other wildlife..." Additional lands were added to LPONWR under authority of the Migratory Bird Conservation Act of 1929 (MBCA), "…for use as an inviolate sanctuary for migratory birds" Memorandum 11 from the Migratory Bird Conservation Commission meeting (September 24, 1940), which recommended the purchase of 1,041 acres for LPONWR under the MBCA, states that establishment history for its 40,000 acres under Executive Order 8104 as "…for the protection of the Pend Oreille white-tailed deer, Rocky Mountain mule deer, ruffed, blue, and Franklin's grouse, minks, muskrats, bears, beavers, and waterfowl. The several small lakes and potholes on the unit attract waterfowl during the migration period." In addition, Memoranda 23 (March 25, 1941) and 8 (October 31, 1945) from the Migratory Bird Conservation Commission meeting, which recommended the purchase of additional lands for LPONWR under the MBCA stated, "…enlarge the area [LPONWR] suitable for waterfowl." For lands acquired to expand an existing or create a new refuge unit or subunit, such areas assume the purpose(s) for establishment of the original refuge along with those specific to the new refuge unit or refuge subunit. However, the original refuge unit does not take on the purposes associated with the addition (Director's Order No. 132).

Throughout its early history after establishment, game species (especially white-tailed deer) received management emphasis on LPONWR and, consequently, they are considered as an important component of the "other wildlife" specified in the Executive Order that established the refuge. Rehabilitation of degraded wildlife habitats and protection of deer winter range were primary goals during early refuge years (US Fish and Wildlife Service 2000). Although white-tailed deer winter range and ultimately white-tailed deer populations may benefit from present and future management strategies, it is only one of many fish, wildlife, and plant species currently considered important to conserve on LPONWR.

The Refuge Administration Act, as amended, clearly establishes wildlife conservation as the core NWRS mission. House Report 105-106, accompanying the Refuge Improvement Act, states "…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first." In contrast to some other systems of federal lands which are managed on a sustained-yield basis for multiple uses, the NWRS is a primary-use network of lands and waters. First and foremost, refuges are managed for fish, wildlife, plants, and their habitats. In addition, units of the NWRS are legally closed to all public access and use, including economic uses, unless and until they are officially opened through an analytical, public process called the refuge compatibility process. With the exception of refuge management activities which are not

economic in nature, all other uses are subservient to the NWRS' primary wildlife management responsibility and they must be determined compatible before being authorized. For additional information regarding existing compatibility determinations for LPONWR, refer to its CCP (US Fish and Wildlife Service 2000). Also, refer to Appendix 1 of this plan for further discussion about the history, use, and evaluation of impacts associated with livestock grazing along with impacts associated with fire suppression and timber harvest on LPONWR and the surrounding landscape.

Section 4(a)(4)(B) of the Refuge Improvement Act states, "In administering the System, the Secretary shall…ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans…" This legislative mandate represents an additional directive to be followed while achieving refuge purposes and the NWRS mission. It requires the consideration and protection of a broad spectrum of fish, wildlife, plant, and habitat resources found on a refuge. FWS policy guiding implementation of this statutory requirement provides a refuge manager with an evaluation process to analyze his/her refuge and recommend the best management direction to prevent further degradation of environmental conditions; and, where appropriate, and in concert with refuge purposes and NWRS mission, to restore lost or severely degraded resource components. Within the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3[3.7B]), the relationships among biological integrity, diversity, and environmental health; NWRS mission; and refuge purposes are explained as follows, "…each refuge will be managed to fulfill refuge purpose(s) as well as to help fulfill the System mission, and we will accomplish these purpose(s) and our mission by ensuring that the biological integrity, diversity, and environmental health of each refuge are maintained, and where appropriate, restored."

The refuge manager is required to conduct the appropriate level of NEPA compliance and public involvement during the development of a HMP. Because this HMP merely provides more specificity for management strategies that were previously described and evaluated in the EIS developed for the CCP, no further NEPA documentation is required, as noted in the Environmental Action Statement appended to this plan (Appendix 2).

1.3 Relationship with Other Plans

This plan is based on the habitat objectives and strategies identified within the LPONWR CCP. As a step-down plan of the CCP, this HMP also provides specificity for the habitat objectives and prescriptions for habitat management strategies, including how, when, why, and where they will be implemented on refuge lands. This HMP also is consistent with LPONWR Fire Management Plan that was completed during 2001.

When the CCP was approved during 2000, it was consistent with the goals, objectives, and management strategies identified within the following plans and program documents:

- North American Waterfowl Management Plan
- Interior Columbia Basin Ecosystem Management Project (ICBEMP) Eastside Draft Environmental Impact Statement
- Washington State GAP Analysis Program

- Inland Native Fish Strategy (INFISH)
- State of Washington
    - Management Recommendations for Washington's Priority Habitats – Riparian
    - Management Recommendations for Washington's Priority Habitats and Species

This HMP considered the following plans and resource documents in addition to those used during development of the CCP:

- State of Washington
    - Management Recommendations for Washington's Priority Species – Volume III: Amphibians and Reptiles
    - Management Recommendations for Washington's Priority Species – Volume IV: Birds
    - Lynx habitat management plan for DNR managed lands
    - State of Washington Natural Heritage Plan
- Partners-in-Flight (PIF)
    - North American Landbird Conservation Plan
    - Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington
    - PIF Continental Priorities and Objectives Defined at the State and Bird Conservation Region Level: Washington
- The Nature Conservancy
    - Canadian Rocky Mountains Ecoregional Assessment Volume 1: Report

2.0 BACKGROUND

From 1879 until 1931, 188 homestead claims were patented within the LPONWR boundaries. For some claims, homesteaders may have been working for lumber and logging companies, staking claims, and then turning over the land to the company. Many settlers sold timber off their claims and kept title to the land after the timber was harvested. They established orchards, gardens, and pastures on many cleared claims. When the Depression hit in the 1930s, many homesteaders had already given up and moved from the area. The short growing season, harsh winters, and overgrazed conditions were factors that led to the Resettlement Administration classifying the land as sub-marginal. In 1935, most of the homesteads were acquired by the federal government from the private landowners as public lands for rehabilitation purposes. Much of the land purchased by the federal government in northeast Washington under the Resettlement Administration was transferred to the U.S. Forest Service (USFS) with about 40,000 acres earmarked for LPONWR.

From 1939 to mid-1965, the FWS managed LPONWR. Early management focused on restoring degraded conditions to improve habitat for white-tailed deer, fur bearing animals, upland game birds, waterfowl, and fish. Considerable effort went into planting a variety of shrubs and grasses to benefit wildlife, managing horse and cattle grazing, and

planting crops to feed deer and game birds. Management also involved igniting fires and selectively cutting forests to improve deer winter range.

In 1965, the Washington Department of Fish and Wildlife (WDFW formerly known as the Washington Department of Game) assumed management responsibility through a cooperative agreement with the US Fish and Wildlife Service. The FWS provided WDFW with a budget to manage LPONWR. WDFW had considerable latitude regarding management of the area. Their management of LPONWR focused primarily on game species and recreation. WDFW managed some acreage through farming; however, most of LPONWR was managed through selective timber harvest on a continual rotation basis to provide the "most benefits to wildlife," which included deer, forest grouse, snowshoe hare, bear, and game-farm pheasants. Most farming had ceased during the mid-1980s. From 1986 until 1994, no timber sales were undertaken.

As a result of an audit by the US General Accounting Office in 1992, FWS resumed on-site management at LPONWR during 1994.

2.1 Inventory and Description of Habitats

2.1.1 Location

LPONWR is located in northeastern Washington, about 70 miles north of Spokane, the State's second largest city (2003 population estimate – 431,027) (Figure 2.1). Colville, the Stevens County seat, is about 10 miles northwest of LPONWR; whereas, the town of Chewelah is about 15 miles south. More than 99% of LPONWR's 40,198 acres is in central-eastern Stevens County, Washington; approximately 21 acres are in adjacent Pend Oreille County. Stevens County has an estimated population of 40,776; whereas, Pend Oreille County has a population of 12,254.

2.1.2 Management units

Management units on LPONWR were based upon watershed boundaries (Figure 2.2). The following are the 11 management units (watersheds) that were used for this HMP: Moran Creek, Noman Creek, Lower Bear Creek, Durlan Springs, Starvation Lake, McDowell Lake, Bayley Lake, Upper Bear Creek, North Fork Bear Creek, Cedar Creek, and Olson. In some cases, management units include areas that are outside the watershed boundary (e.g., Bayley Lake). Habitat and cover types for LPONWR are depicted in Figures 2.2 and 2.3, respectively. Table 2.1 provides acreages of forest cover types (defined Table A4.1 in Appendix 4) on LPONWR that are illustrated in Figure 2.3. For descriptions of habitat types (e.g., dry, moist, and cold forest) presented in Figure 2.2 and Table 2.2, refer to Section 2.2.

Moran Creek

This management unit encompasses 2466.8 acres on the western edge of LPONWR. This unit includes 15.1 acres of alluvial riparian habitat. Its 2,293 forested acres are 71%

moist forest, 28% dry forest, and 1.2% cold forest. Generally, soils are glacially derived, coarse, well drained, and best suited as forestland. Drainages generally run from east to west providing a distinct contrast between the cool, moist northern aspects and the warmer, dryer south slopes. Elevations range from 2200 ft at Long Lake to 4885 ft at the summit of Addy Mountain. Its 500 acres of dry forest is characterized by numerous overstocked stands of second growth ponderosa pine interspersed with groups of older, larger overstory trees with a grass and sparse shrub understory of mixed species. Patches of regenerating ponderosa pine have been thinned to a 12 ft x 12 ft spacing. A total 1,022 acres of this management unit has been pre-commercially thinned beginning in 2001 and 630 acres prescribed burned since 2002.

The moist forest is mixed coniferous species dominating the northerly and easterly aspects as well as cooler wetter areas such as drainages and valleys. Most of the unit's moist forest is mid-seral stage (79%) with only 21% as old forest and <1% in early seral stage. The cold forest in this management unit only covers 27 acres (1.2%), which is located at the summit of Addy Mountain. Most of this forest is late succession that has been passively managed except for wildland fire suppression activities.

Other important features are Daily and Long Lakes, Moran and Slide Creeks, and two large and one small old fields totaling 50.7 acres. In addition, two old fields (7.3 and 20.3 acres) are currently under a special-use permit to an adjacent landowner for alfalfa cultivation. The permittee annually seeds the field (as needed), controls weeds, and harvests one cutting of alfalfa hay leaving subsequent growth for wildlife. The remaining old field (Happy Valley) includes widely scattered conifer trees, mixed grasses with some vetch as well as St John's wort and thistle. Mature aspen clones grow on the east and west end of the draw that runs through the middle of the field. Long-term annual grazing in this unit has resulted in heavy browsing of the aspen seedlings that has suppressed their growth.

Habitat and cover types for the Moran Creek Management Unit are depicted in Figures A3.1 and A3.2 (Appendix 3), respectively. Table A3.1 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.2.

Noman Creek

This management unit encompasses 3865.9 acres on the western side of LPONWR. It has 3,540 acres of forest that is 90% moist forest, 10% dry forest, and <1% cold forest. Generally, soils are derived from granitic and volcanic material and loess and tend to be coarse, well drained, and best suited as forestland. The primary characteristic of this unit (related to its predominance of moist forest) is its orientation with major drainages running south to north into the LPO River. This topography provides long slopes with northern exposures and relatively deep stream channels that lend themselves to the development of mixed species moist forests. Elevations range from 1840 ft at the Little Pend Oreille River to 4885 ft at the summit of Addy Mountain.

This management unit contains a small amount of dry forest consisting of mixed ponderosa pine and Douglas-fir. Approximately 345 acres of its dry forest has been pre-commercially thinned since 2000. An additional 463 acres of dry and moist forest within this unit has been prescribed burned since 2002. The cold forest type is insignificant on this unit.

This management unit includes approximately 51.0 acres contained in five old fields. These old fields are grazed annually. The dominant grass is brome with St. John's wort and mullein. Pine encroachment was thinned during 2001, but open field continues to be lost to trees. There are several aspen clones along the edges of the fields, but grazing and pine shading are suppressing their expansion. Snowberry thickets also indicate heavy livestock browsing. A few of the old fields are adjacent to Buffalo Wilson Road and an unnamed perennial stream that is fed by several natural springs. This unit includes 76.3 acres of alluvial riparian habitat, which has been impacted by livestock grazing (see Section 2.3.2).

Habitat and cover types for the Noman Creek Management Unit are depicted in Figures A3.3 and A3.4 (Appendix 3), respectively. Table A3.2 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.4.

Lower Bear Creek

This management unit encompasses 5137 acres. Its 4,309 forested acres include 82% moist forest, 18% dry forest, and >1% cold forest. Generally, soils are glacially derived, moderately to well drained, and best suited as forestland. In similarity with the Noman Creek Management Unit, slopes and drainages generally run south to north and the forest is characteristically moist. Elevations range from 2100 ft at the mouth of Bear Creek to 4885 ft at the summit of Addy Mountain.

This management unit's 503 acres of dry forest are characterized by a few overstocked stands of second growth ponderosa pine interspersed with groups of older, larger overstory trees with a grass and sparse shrub understory of mixed species. A significant amount of dry mixed forest (400 acres) was commercially cutover during the winter 2004-2005 to remove about 900,000 board ft of lodgepole pine sawlogs that developed during the last 70-80 years as a result of fire suppression. This management activity was done to reduce hazard fuel loads, pre-condition the unit for prescribed fire, and eliminate competition for the remaining old-growth component of dry forest.

Patches of regenerating ponderosa pine, lodgepole pine, and Douglas-fir have been thinned to a 12 ft x 12 ft spacing. A total of 380 acres within this unit has been pre-commercially thinned since 1998 and an additional 725 acres prescribed burned since 2000.

The moist forest within this management unit is dominated by mixed species in the mid-seral (78%) stage along with 16% old, mature forest and about 6% in early seral stage. The cold forest type occurs on 14 acres (>1%) located at the summit of Addy Mountain.

Most of the cold forest on the unit is late succession that will be left to further develop on its own. This forest type has been passively managed except for wildland fire suppression activities.

This management unit includes a complex of about 74.3 acres in 10 old fields and 61.3 acres of scattered natural meadows. These fields include several old homestead sites that have been annually grazed during June and July. These sites have unusually high vegetative diversity that likely is attributable to subirrigation. Most of the old fields are characterized by non-native cultivars like brome, timothy, orchard grass, Kentucky bluegrass, and clover. There is a large patch of sedge growing on a "perched" flat in one field where the soil type and moisture regime provides wetter conditions. Pine encroachment threatens to overrun several of these openings in coming years. The fields truncate the most extensive aspen stand on LPONWR. Cottonwoods, aspen, dogwood, and ferns along the west side of the North Berg Field indicate a moist site with good potential to encourage more hardwood development. Weeds dominate the forb component of these fields, particularly yellow hawkweed and sulfur cinquefoil.

Bear Creek runs through a substantial portion of the northern part of this unit and it provides important habitat to a variety of wildlife and plant species. The unit includes 208.8 acres of alluvial riparian habitat located adjacent to Bear Creek.

Habitat and cover types for the Lower Bear Creek Management Unit are depicted in Figures A3.5 and A3.6 (Appendix 3), respectively. Table A3.3 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.6.

Durlan Springs

This management unit encompasses 827.6 acres including 534 forested acres with a south/southwestern exposure. It is primarily dry forest (79%) with about 22% moist forest in east/west aligned draws and on a few northerly facing slopes. Generally, soils are glacially derived, coarse, well drained, and best suited as forestland. Drainages generally run from north to south through broad slopes of 25 to 30% providing ample warmer, drier growing sites. Elevations range from 2000 ft in the LPO River valley to 2700 ft along the north boundary of LPONWR. Its 500 acres of dry forest is composed of numerous overstocked stands of second-growth ponderosa pine interspersed with groups of older, larger overstory trees with a grass and sparse shrub understory of mixed species. There are patches of regenerating ponderosa pine which has been thinned to a 12 ft x 12 ft spacing on 400 acres of the unit since 2001. During 2004, the forested acres were commercially thinned to reduce tree competition by removing suppressed co-dominant and a few suppressed dominant trees. Since 2002, 400 acres have been prescribed burned, primarily by burning piled slash.

The moist forest on Durlan Springs is characterized by mixed conifer forests dominating the northerly and easterly aspects and in cooler wetter areas such as drainages and valleys. Most of this forest type exists as mid-seral stage (90%) along with 4% old,

mature forest and <6% in early seral stage. In contrast, the cold forest type does not occur on this unit.

The unit includes 67.9 acres in three old fields that flank the west side of the LPONWR headquarters. The two largest old fields are Chimney field (adjacent to the LPO River) and Chester field above LPONWR headquarters. The dominant vegetation on the upland areas of Chimney is American vetch, which likely is a direct response of burning. St. John's wort also occurs throughout this field and thistle forms thick patches in parts of the floodplain. Woody sprouts on some gravel point bars indicate limited passive alluvial riparian recovery.

Chester Field was subjected to long-term, annual livestock grazing that was discontinued during 1998. This old field included meadows on both sides of the LPO River. Prescribed fire was applied to the portion of the unit north of the river during March 2003. The 30-acre Chester Field is undergoing a two-year restoration project to convert it from a weed-dominated field to a mixture of native and introduced grasses and legumes. Treatments to date include the following: prescribed fire to reduce plant litter, disk harrowing to mechanically treat weeds and deplete the seed bank over the growing season, and spot spraying dalmation toadflax with herbicide. During spring 2005, Chester field will be disk harrowed, fertilized, planted with a cover crop, and followed by a late fall planting of a grass legume mix. This unit includes 17.7 acres of alluvial riparian habitat.

Habitat and cover types for the Durlan Springs Management Unit are depicted in Figures A3.7 and A3.8 (Appendix 3), respectively. Table A3.4 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.8.

Starvation Lake

This management unit encompasses 2852.3 acres including 2081 forested acres. Elevations range from 2200 ft in the southwest corner of the subwatershed at the LPO River to 2910 ft at the northeastern corner. It is largely low elevation with the majority of the LPONWR dry forest ponderosa pine located within this unit. It is dominated by dry forest (67%) with about 33% moist forest in east/west aligned draws and on a few northerly facing slopes. Generally, soils are derived from glacial outwash and granitic material; they tend to be coarse, well drained, and best suited as forestland. Drainages generally run from north to south across broad flats with little gradient that extends to the southern and eastern ends of the unit where the land falls sharply to the LPO River. These wide plains provide ample warm, dry, growing sites best suited for ponderosa pine. Remains of the old Winslow Logging Company railroad line pass through the unit and numerous large ponderosa pine stumps reveal the type of stand once existing here.

This management unit has recently been commercially and pre-commercially thinned to remove overstocking of smaller trees and increase ponderosa pine old growth habitat. This treatment consisted of manually thinning 781 acres and commercially removing 389,000 board ft of sawlogs and 655 tons of pulp of mixed ponderosa and lodgepole pine.

After treatment, the unit's 1395 acres of dry forest is composed of numerous even-aged groups of maturing ponderosa pine interspersed with regenerating stands in different age classes. Patches of regenerating ponderosa pine have been thinned to a 12 ft x 12 ft spacing on 990 acres of the unit beginning in 1998. Since 2001, 1175 acres have been prescribed burned.

The moist forest component of this management unit is mixed Douglas-fir and western larch occurring on favorable sites moderated by suitable moisture and aspect. Most of the moist forest type exists in a mid-seral stage (90%) along with 6% in old, mature and 4% in early seral stage. The cold forest type does not occur within this unit.

The unit includes 117.3 acres in seven fields. The largest old fields in this unit are Upper and Lower Manz, Log Barn, and Starvation Flats. The Log Barn Field is situated on the floodplain north of the LPO River and it is dominated by timothy with a mix of other grasses and forbs. Prescribed fire was applied to this field during 2000 and 2003. Lower Manz Field is adjacent to the LPO River and it probably was part of that river's floodplain before the river incised deeply enough that it could no longer access it. Brome and blue bunch wheatgrass are the dominant grasses and sedges of various species inhabiting about 35% of the field. St. John's wort also is dispersed throughout this old field. Pines are encroaching, especially on the north end. A small patch of Adder's Tongue (a state threatened plant) occurs in one of the wetter, sedge-dominated low spots. The Upper Manz Field is another old homestead site dominated by brome grass and vetch with a conspicuous amount of St. John's wort throughout the field. There are some scattered pines with little potential for aspen. Since 2000, the Starvation Flats Field has been rehabilitated by drilling grass seed and spraying for broadleaf weeds.

This unit includes 65.4 acres of alluvial riparian habitat that is adjacent to the LPO River.

Habitat and cover types for the Starvation Lake Management Unit are depicted in Figures A3.9 and A3.10 (Appendix 3), respectively. Table A3.5 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.10.

McDowell Lake

This management unit encompasses 4114.9 acres with 3415 forested acres. It is characterized by highly variable topography consisting of a series of wide benches separated by sharply rising complex slopes and deep draws with generally increasing elevation from west to east creating a nearly even split between dry and moist forest types. Elevations extend from 2230 ft at the LPO River in the western portion to 4166 ft at Blacktail Mountain Summit. The ridges formed by this topography are dry forest (44 %) on the flat, west and south aspects with moist forest (56 %) typically occurring on the north and east faces. Soils are derived from glacial till, volcanic ash, and loess with moderate to high permeability and numerous rock outcrops that are generally well suited for forestry applications. Drainages generally flow west and south with slopes >35%. The benches are flat or gently inclined that favor development of ponderosa pine stands.

In 2004, about 667 acres of this management unit were commercial and pre-commercial thinned to remove smaller trees and advance old growth dry forest habitat. The treatment consisted of manually thinning 200 acres of small stems and commercially removing 723,000 board ft of sawlogs and 620 tons of pulp of mixed conifer species. Prescribed burning was conducted during the spring and fall 2003. The unit's 1517 acres of dry forest currently are characterized by uneven-aged groups of mature ponderosa pine and stands of Douglas-fir in a variety age classes. There are patches of regenerating western larch, ponderosa pine, and lodgepole pine that have been thinned to a12 ft x 12 ft spacing on 316 acres of the unit beginning in 1998. Since 2001, 519 acres have been prescribed burned.

The moist forest component of the McDowell Lake Unit is mixed Douglas-fir, grand fir, and western larch; 84% of the moist forest is in mid-seral stage along with 13% old, mature forest and 3% in early seral stage. The cold forest type does not occur in this management unit.

The unit includes 178.9 acres in six old fields and approximately 18.4 acres of scattered natural meadows. The largest old fields are located within this unit and they include the three Christiansen farm fields, Sampson Orchard, Knutson Meadow, and the field west of Cottonwood Camp. The Christiansen farm fields are characterized by undesirable plants including knapweed, St. John's wort, cinquefoil, and mullein. Sampson Orchard and Knutson Meadow are dominated by smooth brome. Timothy, sedges and rushes, and other nonnative grasses and weeds (e.g., spotted knapweed, Canada thistle, St. John's wort, cinquefoil) dominate the Cottonwood Camp field.

This unit includes 41 acres of alluvial riparian habitat adjacent to the LPO River.

Habitat and cover types for the McDowell Lake Management Unit are depicted in Figures A3.11 and A3.12 (Appendix 3), respectively. Table A3.6 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.12.

Bayley Lake

This management unit is relatively small (426.8 acres) and it is divided into two distinct areas by a parcel of USFS land. Its 294 forested acres are 95% moist forest and 5% dry forest. The primary feature of this unit is water (15-acre Potter's Pond and 72-acre Bayley Lake) along with a series of beaver ponds all surrounded by sheer cliff walls and steep mountain slopes. The large trees along the shorelines provide perching and nesting habitat for bald eagles and other species of birds. There are no plans to actively manage these shoreline forests other than protection from wildland fire or human-derived damage and disturbance. Elevations range from 2360 ft in the beaver ponds of the southernmost portion to 2980 ft in the southeast corner of the Bayley Lake section. Soils are primarily histosols-deep, poorly drained soils typical of lakes and beaver ponds derived from organic and volcanic material. Drainages generally flow south.

The 16 acres of dry forest is confined to the northern portion of the unit mostly to the north and west of Potter's Pond and it is largely mid-seral stage (13 acres) Douglas-fir/ponderosa pine with a few solitary or groups of old, mature stands (3 acres).

The moist forests are largely restricted to the bluffs and tops of the west cliffs above Bayley Lake. The moist forest type is mostly mid-seral (225 acres) Douglas-fir and western larch with occasional patches of western redcedar in wetter micro-sites and draws of suitable aspect. No cold forest exists in this management unit.

The Bayley Lake Unit includes no old fields, 11.5 acres of scattered natural openings, and about 20 acres that include camp sites, boat launches and other administrative sites. Six acres of the unit were burned during 2002. There is no alluvial riparian habitat within this management unit.

Habitat and cover types for the Bayley Lake Management Unit are depicted in Figures A3.13 and A3.14 (Appendix 3), respectively. Table A3.7 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.14.

Upper Bear Creek

This management unit encompasses 4993.5 acres of varied topography generally rising in elevation from west to east. Elevations range from 2329 ft (Bench Mark - BM) at the junction of the North Fork of Bear Creek with the South Fork of Bear Creek to 5440 ft at the east boundary of LPONWR. The unit encompasses the entire upper watershed of the South Fork of Bear Creek and it is heavily forested except for private in-holdings. Its 4826-forest acres is composed of 48% dry forest and 59% moist forest in east/west-aligned draws and on northerly and easterly facing slopes. Generally, soils are glacial till from granite mantled with volcanic ash, moderate to well drained with numerous rock outcrops. The soils located on this unit are well suited as forestland. Major drainages generally run from east to west on 20 to 30% slopes. The southerly and westerly slopes tend to be dry forest Douglas-fir/ponderosa pine/western larch, especially on the upper third. North facing slopes are covered in moist forest of Douglas-fir, grand fir, and western larch with western redcedar and western hemlock occurring in the draws and moist valleys.

The unit's 2080 acres of dry forest is composed of 88% mid-seral forest that is primarily Douglas-fir/grand fir, ponderosa pine/Douglas-fir, and ponderosa pine within homogenous stands. Patches of regenerating western larch, ponderosa, and lodgepole pine have been thinned to a 12 ft x 12 ft spacing on 26 acres of the unit since 2000. Only 6 acres of this management unit has been prescribed burned since 2002.

The moist forest component of this management unit (2552 acres) is mainly mixed conifer (82%), which is in mid-seral stage. About 5% of the unit is cold forest (194 acres), where 90% is old, mature forest that has been passively managed for wildland fire suppression activities. The unit includes 16.4 acres in three old fields near Potters Pond and Lenhart Meadow. Non-native forbs and grasses dominate the upland portion of

Lenhart; whereas, sedges dominate the wetland portions. No alluvial riparian habitat exists within this unit.

Habitat and cover types for the Upper Bear Creek Management Unit are depicted in Figures A3.15 and A3.16 (Appendix 3), respectively. Table A3.8 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.16.

North Fork Bear Creek

This management unit encompasses 6662 acres and it has varied topography generally rising in elevation from west to east. This is the largest management unit on the LPONWR. The 160-acre Baird Basin Resource Natural Area (RNA) lies within it. Elevations range from 2329 ft (BM) at the junction of the North Fork of Bear Creek with the South Fork of Bear Creek to 5610 ft at the summit of Olson Peak, the highest point on LPONWR. It takes in the entire watershed of the North Fork of Bear Creek and, similar to the Upper Bear Creek sub-watershed, is virtually all heavily forested except for certain portions of private land. Its 6652 acres of forested lands are 32% dry forest and about 62% moist forest in east/west aligned draws and on northerly and easterly facing slopes. The cold forest (6% of the unit) is clustered on the east boundary of LPONWR around Olson Peak. Most of the soils are in a variety of rockout crop complexes and they are composed of glacial till from parent granite with a component of volcanic ash and loess, moderate to well drained and suited for forestry. Major drainages generally run from east to west on 20 to 30% slopes. The southerly and westerly slopes tend to be dry mixed forest of Douglas-fir/ponderosa pine/western larch, especially on the upper third slopes. The northerly and easterly-facing slopes are covered in moist forest of Douglas-fir, grand fir, and western larch with western redcedar and western hemlock occurring in the draws and moist valleys.

Patches of regenerating mixed species have been thinned to a 12 ft x 12 ft spacing on 72 acres of the unit since 2003.

The management unit's 2128 acres of mixed species dry forest is composed of 87% mid-seral Douglas-fir/grand fir, ponderosa pine/Douglas-fir, and ponderosa pine. The moist forest component of this unit (4137 acres) is mainly mixed conifer (82%) which is in mid-seral stage. About 6% of the unit is cold forest (387 acres) that is mostly (84%) old, mature stands of subalpine fir, Engelmann spruce, western larch, and lodgepole pine. This forest type has been passively managed except for wildland fire suppression activities.

This management unit includes no old fields and 18.1 acres of scattered natural openings. No alluvial riparian habitat exists within this unit.

Habitat and cover types for the North Fork Bear Creek Management Unit are depicted in Figures A3.17 and A3.18 (Appendix 3), respectively. Table A3.9 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.18.

Cedar Creek

This management unit encompasses 5566.7 acres with complex slopes generally rising in elevation from northwest to southeast. Elevations range from 2400 ft at the LPO River to 5572 ft at the summit of Scrabbler Mountain. Major drainages flow to the northwest into the LPO River, where numerous smaller drainages having opposing slopes of northeast and southwest aspects; this creates a wide array of varied forest habitat types virtually all of which are heavily forested except for certain portions of private land where large cutting operations have occurred. Because only a few of the LPONWR drainages in this unit have been lightly impacted by logging, this management unit contains old, mature moist forest habitats. Its 5397-forested acres are 17% dry forest, 79% moist forest, and 4% cold forest surrounding Scrabbler Mountain. Most of the soils are in a variety of rock outcrop complexes and they are composed of glacial till from parent granite with a component of volcanic ash and loess, moderate to well drained and suited for forestry. The southerly and westerly slopes tend to be dry, mixed forest of Douglas-fir/ponderosa pine/western larch, especially on the upper third slopes. The facing slopes, northerly and easterly, are covered in moist forest of Douglas-fir, grand fir, and western larch with western redcedar and western hemlock occurring in the draws and moist valleys.

Patches of regenerating mixed species have been thinned on 180 acres of the unit since 2003. In addition, 77 acres on this management unit were prescribed burned during 2004.

The unit's 908 acres of mixed species dry forest is composed of 89% mid-seral forest primarily of ponderosa pine/Douglas-fir and lodgepole pine/western larch. The moist forest component of this unit (4272 acres) is mainly (83%) mixed conifer in the mid-seral stage. About 4% of the unit is cold forest (218 acres), which is mainly (73%) old, mature forest comprised of subalpine fir, Engelmann spruce, western larch, and lodgepole pine. This forest type has been passively managed except for wildland fire suppression activities.

The unit includes 30.9 acres in eight old fields. The largest field (Schumaker Meadow at 19.8 acres) is dominated by a mix of timothy, orchard grass, and brome in the upland portions of the field with sedges and rushes in the wetland portion. No alluvial riparian habitat exists within this unit.

Habitat and cover types for the Cedar Creek Management Unit are depicted in Figures A3.19 and A3.20 (Appendix 3), respectively. Table A3.10 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.20.

Olson Creek

This management unit encompasses 3326 acres of complex slopes generally rising in elevation from northwest to southeast much the same as the Cedar Creek sub-watershed. Elevations range from about 3100 ft (BM) at the mouth of Olson Creek to 5572 ft at

Scrabbler Mountain summit. This is the most easterly and northerly management unit on LPONWR with the highest elevations. Major drainages flow to the northwest into the LPO River where there are numerous smaller drainages having opposing slopes of northeast and southwest aspects. This creates a wide array of varied forest habitat types virtually all of which are heavily forested except for certain portions of private land where large cutting operations have occurred. In similarity with Cedar Creek, logging has only lightly impacted some of its drainages and old, mature moist forest habitats still remain in this unit. Its 3195-forested acres include 11% dry forest, 78% moist forest, and 11% cold forest north and east of Scrabbler Mountain summit.

Most of the soils are in a variety of rock out crop complexes and they are composed of glacial till from parent granite with a component of volcanic ash and loess, moderate to well drained and suited for forestry. The southerly and westerly slopes tend to be dry mixed forest of Douglas-fir/ponderosa pine/western larch with intermixed patches of younger lodgepole pine. The northerly and easterly-facing slopes are covered in moist forest of Douglas-fir, grand fir, and western larch with western redcedar and western hemlock occurring in the draws and moist valleys.

The unit's 342 acres of mixed species dry forest is mostly (85%) composed of mid-seral ponderosa pine/Douglas-fir and lodgepole pine/western larch. The moist forest component of this management unit (2495 acres) is mainly (86%) mixed conifer in the mid-seral stage. About 11% of the unit is cold forest (358 acres) that is mainly (87%) mature, old forest comprised of subalpine fir, Engelmann spruce, western larch, and lodgepole pine. This forest type has been passively managed except for wildland fire suppression activities.

This management unit includes 9.7 acres in four old fields. No alluvial riparian habitat is found within this unit.

Habitat and cover types for the Cedar Creek Management Unit are depicted in Figures A3.21 and A3.22 (Appendix 3), respectively. Table A3.11 (Appendix 3) provides acreages of cover types for dry, moist, and cold forest that are illustrated in Figure A3.22.

2.1.3 Physical and geographic setting

LPONWR is located within the Okanogan Highlands Physiographic Province (Franklin and Dyrness 1973) of northeastern Washington. The Okanogan Highlands Province extends from the Okanogan River to the Idaho border. LPONWR also is within the Columbia River Basin Ecosystem, which includes lands within the United States east of the Cascade Crest in Washington and Oregon.

The LPONWR landscape was shaped by events occurring during the Pleistocene Epoch (2 million to 11,000 years ago) when continental ice sheets from Canada excavated and molded valleys and glaciers, scoured lakes, and shaped mountains. LPONWR is situated on the western edge of the Selkirk Mountains, whose topography influences the climate and plant communities of the area. LPONWR highest elevations range from 1,800 ft on

the west to 5,600 ft at Olson Peak on the eastern boundary. Most of LPONWR is underlain by sandy loam soils that are derived from deep glacial drift. Westerly winds prevail that bring warm air from the Pacific Ocean moderating year-round temperatures. Some weather patterns are influenced by inland continental air masses from the south and north. LPONWR annually receives 15 to 25" of precipitation in the valleys and up to 40" at higher altitudes. Temperatures range from the upper 40s to mid 80s°F during summer and 10 to 32° F during winter.

Within the 1939 Executive Order (8104) boundaries for LPONWR, there are approximately 10,000 acres of private lands. Most of the private land parcels within LPONWR are owned by Stimson Lumber Company (6500 acres) or Boise Cascade (1500 acres). Within the LPONWR boundaries, most of the commercially-owned timber lands were clear cut or seed tree cut within the last 25 years. Large blocks of land, sometimes whole sections (640 acres), were cut.

On the southern and eastern boundaries, the land is primarily managed or owned by the USFS - Colville and Kaniksu National Forests (NFs) as well as Boise Cascade and Stimson Lumber Company. The Washington Department of Natural Resources (WDNR) manages two large areas north of LPONWR (Narcisse and Little Pend Oreille blocks). WDNR manages these State-owned lands primarily for the long-term economic benefit of the local schools (revenue from timber production and livestock forage). When not in conflict with this primary purpose, State lands may be managed for watershed, wildlife habitat, open space, and recreation. USFS lands are managed for multiple resources and uses including recreation, wildlife and fish, range, timber, watershed, forage, minerals, and wilderness. Most USFS lands bordering LPONWR on the east and south are managed for timber and forage production; fewer bordering acres are managed for scenic values, winter range, recreation, and old-growth (late successional) forest.

2.2 Historic Condition

This section establishes the historical and ecological frame of reference to be used in maintaining and, where possible, restoring the biological integrity, diversity, and environmental health of LPONWR (see 601 FW 3). It also provides the basis for development of habitat objectives as well as development and implementation of specific habitat management strategies and prescriptions. Within this section, descriptions of historic plant communities for forest and alluvial riparian habitats were primarily derived from Williams et al. (1995) and Kovalchik and Clausnitzer (2004). In some cases, descriptions of plant associations were taken verbatim from these sources.

Throughout this section (especially the historical condition), the terms series, plant association, and community type are used as the basic units of plant classification in accordance with Williams et al. (1995) and Kovalchik and Clausnitzer (2004). Series refers to all the plant associations and community types dominated by the same species at climax or in good ecological condition. Pfister et al. (1977) define a plant community as an assemblage of plants living together reflecting no particular ecological status. The community type is an aggregation of all plant communities distinguished by floristic and

structural similarities in both overstory and undergrowth (Youngblood et al. 1985a). Pfister et al. (1977) define the plant association as a climax community type.

The forest habitats on LPONWR can be grouped into the three broad potential classifications (zones) as described in Quigley and Arbelbide (1997): dry, moist, and cold. A zone is a geographic area in which one plant association is the climatic climax that tends to occur along moisture and temperature gradients extending through broad regions or up mountain slopes (Daubenmire 1978). The following are attributes associated with this zonal scheme for forests (Franklin and Dyrness 1973):

- Zones may occur as sequential belts on mountains slopes; however, they may often interfinger to attain the lowest elevational limits in valleys and the highest limits on ridges. As a result, zones along slopes of a narrow valley can be reversed from their otherwise normal relationship to elevation (Daubenmire 1946).
- There is a tendency for species or associations, occupying modal sites in one zone, to occur on moist, cool habitats in the adjacent warmer, drier zone and on warm, dry habitats in the adjacent cooler and moister zone. For example, Douglas-fir can occur as a climax species on relatively moist habitats in Ponderosa pine or on relatively dry ridges within grand fir.
- Disturbance and resulting seral vegetation may obscure zonal consequences. Pioneer species often range through several vegetative zones. Many of the seral dominants in a zone tend to be climax species in adjacent warmer and drier zones.
- Zonal schemes tend to reflect plant response to strong macroclimatic gradients in temperature and moisture. Unusual physical or chemical soil properties sometimes override climatic factors to severely modify zonal patterns.

Pre-European settlement (mid 1800s) vegetation of eastern Washington was dominated by coniferous forests along with a complex mosaic of non-forest habitats such as shrublands, grasslands, wetland, and alpine (Kuchler 1964). On LPONWR prior to settlement and exploitation, photographic records, survey notes, and existing remnant stands indicate the LPONWR landscape was characterized by extensive stands of large, old growth ponderosa pine, Douglas-fir, and western larch. Impressive stands of western redcedar, western hemlock, and other mixed conifer stands were also present on LPONWR. An abundance of forest types and a complex array of seral communities historically resulted in diverse communities of wildlife. Climax associations arrayed on an elevational basis in zones because tree species responded differently to temperature and moisture gradients with variable tolerance.

Throughout northeastern Washington, forest and other habitat types were shaped and maintained by physical (e.g., slope, aspect) and environmental factors (e.g., temperature, moisture) as well as natural disturbances, especially fire (Franklin and Dyrness 1973, Agee 1990, Kauffman 1990). Postglacial forest fires were instrumental in shaping forest succession (Hermann 1985). Fire has been an important disturbance factor in Pacific Northwest forests for thousands of years (Agee 1990) as indicated by pollen analysis and charcoal deposits (Hansen 1938, Tsukada et al. 1981, Cwynar 1987). When the first

Europeans arrived in the Pacific Northwest, they recorded substantial amounts of burned land.

Most forest biota in the Pacific Northwest are adapted to persist after fire. These adaptations include those that facilitate the survival of individuals as well as those perpetuating species. Examples of fire survival traits of individuals include thick bark (e.g., ponderosa pine), the capacity to sprout from below-ground organs (e.g., roses, tanoak), and protected buds (e.g., bluebunch wheatgrass). The following are fire adaptations for survival of species: refractory seed buried in soil (e.g., ceanothus), fire-stimulated flowering (e.g., forbs), seed storage on plants (e.g., lodgepole pine), and windborne seeds (Kauffman 1990).

The health of natural riparian ecosystems is related to periodic occurrences of flooding, associated channel dynamics, and the preservation of base flows that sustain high floodplain water tables. Reproduction and growth of riparian plant species is closely related to peak flows and related channel processes such as meandering. Successful establishment of riparian plants typically occurs only in channel positions that are moist, bare, and protected from removal by subsequent disturbances (Sigafoos 1964, Everitt 1968, Noble 1979, Bradley and Smith 1986, Stromberg et al. 1991, Sacchi and Price 1992, Johnson 1994). Survival of woody riparian species depends upon groundwater moisture that is related to instream flows (Busch el al. 1992).

Unlike fire, ungulate herbivory has not been considered a major natural disturbance that shaped forest plant communities west of the Rocky Mountains (Belsky and Gelbard 2000). For thousands of years before the arrival of Euro-Americans and livestock, large grazers were sparse throughout the intermountain West and California (Baker 1978, McDonald 1981, Mack and Thompson 1982, Milchunas et al. 1988, Wagner 1989, Holland and Keil 1995, Painter 1995). Native herbivores such as bison, deer, elk, and pronghorn likely were not sufficiently abundant to have exerted selective pressures on native grasses and herbaceous species in this area (Daubenmire 1970, Mack 1989, Miller et al. 1994). Within 20-40 years after livestock introduction west of the Rocky Mountains, many grasslands and shrublands were dramatically altered and severely damaged by grazing (Young et al. 1972, Mack 1981, Harris 1991).

2.2.1 Dry forest

Within northeastern Washington, dry forests historically occurred on the warmest and driest sites at the lowest elevations (Franklin and Dyrness 1973, Henjum et al. 1994). In the Okanogan Highlands of northeastern Washington, ponderosa pine historically occupied a band at 1,968-3,937 ft (Franklin and Dyrness 1973). The dry forest zone on LPONWR was dominated by ponderosa pine and Douglas-fir found on south or southwest facing slopes. Ponderosa pine, western larch, and lodgepole pine occur as seral species in the Colville National Forest (NF); whereas, western hemlock, western redcedar, subalpine fir, and grand fir are typically unable to occupy dry forest as a result of drought stress (Williams et al. 1995). The following seven associations (a group of plants growing together in a climax state) may be found in dry forests (Appendix 5):

- Douglas-fir/ninebark-twinflower (PSME/PHMA-LIBOL);
- Douglas-fir/ninebark (PSME/PHMA);
- Douglas-fir/dwarf huckleberry (PSME/VACA);
- Douglas-fir/common snowberry (PSME/SYAL);
- Douglas-fir/mountain snowberry (PSME/SYOR);
- Douglas-fir/pinegrass (PSME/CARU);
- Ponderosa pine-Douglas-fir/bluebunch wheatgrass (PSME/AGSP); and
- Douglas-fir/big huckleberry (PSME/VAME [Community Type])

Douglas-fir is the only regenerating tree species widely found in mature stands of Douglas-fir associations. In contrast, ponderosa pine only occurs within the Ponderosa pine-Douglas-fir/bluebunch wheatgrass association. Within wet microsites, aspen stands were present within the dry forest. Although the Colville NF does not have a plant association with ponderosa pine as the only climax, dominant overstory species, it is found in the dry forest on LPONWR. As a result, the Ponderosa pine/pinegrass-bluebunch wheatgrass (PIPO/CARU-AGSP) association from the Wenatchee NF (Lillybridge et al. 1995) also was used as a reference for the dry forest on LPONWR.

In many areas of eastern Washington and Oregon, there is a strong tendency for climax ponderosa pine stands to be even aged by small groups rather than uneven aged. Daubenmire and Daubenmire (1968) indicated that grassy ponderosa pine stands consist of "…a mosaic of dense patches of trees, each tending to be distinctive in height and age." West (1969) recognized four structural patterns in ponderosa pine in central Oregon: differences in regeneration related to a moisture gradient; a mosaic of even-aged regeneration groups as a result of past fires; variation in stand density within even-aged groups primarily as a result of chance factors during establishment; and a tendency toward regular dispersal of individual trees with a regeneration group from competition.

The undergrowth of mature stands within dry forests is largely shrub dominated except for the Douglas-fir/pinegrass association or early successional sites. The undergrowth of the driest sites is dominated by pinegrass swords or bluebunch wheatgrass. Serviceberry, common snowberry, yarrow, heartleaf arnica, strawberry spp., and pinegrass are the only species present in >50% of the dry forest stands on the Colville NF (Williams et al. 1995). Pinegrass and strawberry species are the only widespread herbaceous plants (Appendix 5). Many of the herbaceous and shrub species in the dry forest are rhizomatous, which allows them to survive natural disturbances such as fire.

Deciduous trees and shrubs served as understory plants and riparian species in dry forests. A typical or natural dry forest landscape would likely be dominated by ponderosa pine stands. Although larger stands would be mixed age, individual stands would generally be uniform with single age, widely-spaced trees. Grasses or shrubs would dominate the understory depending upon the recent fire history (Appendix 5). These stands can be quite long-lived and productive after establishment, but they tend to regenerate slowly as a result of frequent fires and dry conditions. Where factors such as aspect, slope, soils, and moisture allow, dry sites can be dominated by Douglas-fir and

grand fir. These species are fire sensitive until they become large (thick bark) and mature.

Fire was the natural process that historically shaped dry forests in eastern Washington (Franklin and Dyrness 1973, Agee 1990, Kauffman 1990). Dry forest species (e.g., ponderosa pine, Douglas-fir) are adapted to survive harsh, dry conditions and frequent (5-50 years), low-intensity fires (Agee 1993). Specifically, the climax, healthy ponderosa pine forest was characterized by an open park-like understory maintained by frequent (5-25 years), low intensity fires which seldom caused mortality to mature trees (Hejl 1992).

2.2.2 Moist forest

The moist forest historically occurred at mid elevations and sites that were not moisture-stressed in eastern Washington. From a landscape perspective, a healthy, moist forest was generally characterized by a closed canopy with diverse communities of trees, herbs, and shrubs. A complex fire regime within moist forests resulted in a variety of stand structures, including old-growth, single-layer canopies, and multi-storied stands. Many other structural features (e.g., large snags, downed woody debris) were prevalent.

There historically was considerable regional variation in importance among tree species in the moist forest zone. In the Blue Mountains of northeastern Oregon and southeastern Washington, grand fir was probably the most extensive forest habitat; whereas, Douglas-fir was minimal in extent (Franklin and Dyrness 1973). In contrast, Douglas-fir was a more dominant component of the landscape than grand fir in the Okanogan Highlands of eastern Washington. At lower elevations near the dry forest transition, areas may be dominated by Douglas-fir. Western redcedar and western hemlock are mostly limited to cooler, wetter sites such as riparian zones or micro-sites strongly influenced by northern aspect and less inclined slopes.

For the Colville NF, the grand fir is one of three series that occurs within the moist forest zone, where a series is defined as a group of associations taking the name of the dominant climax species (Williams et al. 1995). The grand fir series includes the following 4 associations (Appendix 5):

- Grand fir/Douglas maple/queencup beadlily (ABGR/ACGLD/CLUN);
- Grand fir/ninebark (ABGR/PHMA);
- Grand fir/dwarf huckleberry (ABGR/VACA); and
- Grand fir/big huckleberry/queencup beadlily (ABGR/CLUN).

The grand fir series is primarily found on east and west aspects at mid- and upper-slope (2,500 to 5,000 ft). In addition, this series is largely restricted to warm aspects and excessively drained substrates. Douglas-fir is the major seral tree species on nearly all grand fir associations, and it usually remains a dominant or co-dominant in the stand.

The undergrowth of the grand fir series is characterized by species assigned to the "pachystima union" by Daubenmire and Daubenmire (1968). Shiny-leaf spirea, common snowberry, big huckleberry, and pachystima are commonly found shrubs for the grand fir

series. Queencup beadlily, strawberry species, white hawkweed, and sweetroot are common forbs (Franklin and Dyrness 1973, Williams et al. 1995). Other forbs include sweetscented bedstraw, starry solomonplume, and heartleaf arnica (Appendix 5).

Fire regimes for the grand fir series are dependent upon the plant association. Most grand fir communities are mixed species stands with Douglas-fir, ponderosa pine, western larch, lodgepole pine, and grand fir. Agee (1994) found these mixed stands were subjected to the most frequent fire activity of eastern Washington forests. Because of increased levels of fine fuels, these sites have more fire activity than ponderosa pine stands (Williams et al. 1995). In contrast, high elevation grand fir communities are characterized by infrequent, high-intensity fires. Stand replacement fires with return intervals of 100-200 years were reported for cooler, moister grand fir associations; whereas, fire-return intervals of 16-47 years have been reported for low-intensity fires within drier stands (Agee 1994, Johnson and Clausnitzer 1992, Clausnitzer 1994).

Grand fir is kept subordinate to ponderosa pine and Douglas-fir in the understory of most associations in the grand fir series as a result of historic fire regimes. There has been a shift from a low-to-moderate fire intensity regime (favored regeneration-thinned stands with large residuals where shade-tolerant species were nearly eliminated) to one of higher fire intensity associated with expansion of shade-tolerant species in the understory. These structural and compositional changes have shifted the fire intensity regimes through increases in surface and ladder fuels. Presently, the grand fir stands are characterized by dense, multi-layered stands with shade-tolerant species in the understory (Williams et al. 1995).

For the Colville NF, western hemlock is the second of three series that occurs within the moist forest zone (Williams et al. 1995). The following are six associations for the western hemlock series (Appendix 5):

- Western hemlock/wild sarsaparilla (TSHE/ARNU3);
- Western hemlock/queencup beadlily(TSHE/CLUN);
- Western hemlock/oak-fern (TSHE/GYDR);
- Western hemlock/rusty menziesia (TSHE/MEFE);
- Western hemlock/five-leaved bramble(TSHE/RUPE); and
- Western hemlock/beargrass (TSHE/XETE).

Most western hemlock stands are found between 2,500 and 5,000 ft, but it has occurred as high as 5,800 ft on warm southerly slopes in areas of high precipitation. Mid- (100-200 years) to late-seral (>200 years) stands are dominated by western hemlock and western redcedar; however, a variety of other tree species are present depending upon the association as well as type, extent, and time since disturbance.

Undergrowth composition varies from dense, tall shrubs to open glades characterized by a mixture of low shrubs and herbs. Species such as oak-fern, rusty menziesia, beargrass, five-leaved bramble, and wild sarsaparilla characterize the understory, especially in early seral stages. Dense stands with a paucity of shrubs and herbs are common. Litter

accumulation is the most prominent feature of these western hemlock stands. Dense shrubfields often dominate early successional stages after disturbances such as fire. Douglas maple, Scouler willow, big huckleberry, serviceberry, Sitka alder, and snowbrush ceanothus are common shrubfield species in western hemlock stands. Shrubs disappear as vegetation physiognomy changes from shrubfield to conifer forest. Some species such as Scouler willow, Douglas-maple, alders, serviceberry, pachystima, baldhip rose, and common snowberry linger as scattered individuals after development of the closed canopy (Appendix 5).

Fire-return intervals for the western hemlock series are not well documented, but fire was likely a major influence. In northern Idaho, a typical fire-return interval for low-to-moderate intensity fires was 50-100 years; a stand-replacement interval is 150-500 years (Arno and Davis 1980). The drier western hemlock associations found on uplands are more at risk of burning than wetter ones situated in stream bottoms, seeps, and benches. Because western hemlock has a shallow rooting system, it is easily killed by moderate intensity fires. After stand-replacing fires, western redcedar usually enters most sites during early succession as a result of its seed production (Smith and Fischer 1995). Western hemlock usually dominates the mid- to late-successional stages on most sites.

Western redcedar is the last of three series that occurs within the moist forest zone for the Colville NF (Williams et al. 1995). The following are three associations and one community type for this series (Appendix 5):

- Western redcedar/devil's club (THPL/OPHO);
- Western redcedar/wild sarsaparilla (THPL/ARNU3);
- Western redcedar/queencup beadlily (THPL/CLUN); and
- Western redcedar/big huckleberry (THPL/VAME [Community Type]).

The western redcedar series occurs on wet sites where western hemlock is usually a climax co-dominant. This series occupies a variety of aspects and elevations, where most stands occur between 2,500 and 4,500 ft. Western larch, Douglas-fir, lodgepole pine, and grand fir are the most important seral tree species. Subalpine fir and Engelmann spruce are locally abundant as seral species within cooler stands, particularly stream bottoms with cold air drainages.

The undergrowth for western redcedar has more species and larger individuals compared with western hemlock (Turner and Franz 1986). The tree regeneration layers follow a pattern similar to the overstory. Western redcedar is usually present along with lesser amounts of grand fir. Douglas-fir may be an important regeneration component under certain seral conditions (e.g., beneath lodgepole pine), but it disappears as the second canopy of Douglas-fir, grand fir, and western redcedar assumes dominance. Depauperate shrub and herb layers are frequently found in dense stands of redcedar with a thick layer of litter. These stands typically have few or no shrubs and herbs or very low cover if species are present. The undergrowth of mature stands varies from lush devil's club and ferns to continuous cover of pachystima and twinflower to almost no cover for dense overstory conditions. Tall shrubs (>3.5 ft) rarely dominate except for devil's club in early seral stages. Dense shrub fields are characteristic of early seral stages after

disturbance (e.g., fire). Redstem ceanothus, pachystima, sticky currant, thimbleberry, snowberry, Douglas maple, shiny-leaf spirea, and Scouler willow are important shrub field species. Typical upland undergrowth includes pachystima, queencup beadlily, twinflower, *Orthilia* spp., and common brome (Williams et al. 1995)(Appendix 5).

Fire-return intervals are not well documented for the western redcedar series, but most sites show evidence of past fire (e.g., buried charcoal and fire-scarred trees). In northern Idaho, a typical fire-return interval for low- to moderate-intensity fires is 50-100 years; a stand replacement interval is 150-200 years (Williams et al. 1995). However, drier western redcedar associations found on uplands are more at risk of burning than wetter types in stream bottoms, seeps, and benches. The variable fire regimes and intensities result in a pattern of late succession stands surrounded by young forests on drier uplands. Under severe drought conditions, the very moist redcedar sites burn when crown fires spread from drier sites next to them.

Within wetter parts of the forest, redcedar and hemlock stands tend to be widespread and continuous with longer fire-return intervals that allows for the development of old forests. However, fire has been a major disturbance in these areas, particularly in stands on steep mid-slopes that are generally warmer, drier, and wind-exposed forming a thermal belt burning more intensely than lower slopes (Arno and Davis 1980). When fire occurs in these stands, the patch size can be large throughout northeastern Washington, northern Idaho, and northwestern Montana. Cooper et al. (1991) noted intensive fires in northern Idaho in 1889, 1919, 1926, and 1934. Barrows (1952) indicated that 400,000 ha burned in northern Idaho in 1910.

2.2.3 Cold forest

The cold forest is represented mainly by the subalpine fir series that includes all upland forest stands potentially dominated at climax by subalpine fir and/or Engelmann spruce. The following are 11 plant associations identified for the subalpine series plus one Engelmann spruce association within the Colville NF (Appendix 5):

- Subalpine fir/bunchberry dogwood (ABLA2/COCA);
- Subalpine fir/Cascade azalea-beargrass (ABLA2/RHAL-XETE);
- Subalpine fir/Cascade azalea (ABLA2/RHAL);
- Subalpine fir/false bugbane (ABLA2/TRCA3);
- Subalpine fir/beargrass (ABLA2/XETE);
- Subalpine fir/queencup beadlily (ABLA2/CLUN);
- Subalpine fir/dwarf huckleberry (ABLA2/VACA);
- Subalpine fir/twinflower (ABLA2/LIBOL);
- Subalpine fir/pinegrass (ABLA2/CARU);
- Subalpine fir/grouse huckleberry (ABLA2/VACA);
- Engelmann spruce/horsetail spp. (PIEN/EQUIS); and
- Subalpine fir/big huckleberry (ABLA2/VAMA [Community Type]).

As implied by its name, subalpine represents a transitional type between the forested and non-forested alpine landscape. This series ranges from mid-elevations to upper

timberline. For the LPONWR CCP, the cold forest occurs >4,500 ft. Although widely distributed, subalpine fir grows within a narrow range of mean temperatures (Burns and Honkala 1990). Cool summers, cold winters, and deep winter snowpacks are important factors that determine where subalpine fir grows in relation to other species. These forests are conspicuous in frost pockets and other habitats characterized by accumulation of cold air. Because subalpine fir has high rates of evapotranspiration, it is found primarily on cold, moist sites. Forests with subalpine fir as a climax generally occupy some of the highest water yield areas in the West (Burns and Honkala 1990).

Undergrowth can vary from dense shrub thickets to open, species-rich, forb dominated glades to near mono-specific low shrub patches. Few undergrowth species are widely distributed across the subalpine fir series. Utah huckleberry, pachystima, sidebells wintergreen, and pinegrass are commonly occurring undergrowth on the Colville NF (Appendix 5).

Fire intensities increase and fire-return intervals lengthen to over 100 years for the subalpine fir series (Agee 1994). Large, stand-replacing fires were very common early in the 1800s (Gannett 1902, Gorman 1899). Fire regimes are diverse because there is a wide variation in environments on subalpine fir sites. Subalpine fir distributions are associated with marine weather patterns exhibit the longest fire-return intervals. Subalpine fir forests likely are subjected to a pattern of a few large fires with many smaller ones (Williams et al. 1995). Because of the extreme conditions at high elevations, blow downs are also an important natural disturbance process (Williams et al. 1995, Kovalchik and Clausnitzer 2004).

After fires, lodgepole pine often dominates early succession that is followed by subalpine fir and Engelmann spruce. The development of lodgepole pine is favored by severe fires that occur at <150 year intervals. Replacement of lodgepole pine with subalpine fir and Engelmann spruce may take centuries. Burned sites may be dominated by shrubs such as big huckleberry, Cascades azalea, or beargrass for 30-40 years after a fire if lodgepole pine does not regenerate immediately after the fire. As the canopy develops, big huckleberry likely will decrease. Eventually a mixed stand of long-lived western larch with small subalpine fir and Engelmann spruce may develop (Agee 1994). Depending upon the size and intensity of the fire, burned areas may remain treeless for decades except where lodgepole pine was present before the fire (Williams et al. 1995).

2.2.4 Quaking aspen

Quaking aspen is rarely a major landscape component. It usually occurs in small clumps of a few acres or as scattered trees in conifer-dominated stands. In most cases, areas with quaking aspen have sufficient conifer regeneration to indicate future dominance by conifers. However, some sites have little or no conifers and evidence of eventual conifer dominance is lacking, especially for aspen communities in riparian sites such as wet, poorly drained basins as well as around springs and seeps. Some of these riparian sites appear to be successionally stable or climax quaking aspen stands.

The quaking aspen/common snowberry association is found on the Colville NF. This association is situated on sites ranging from the edge of marshes and wet meadows to drainage depressions to mesic mid- and lower-slopes. This association has a tree layer with quaking aspen, lodgepole pine, and western larch. Its tree understory is composed of quaking aspen and Douglas-fir. Shrubs include common snowberry and serviceberry. Herbs include yarrow, dandelion, and meadowrue. Kovalchik (1987) indicated that aspens stands are important for wildlife, including deer that frequently use them as fawning areas.

Fire is an important disturbance for stimulating aspen suckers and rejuvenating deteriorating stands. Snowberry will resprout from stem bases following light to moderate-intensity fire (Williams et al. 1995). Fire suppression has contributed to the conversion of aspen stands to conifers or meadows (Kovalchik 1987).

2.2.5 Alluvial riparian

Although there are other types of riparian habitat on LPONWR, the focus of this HMP is alluvial riparian. It has been impacted as a result of long-term implementation of season-long livestock grazing (see Appendix 1). Forest riparian (especially those along steep gradients) generally have not been degraded by livestock primarily because they are relatively inaccessible to cattle. Therefore, the description of historic (natural) habitat conditions within this section focuses upon alluvial riparian.

Typical riparian and wetland sites are composed of three distinct ecosystems (Figure 2.4) as described by (Kovalchik 1987):

- Aquatic—The permanently flooded portion of the riparian or wetland zone, which includes streams, rivers, ponds or lakes.
- Riparian and wetland—The land next to water where plants are located that are dependent on a perpetual source of water.
- Transitional or xeroriparian—Subirrigated sites lying between riparian/wetland sites and upland. This ecosystem does not have true hydrophytic vegetation such as sedges and willows, but it is uniquely different from uplands.

Kovalchik and Clausnitzer (2004) identified riparian associations in climax and late-seral ecological status (fair or better ecological condition) that represented undisturbed sites within the Wenatchee, Okanogan, and Colville NFs. The aquatic/riparian/wetland series and associations are often restricted to very specific fluvial surfaces within a valley segment. Plant associations and fluvial surfaces provide a meaningful way of integrating various environmental factors such as water regime and soils that affect vegetation. They represent a relatively narrow portion of the environmental variation found in riparian landforms that reflect certain potential for vegetation and fluvial surface development. Therefore, riparian association and community types are useful as an ecological basis for management guidelines related to ecological status, wildlife, fisheries, productivity, silviculture, succession, range management, hydrology, and mapping.

A fluvial surface occurs within a valley segment and it includes the riparian and wetland plant associations that grow within it. Fluvial surface examples include alluvial bars,

point bars, floodplains, streambanks, terraces, overflow channels, fens, and bogs. Fluvial surfaces are similar to land-type phases and they represent the response to patterns of stream erosion, overflow, and deposition. They also represent environmental variations found in a valley segment and reflect a specific potential for vegetation development. Riparian and wetland plant associations respond characteristically to differences in soil structure, soil texture, and water tables in fluvial surfaces. Together, fluvial surfaces and riparian plant associations provide a meaningful way of integrating various environmental factors (e.g., water regime, soils), which affect vegetation potentials in riparian landforms.

Four interdependent factors historically shaped the mosaic of riparian associations and fluvial surfaces within valley segments of eastern Washington (Kovalchik and Clausnitzer 2004):

- Climate is mostly determined by the geographic setting. Annual precipitation, hydrologic regime, and temperature range determine factors such as soil formation rates, disturbance regime, and species composition. Climate varies with elevation and aspect such that similar climates can occur at different elevations or aspects in different areas.
- Geology largely determines drainage pattern and the soil type deposited on fluvial surfaces.
- Steep valley gradients (>4%) tend to form narrow, down cutting valley cross sections. Intermediate gradients (1-3%) interact with biological factors (e.g., large wood, beaver dams) to form infinitely varied habitats. Flat gradients (< 1%) form wide, depositional floodplains.
- Vegetation filters and traps sediments and helps build and anchor fluvial surfaces. In steeper segments the roots of large trees can both stabilize banks or alter the course of the stream when the trees fall.

Stream action is a major factor in landscape formation. Valley deepening is often associated with relatively early stages of landscape formation and results from hydrologic, corrosive, abrasive, and weathering processes on the valley floor (Thornbury 1969). Valley widening is the result of lateral erosion, slumping, soil creep, and other hill-slope processes (Horton 1945). Valley lengthening is the result of headwall erosion, meander development, and the formation of fans and deltas. All these are indirectly tied to the effects of water and result in the formation of water-related landforms in the vicinity of streams and other bodies of water that form the riparian and wetland zone.

For the transportation of a stream's sediment load, changes in structure or process require change in gradient and channel characteristics (Leopold et al. 1964). The gradient or steepness of a valley is often related to the width of the valley floor. Narrow valleys, especially those in headwater or first-order drainages, often have V-shaped profiles, moderate to steep gradients, and narrow riparian zones. Streams in these valleys have high energy, relatively straight channels. If they adjust to dissipate energy, it is done so vertically, over steps or cascades. Steep channels cut downward by deepening the pools, and move relatively coarse material along the bed and in suspension. They build streambanks and terraces with moderate- to coarse-textured, well-aerated soils. At lower

elevations, third- to fifth-order streams predominate (Strahler 1952); valley gradients are low, and most valleys are wide. These streams oscillate horizontally, forming meanders, and lateral erosion is predominant. These streams carry fine-grained sediment loads and form floodplains with finer textured soils. They may have numerous overflow and cutoff channels. Steep and shallowly graded sections are often present on the same stream.

Because riparian plant associations are related to physiographic areas, watersheds, valley segments, and fluvial surfaces, it is possible to predict potential natural vegetation on degraded sites. The classification developed by Kovalchik and Clausnitzer (2004) for wetlands and riparian sites recognizes 32 series and 163 aquatic, wetland, and riparian plant associations or community types. The following are plant associations specifically identified for mesoriparian and xeroriparian ecosystems (Figure 2.4) on fluvial surfaces of the Wenatchee, Okanogan, and Colville NFs (Appendix 6):

- Mountain alder/alluvial bar association (ALIN/ALLUVIAL BAR);
- Quaking aspen/red-osier dogwood (POTR/COST);
- Quaking aspen/common snowberry (POTR/SYAL);
- Engelmann spruce/common snowberry association (PIEN/SYAL); and
- Engelmann spruce/red-osier dogwood association (PIEN/COST)

As previously mentioned, the focus of this HMP is alluvial riparian. The species for tree overstory, tree understory, shrubs, low shrubs and subshrubs, perennial forbs, grass or grasslike species, and fern and fern allies for these plant associations can be found in Appendix 6. Because these species were found mostly on undisturbed sites, they represent natural (historic) conditions for the 4 plant associations on fluvial surfaces.

2.3 Factors Causing Habitat Changes from Historic to Current Conditions

USFS lands are managed for multiple resources and uses including recreation, wildlife and fish, range, timber, watershed, forage, minerals, and wilderness. In 1996, the USFS implemented the Addy-Chewelah Project on the Colville NF, which involved harvesting 54 million board ft of timber on 13,550 acres within the 47,158-acre area which borders LPONWR on the north. This action also involved construction of approximately 62 miles of new roads, 2,590 acres of pre-commercial thinning, and 8,842 acres of prescribed fire. Most of the USFS land bordering LPONWR on the east and south is managed for timber and forage production objectives with fewer bordering acres managed for scenic values, winter range, recreation, and old growth.

Regardless of ownership, there is an increasing trend in road development, forest fragmentation, loss of older-aged forests, recreational use, riparian habitat degradation, and rural residential development on lands surrounding LPONWR. Growth within Stevens County is affecting privately owned land near the western and northern LPONWR boundaries. Within the last several years, new homes and subdivisions next to the Refuge boundary have been added near five LPONWR access points (Narcisse Creek Road, Buffalo Wilson Road, Miller Road, Bear Creek Road, and Slide Creek Road). New short- and long-plat developments have also been planned along Highway 20 on LPONWR's northern border. Rural residential development increases the potential for

habitat fragmentation, wildlife/people conflicts, pest management problems, risks of prescribed fire, and need for law enforcement. Development adjacent to LPONWR lands may increase market pressure on smaller private landowners to sell their lands for further development. Real estate market values are often higher for property adjacent to public land.

2.3.1 Forests

Departure from historic (natural) forested communities throughout the interior Columbia Basin (including eastern Washington) has been related to altered disturbance patterns, especially changed fire regimes (suppression), timber harvesting, and livestock grazing (Hessberg et al. 1999). Consistent with the findings of Hemstrom et al. (2002), mid-seral forests on the LPONWR are generally more prevalent than they were historically; whereas, old forests (especially single-layer types) are less abundant. Many ponderosa pine and mixed-coniferous forests on LPONWR have undergone substantial structural and compositional changes since settlement by Euro-Americans because of altered fire regimes and grazing as also reported by Belsky and Blumenthal (1997). Nearly a century of fire suppression and livestock grazing has promoted greater numbers of woody saplings that develop into thick undergrowth and increase fuels on LPONWR. On the LPONWR, long-term changes in natural processes have produced forests of more fire-sensitive, shade-tolerant species (e.g., Douglas-fir) that replaced light tolerant species such as ponderosa pine similar to findings by Belsky (1996).

Human activities have affected both the natural disturbance cycle and the process of succession in dry forests on LPONWR. Patterns of plant species succession have been altered by harvesting selected, mature trees, livestock grazing, and suppressing fire (Appendix 1). As a result, there are more dense (over stocked) stands, less shrub cover, and a gradual increase in shade-tolerant species such as Douglas-fir and grand fir on LPONWR. The “clumpy” nature of single story, mature stands that existed historically is not currently well represented on LPONWR.

Logging (historically focused upon high-value large diameter trees), fire suppression, and livestock grazing (see Appendix 1) are the primary anthropogenic factors that have contributed to the changes in forest structure within the Colville sub-basin (Williams et al. 1995, Kovalchik and Clausnitzer 2004). There has been a clear shift in fire regimes throughout the Colville sub-basin from frequent to infrequent fires. Specifically, fire regimes have also become more infrequent and lethal with a decline in frequent and mixed frequency fires. The frequent, low intensity fires historically contributed to the maintenance of large trees with open understories characteristic of mature, old growth conditions such as single-layer ponderosa pine. The loss of frequent, non-lethal fires has resulted in increased fuel loads, crowded and over-stocked forest stands, and increased risk of catastrophic (lethal, stand-replacement) fire occurrence.

Fire suppression and timber harvesting have blurred the relatively distinct historical elevational zones of forest vegetation on LPONWR. Specifically, fire suppression has resulted in overstocked ponderosa pine stands producing advantageous conditions for

shade-tolerant species (e.g., Douglas-fir and the true firs) that are perpetuated through the unnatural absence of frequent, low-intensity fire. Refer to Appendix 1 for discussion on the effects of fire suppression and timber harvesting on forest habitats.

Historic changes in forest conditions on the LPONWR can be related to the Colville sub-basin (650,000 acres) that encompasses LPONWR. Vegetation structures within this sub-basin have been dramatically altered since the late 1800s. Although forest cover types are found over approximately the same total areas as during 1900, dramatic changes in forest structure have occurred over large areas within the Colville sub-basin (Table 2.2). Specifically, old single-layer forest is nearly absent within the sub-basin and old multi-strata forest currently covers only about 10% of its former area. Cover of young forests (particularly the mid seral types of young multi-strata and understory re-initiation forests) has increased 15-18 times their extents during 1900. In addition, the sizes of similar forest patches were distinctly smaller in the past as indicated by a more fragmented (checkerboard) appearance of the historic vegetation map (Figure 2.5). The greater continuity of forest habitat types now is likely due to the unnatural role of fire and fire regimes that occur now as compared to historically.

Quaking aspen occurs on wet sites within all three forest zones. Many aspen stands on LPONWR tend to be mature and even-aged with little or no regeneration. Vegetative reproduction by suckering is the primary mechanism by which aspen stands are maintained and enlarged on LPONWR. For vigorous sucker reproduction to occur, light and radiant energy must reach the forest floor which is prevented by shading from competing conifers. Especially in dry forests, aspen has been eclipsed by conifers because fire suppression has eliminated frequent, low intensity fires which kept conifer species in check. Under normal circumstances when conditions were conducive to light surface fires in the dry forest, aspen sites were too wet to burn. When aspen sites are dry enough to burn by fire that kills the above ground portions of the tree apical dominance is suppressed, the ground surface is blackened and nutrients are released. These events act to stimulate aspen suckering especially in the spring when moisture conditions are optimal. In addition to fire suppression, annual browsing of aspen suckers by domestic livestock and, to a lesser extent, native ungulates reduces regenerative aspen growth and contributes to the continuance of decadent, non-sustaining stands.

Concern for deteriorating aspen stands on LPONWR necessitated an assessment of aspen health. During 2002, James Hadfield (Plant Pathologist with the Wenatchee Forestry Sciences Laboratory) conducted an aspen condition assessment survey (US Forest Service 2003) to characterize the amount of tree mortality within aspen clones, identify damage to stems, and rate the condition of LPONWR aspen clones. Clone condition status was rated as healthy, successional to conifers, or decadent using definitions developed by Bartos (2001). Twenty-seven clones less than one acre in size were surveyed between 2,028 and 3,839 ft in elevation. Of the 27 sampled clones, nine were stable, 15 were successional to conifer, and three were decadent. Results of the aspen assessment indicated that the majority of the aspen clones sampled are declining and lacked recruitment primarily as a result of conifer competition.

2.3.2 Alluvial riparian and instream

Assessments of alluvial riparian and instream habitat were conducted on LPONWR during the late 1990s. Specifically, the alluvial riparian survey was conducted on the Refuge-owned portions of the LPO River, Bear Creek, and North Fork of Bear Creek using survey and classification procedures described by the FWS and the US Bureau of Land Management (BLM)(Pyle 2000). Riparian resource and functional conditions were assessed based on a thorough examination of site characteristics resulting in classification as either properly functioning or functioning at risk.

Approximately 5 of the 8.5 miles for Bear Creek surveyed were classified as being in unsatisfactory condition. Of the approximately 7.5 miles of the LPO River surveyed, about 2 miles were classified as being in unsatisfactory condition. These unsatisfactory areas were mostly in the alluvial, low gradient troughs that comprise more than 50% of the total riparian habitat occurring on LPONWR (Figure A1.2 in Appendix 1). Alluvial riparian habitat also has received the majority of the livestock grazing activity occurring on LPONWR. Characteristics of riparian areas in unsatisfactory condition included the following: excessive stream bank erosion, increased channel entrenchment, lowered water tables, reduced extent of active flood plain, and a diminished composition of the hydric riparian species expected to occur in a fully functional riparian system (Pyle 2000).

Fish habitat assessments of the LPO River and Bear Creek were conducted during 1996 and 1997, respectively (Kelly Ringel 1998, 1999). These rivers were divided into reaches (a relatively homogeneous section of stream that contains attributes of common character) based on landform characteristics such as valley form, valley floor width, side slope angles, estimated stream length, and other watershed characteristics. The LPO project involved a survey of six reaches along about 9.5 miles of the river from the western boundary of LPONWR to below Crystal Falls. Reaches 2 and 7 were further subdivided when measuring fine sediment. The Bear Creek survey was completed with five reaches designated along 5.2 miles of the creek from the confluence with the LPO River upstream to the confluence with the North Fork of Bear Creek. Two reaches along the North Fork of Bear Creek (reach 1 and 2) were also comprehensively surveyed (Figure A1.3 in Appendix 1).

Data for the fish habitat assessments were collected using a modified Hankin-Reeves (1988) stream survey method (US Forest Service 1996). This method was selected because it identifies and measures key stream characteristics that are the most critical for defining existing watershed conditions (US Forest Service 1996). These characteristics include the following: pool frequency, quality, and proportion; amount of woody debris; proportion of fine sediment; bank erosion; entrenchment; sinuosity; width/depth ratio; riparian vegetation species, seral stage, and amount of stream shading; and water temperature. As part of these studies, stream conditions were compared to criteria and guidelines from the Inland Native Fish Strategy (INFISH), which is currently used for USFS and BLM lands located east of the Cascade Crest (US Forest Service 1995), and the ICBEMP standards that were established in the original preferred alternative for the

Eastside Environmental Impact Statement (EIS) released in May 1997 (US Forest Service and US Bureau of Land Management 1997).

The results of the fish habitat surveys (Tables A1.3 and A1.4 in Appendix 1) indicate the general condition of LPONWR aquatic habitats. Water temperatures measured during the survey are not directly comparable to the standards because they were not taken continuously over at least 7 days. However, 4 of 6 reaches on the LPO River exceeded the maximum recommended temperature of <59°F for adult fish holding habitat. All reaches of the surveyed streams exceeded the maximum recommended temperature (<49° F) for spawning and rearing habitat. Water temperatures are influenced by local climate, snow runoff, and the amount of solar warming of the stream. Lack of overhead cover increases water temperature by solar warming. Alteration of riparian vegetation has resulted from logging, channelization, and livestock grazing. These measurements indicate a need to more closely monitor temperatures in all reaches to determine if standards are being exceeded.

The low percentage of stable banks along reach 2 of the LPO River likely resulted from livestock grazing. Cattle were present along the stream and there were many areas where cow hooves had sheared off the banks. As a result of erosion, banks were down-cut, which increased the entrenchment of the stream and width/depth ratio. Non-native reed canarygrass was present throughout this reach. Because it is not as deeply rooted as some native grasses, alders, and willows, reed canarygrass does not provide adequate bank stabilization. In addition, reed canarygrass out competes native plant species in active riparian floodplains and can create large, undesirable, monotypic expanses.

Sediment was high in reaches 2 and 6 of the LPO River and all but two reaches of the North Fork of Bear Creek. The large percentage of fine substrate indicates both local soils, which contain a high percentage of granitic sands, and low stream gradients. There are numerous roads in the watershed that contribute more sediment to steams than any other land management activity (Lee et al. 1997). Other sources of sediment input include livestock grazing, timber harvest, and fire. These activities can cause loss of native vegetation, changes in hydrology, and bank instability; all which contribute to sediment input.

In 1998, a study was conducted by the University of Idaho to assess the short-term response (1-2 years) of the structure and composition of streamside vegetation to livestock exclusion on LPONWR. This study involved comparing plant communities in grazed and ungrazed areas on LPONWR at the beginning and end of the grazing season. There generally were no differences between grazed and ungrazed (livestock grazing removed after long-term, seasonal grazing) areas for plant species composition and structure. However, the authors indicated it is likely that significant differences between grazed and ungrazed areas of LPONWR would be found with additional time (2-3 years) for recovery.

Kelly Ringel (1998, 1999) and Pyle (2000) indicated that portions of the LPO River, Bear Creek, and North Fork Bear Creek (particularly the lower gradient flood plain or alluvial

areas) have been compromised or degraded from past use and management. These alluvial valleys are among the most important habitats within LPONWR. Frequent floods have formed diverse habitat in these valleys featuring sandbars, off-channel sloughs and wetlands, and a wide range of plant species; all of which are important to wildlife. However, these Refuge studies indicate that in some stream sections in the alluvial valley are becoming wider and shallower with unstable banks and lower water tables. In addition, there is insufficient stream-side vegetation to provide shading. Stream-side vegetation is also an important source of nutrients by providing downed wood to the stream and helping stabilize the stream bank. Because of their value to wildlife, the restoration of these degraded lower alluvial valleys is a priority for LPONWR.

In similarity with other studies (Behnke and Raleigh 1978, Duff 1979, Kaufman and Krueger 1984, Davis 1986, Taylor 1986, Kovalchik 1987, Clary and Webster 1989, Kinch 1989, Platts 1989, Armour et al. 1991, Myers and Swanson 1991, Kovalchik and Elmore 1992, Goguen and Mathews 1993, Busch and Scott 1995, Leonard and Karl 1995, Clary et al. 1996), Pyle (2000), Nielson and Lohman (1999), and Kelly Ringel (1998, 1999) found that consumption of shrubs, saplings, and herbaceous vegetation by livestock along with compaction and trampling of soils has impacted alluvial riparian and instream habitats on LPONWR in the following ways:

- Reduced or eliminated regeneration of woody vegetation;
- Changed plant species composition (e.g., xeric species and highly competitive exotic species invade, perennials are replaced by annuals, and trees/willows/sedges are replaced by brush and bare soil);
- Reduced overall riparian vegetation;
- Reduced overall plant vigor;
- Increased bank and instream deformation and erosion from loss of protective vegetation;
- Increased soil compaction and churning by hoof action, which lead to reduced water quality and changes in bank and channel integrity;
- Caused stream channel widening, shallowing, trenching, or braiding associated with increased stream bank erosion;
- Reduced the ability of riparian habitat to trap and filter sediments and pollutants that leads to increased sedimentation and pollution from fecal matter of livestock;
- Increased stream temperatures as a result of lost cover provided by both woody and herbaceous plants;
- Resulted in loss of nutrient inputs, especially invertebrate food sources, to streams;
- Lowered the water table with subsequent loss of riparian vegetation and stream flow;
- Increased the magnitude of high and low stream flow events;
- Reduced shrub and ground-nesting habitat for migratory landbirds and other wildlife;
- Caused declines of amphibians, small mammals, and other ground-dwelling animals that need herbaceous and woody vegetation for food and cover;

- Increased songbird nest predation and brown-headed cowbird parasitism due to loss of protective vegetation;
- Resulted in loss of structural and compositional diversity of plant communities, thereby reducing overall wildlife diversity; and
- Reduced forage available for wild ungulates and other herbivores.

A more detailed discussion of grazing impacts to riparian and instream habitats along with forest communities can be found in Appendix 1.

2.3.3 Old fields

When the FWS began managing LPONWR during 1939, it included approximately 500 acres that homesteaders and former land owners had actively farmed and another 500 acres that produced grass hay or were used as livestock pastures. LPONWR continued a farming program in many of these fields or allowed permittees to graze cattle and horses in them. These farmed fields ranged in size from 1 to 92 acres and they were scattered through the west side of LPONWR. Most crops were wildlife food oriented such as sweet clover, winter wheat, rye, oats, barley, alfalfa, and vetch for deer and other species. Past LPONWR staffs believed these food plots helped reduce heavy use of browse by wintering deer. Most cultivated fields were replanted every five years. Other fields were maintained in perennial grasses, mainly timothy, orchard grass, red top, blue bunch wheat grass, Kentucky bluegrass, and crested wheatgrass. Share croppers removed much of the hay grown on LPONWR, but a portion was stored or left in the field for supplemental deer feeding.

Of the 443 acres of agricultural land on LPONWR during 1965 when WDFW began managing the Refuge, 313 acres were still tillable. Forest succession was reclaiming the remaining 130 acres with pine and Douglas-fir. WDFW records indicate an average of 100 acres annually farmed during the 1970s. Many of these fields, which ranged in size from 10 to 92 acres, were maintained in crops until 1989 when WDFW phased out its annual cropping of tillable land for budgetary reasons. By 1988, 494 acres of perennial grass fields remained on LPONWR in 9 parcels ranging from 4 to 62 acres. WDFW recommended converting these grassland acres to crested wheat grass. WDFW indicated irrigation was necessary to make these fields productive and new expensive equipment would be needed to maintain the farm program. WDFW began planting many of these fields to small burnet (a perennial evergreen forb) and in 1988 there were about 100 acres planted in this forb. Currently, most of these old fields and pastures are infested with invasive plants such as St. John's wort and knapweed. Small burnet, which is a desirable species for big game and birds, has become increasingly rare.

An analysis of LPONWR aerial photos indicated 58 openings or meadows >1 to 60 acres (totaling 631 acres with an average=11 acres) classifiable as old fields. They include large bottomland alluvial meadows along the LPO River as well as the small remnants of old homestead fields surrounded by forest. Many of these old fields or meadows are shrinking as trees encroach along their edges. Several also contain the remnants of fruit orchards planted by homesteaders. Some of these meadows have moist or wet soil types (especially along the low gradient portions of Bear Creek and the Little Pend Oreille

River); whereas, others are more upland with well drained soils. Vegetation within these fields range from thick stands of redtop, timothy, or orchard grass to dense infestations of invasive plants including cheatgrass, thistle, St. John's wort, and spotted knapweed (Nielson and Lohman 1999). Most of these meadows have been included in livestock grazing allotments. Two small fields near the southwestern corner of LPONWR (30 acres) are under a special-use permit to a neighboring private landowner. These fields are planted to alfalfa where the permittee is allowed one cutting of hay each year. No other agricultural cultivation has occurred on LPONWR since 1989.

2.4 Biological Integrity, Diversity, and Environmental Health

The Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3[3.7B]) mandates "…each refuge will be managed to fulfill refuge purpose(s) as well as to help fulfill the System mission, and we will accomplish these purpose(s) and our mission by ensuring that the biological integrity, diversity, and environmental health of each refuge are maintained, and where appropriate, restored." The maintenance of biological integrity, diversity, and environmental health pertains to the protection of composition and structure, as well as functional natural ecosystem processes that shaped and maintained the historic landscape for native fish, wildlife, plants, and their habitats. The historic forest and riparian communities on LPONWR and the natural processes that shaped them are described in Sections 2.2.1 -2.2.4. Functional remnants of these forest communities (dry, moist, cold) and alluvial riparian still exist on LPONWR. Consequently, these habitats are the highest priority for protection and maintenance on LPONWR.

Because LPONWR occupies a substantial number of acres, it has the potential to contribute significantly to the biological integrity, diversity, and environmental health of the landscape. Most of the remaining forested habitats in the broader landscape including LPONWR have been severely altered as a result of modified fire regime, grazing, and logging. The Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3[3.10A(4)]) indicates that "In deciding on which management activities to accomplish refuge purposes…. we will consider the natural frequency and timing of processes such as flooding, fires, and grazing. Where it is not appropriate to restore ecosystem function, our refuge management will mimic these natural processes including natural frequencies and timing to the extent this can be accomplished."

Because much of the forest landscape on LPONWR evolved under a frequent fire regime and was not subject to substantial grazing by native herbivores (Appendix 1), a natural fire regime and forest management practices that will facilitate the recovery of natural ecological processes of native forest communities will be implemented to achieve LPONWR purposes, maintain and where appropriate restore biological integrity, diversity, and environmental heath as well as manage for FWS mandated trust resources.

Table 2.1 Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest on Little Pend Oreille National Wildlife Refuge (See Figures 2.2 and 2.3).

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	2.4	8.9	1.1	-	-	-	-	-	-
Ponderosa pine	48.1	2699.5	3.2	-	-	-	-	-	-
Ponderosa pine/Douglas-fir	16.8	683.6	6.4	-	-	-	-	-	-
Douglas-fir	69.2	443.4	216.5	71.2	1552.5	361.6	-	-	-
Douglas-fir/grand fir	0.6	191.8	15.8	0.9	1128.9	403.5	-	-	-
Douglas-fir/western larch	1.1	110.4	1.8	0.5	481	125.5	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	64.7	1391.4	366.4	108.2	4974.4	1324.6	-	-	-
Western larch	54.7	162.9	0	242.8	1078.7	3.3	-	-	-
Western hemlock	0	3.1	0.3	0.2	43	27.2	-	-	1.7
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	32.6	931.7	66.6	20.9	4699.7	1312.4	0.3	7.5	399
Engelmann spruce	-	-	-	-	-	-	-	-	0.9
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	20.6	-	-	81.3	4.1	-	0.2	143.4
Subalpine fir	0.4	-	-	1	1.9	-	-	-	48.8
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	27.3

Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	89.9
Lodgepole pine	44.4	1186.7	38.8	15.9	3428.6	12.7	3.4	29.3	346.8
Lodgepole pine/Douglas-fir	4.6	86.1	0.5	1.8	124.3	8.9	-	4.2	-
Lodgepole pine/western larch	5.5	1681.7	108.4	6.8	2609.8	314.2	-	1.1	95.3
Whitebark Pine	-	-	-	-	-	-	-	-	8.4
TOTALS by SERAL STAGE	345.1	9601.8	825.8	470.2	20204.1	3898.0	3.7	42.3	1161.5
PERCENTAGE by SERAL STAGE	*3.20%*	*89.13%*	*7.67%*	*1.91%*	*82.22%*	*15.86%*	*0.31%*	*3.50%*	*96.19%*
TOTALS by FOREST TYPE		10772.7			24572.3			1207.5	
PERCENTAGE by FOREST TYPE		*29.47%*			*67.22%*			*3.30%*	

Table 2.2. Changes in Vegetative Structure within the Colville Sub-basin, Circa 1900-Present (US Fish and Wildlife Service 2000).

VEGETATION STAND STRUCTURE	Seral Stage	Current Acres (1991)	Current % of Sub-basin (1991)	Historic Acres (~1900)	Historic % of Sub-basin (~1900)	Absolute % Change in Landscape (Current % minus historic %)	Approximate Ratio of Current Extent to Historic Extent in Landscape (Current acres divided by historic acres)
Forest Habitat Types							
Stand Initiation Forest	early	24341	4%	68817	11%	**-7%**	**1:3**
Stem Exclusion Closed Canopy Forest	mid	126158	20%	170011	26%	**-6%**	**3:4**
Stem Exclusion Open Canopy Forest	mid	40447	6%	19672	3%	**3%**	**2:1**
Young Multi-strata Forest	mid	99104	15%	3459	1%	**14%**	**29:1**
Understory Reinitiation Forest	mid	239454	37%	11003	2%	**35%**	**22:1**
Old Single-strata Forest	late	0	0%	138643	21%	**-21%**	**1:139,000**
Old Multi-strata Forest	late	15283	2%	135868	21%	**-19%**	**1:9**
Old Multi-strata Woodland		94	0%	0	0%	**0%**	**94:1**
Subtotal: Forest Habitat Types			84%		85%	**-1%**	**1:1**
Non - Forested Habitat Types							
Closed Herbland		37410	6%	13752	2%	**4%**	**3:1**
Open Herbland		247	0%	0	0%	**0%**	**247:1**
Agricultural		47947	7%	0	0%	**7%**	**48,000:1**
Open Low Shrub		12560	2%	17050	3%	**-1%**	**3:4**
Closed Mid Shrub		494	0%	66256	10%	**-10%**	**1:100**
Water		1483	0%	1483	0%	**0%**	**1:1**
Urban		988	0%	0	0%	**0%**	**1000:1**
Subtotal: Non-Forested			15%		15%	**0%**	**0**
Habitat Types							
Total Area		**646011**	**100%**	**646011**	**100**		

Figure 2.1. Little Pend Oreille National Wildlife Refuge, Northeastern Washington.

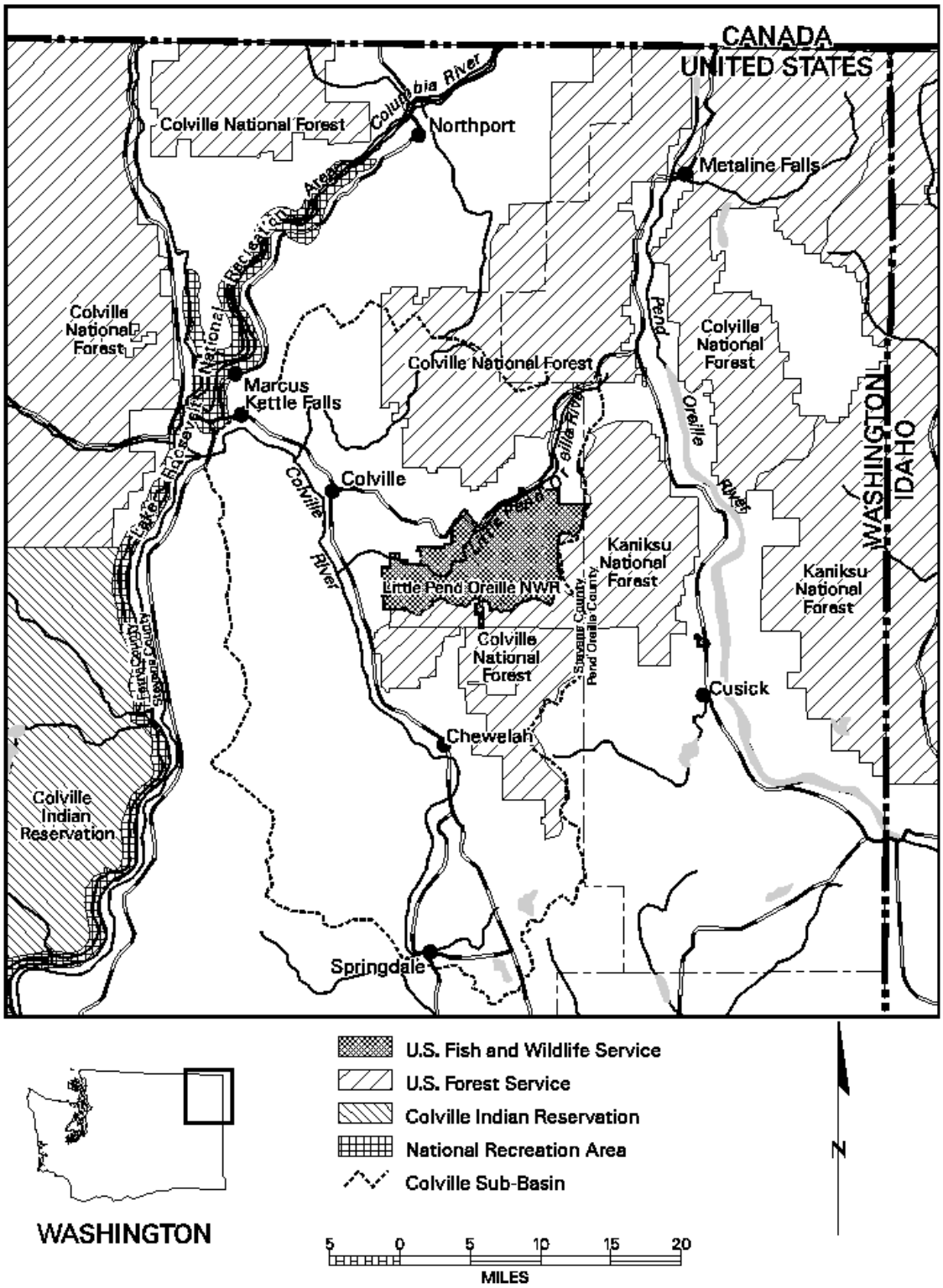


Figure 2.2. Habitat Types on Little Pend Oreille National Wildlife Refuge.

Figure 2.3. Cover Types on Little Pend Oreille National Wildlife Refuge.

Figure 2.4. Plant Associations for Fluvial Surfaces within the Colville, Okanogan, and Wenatchee National Forests (Kovalchik and Clausnitzer 2004).

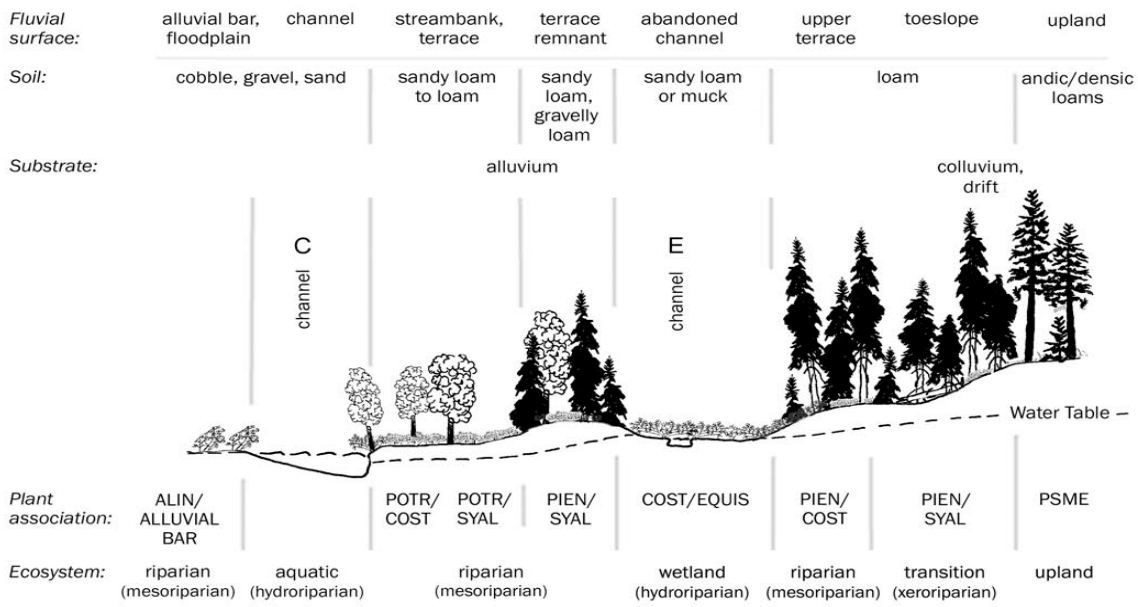
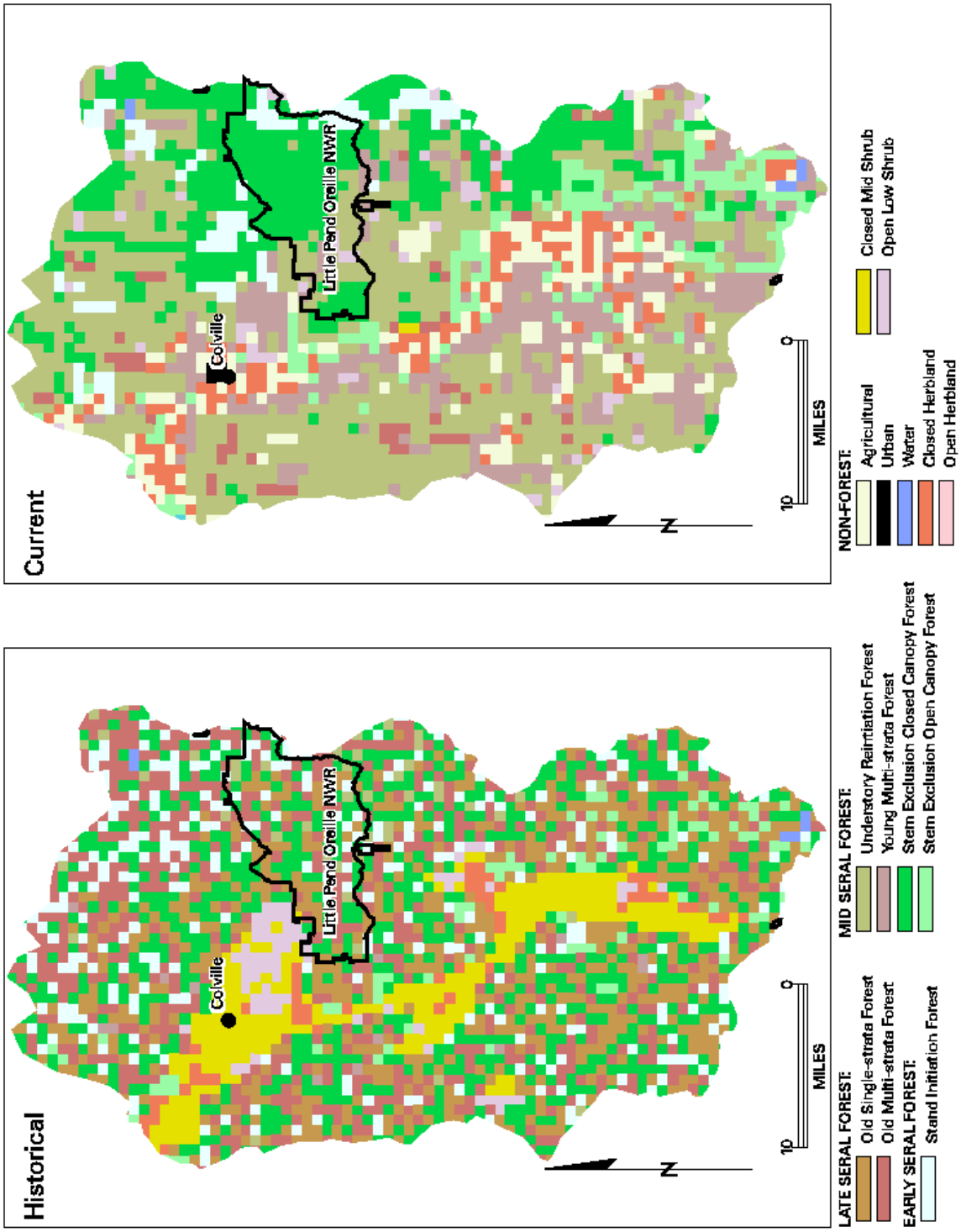


Figure 2.5. Changes in Vegetative Structure within the Colville Sub-basin, Circa 1900-Present (US Fish and Wildlife Service 2000).



3.0 RESOURCES OF CONCERN

As described in the Biological Integrity, Diversity, and Environmental Health policy (601 FW 3), the goal of habitat management on units of the NWRS is to ensure the long-term maintenance and, where possible, restoration of healthy populations of native fish, wildlife, plants, and their habitats. Because there is a wide diversity of species and habitats within the Okanogan Highlands, the approach to habitat management articulated in this HMP considers the historic, current, and the potential complex array of conditions and constraints associated with LPONWR. The primary focus of this plan is to provide management strategies and prescriptions to achieve habitat objectives that consider the habitat requirements for resources of concern.

3.1 Identification of Refuge Resources of Concern

Priorities associated with wildlife and habitat management for the NWRS are determined through directives, policies, and legal mandates. Resources of concern include species, species groups, and/or communities that support refuge purposes as well as FWS trust resource responsibilities (including threatened and endangered species and migratory birds). Resources of concern are also native species and natural, functional communities such as those found under historic conditions that are to be maintained and, where appropriate, restored on a refuge (601 FW 3.10B[1]). Historic conditions associated with forest habitats on LPONWR can be described by the Historic Range of Natural Variability (HRV) for forest seral stages (early, mid, old). The HRV concept is based on the following two principles: past conditions and processes provide context and guidance for managing ecological systems today, and disturbance-driven spatial and temporal variability is a vital attribute of forested ecological systems in the West. This concept was used to develop the broad forest management objectives for the LPONWR CCP. The CCP objectives for dry, moist, and cold forest habitats are stepped down as habitat objectives in this HMP to address the specific requirements for the resources of concern.

Resources of concern for LPONWR take into account the conservation needs identified within international, national, regional, or ecosystem goals/plans; state fish and wildlife conservation plans; recovery plans for threatened and endangered species; regional fisheries management plans; and previously approved refuge resource management plans as identified in the Comprehensive Conservation Planning Process policy [602 FW 3.4C[1][e]) as well as Section 1.3 of this HMP. The species selected as resources of concern (Table 3.1) from these plans support the following NWRS mandates:

- Support refuge purposes and the NWRS mission;
- Conserve biological integrity, diversity, and environmental health (giving special consideration to rare, declining or unique natural communities, species, and ecological processes within the LPONWR boundary and the Okanogan Highlands); and
- Fulfill FWS trust resource responsibilities (migratory birds, threatened and endangered species, interjurisidicational fish, and marine mammals [see Section 1.2]).

Achieving healthy, functional ecosystems for native fish, wildlife, and plants on LPONWR can be described through the habitat requirements of "focal species" highly associated with important attributes or conditions within habitat types. As described by Altman (2000), the rationale for using focal species is to emphasize habitat attributes most in need of conservation or most essential for functional ecosystems. By managing for a group of species representative of important components in a functioning ecosystem, the elements of biological integrity, diversity, and environmental health also will be addressed.

A subset of focal species was selected from the list of resources of concern in order to identify priorities for habitat management throughout the remainder of this plan (Table 3.2). Several migratory landbirds were selected as focal species because they were identified as priority, focal species by PIF (Altman 2000) or WDFW (2004) and they are dependent upon functional dry, moist, and cold forests as well as alluvial riparian habitats. The white-tailed deer was selected as a focal species because it was identified in the LPONWR purpose (see Section 1.2) and it requires all seral stages of functional dry forest habitat (winter foraging and cover) as well as managed old fields and functional alluvial riparian habitat for foraging and fawning, respectively. The westslope cutthroat (priority species for WDFW) was selected as a focal species because it is dependent upon functional, instream habitat that is a resource addressing biological integrity, diversity, and environmental health for LPONWR. The Canada lynx was selected as a focal species because it is a federally listed species that is dependent upon functional old growth conditions in cold forests.

3.2 Identification of Habitat Requirements

Habitat requirements that are necessary to support the focal species for LPONWR are listed in Tables 3.3-6. These habitat requirements were derived from published, scientific literature including PIF, WDFW priority species, and USFS general technical reports; LPONWR reports and data from inventory and monitoring activities; and local area, species, or plant community experts. The specific types of information representing habitat requirements for LPONWR focal species included the following:

- Size, configuration, and juxtaposition of different habitats or seral stages;
- Presence or absence of edge habitats;
- Temporal distribution of required habitat elements or conditions based on cyclic life history needs of a species;
- Necessity for connectivity to other habitats in the landscape for dispersal of young, seasonal migration, and genetic flow;
- Need for buffers from adjacent land uses or land cover negatively impacting refuge habitat;
- Existence of appropriate hydrologic, edaphic, climatic, and topographic conditions to support the resources of concern; and
- Conservation, and where appropriate, restoration of the remnant habitats (e.g. alluvial riparian and landscape connectivity) that are or potentially support the potential native biological communities or processes.

Table 3.1. Resources of Concern (Conservation Targets) for Little Pend Oreille National Wildlife Refuge.

Common Name	Scientific Name	Status[1]
BIRDS		
Common loon	*Gavia immer*	1,2
Red-necked grebe	*Podiceps grisegena*	1,2
Great blue heron	*Ardea herodias*	1,2
Wood duck	*Aix sponsa*	1,2
Common goldeneye	*Bucephala clangula*	1,2
Hooded merganser	*Lophodytes cucullatus*	1,2
Bald eagle	*Haliaeetus leucocephalus*	1,2,3
Northern goshawk	*Accipiter gentiles*	1,2
Merlin	*Falco columbarius*	1,2
Ruffed grouse	*Bonasa umbellus*	1,5
Wilson's phalarope	*Phalaropus tricolor*	1,2
Flammulated owl	*Otus flammeolus*	1,2
Vaux's swift	*Chaetura vauxi*	1,2
Red-naped sapsucker	*Sphyrapicus nuchalis*	1,2
Black-backed woodpecker	*Picoides arcticus*	1,2
White-headed woodpecker	*Picoides albolarvatus*	1,2
Northern flicker	*Colaptes auratus*	1,2
Pileated woodpecker	*Dryocopus pileatus*	1,2
Willow flycatcher	*Empidonax trailii*	1,2
Olive-sided flycatcher	*Contopus cooperi*	1,2
Red-eyed vireo	*Vireo olivaceus*	1,2
Veery	*Catharus fuscescens*	1,2
Hermit thrush	*Catharus guttatus*	1,2
Varied thrush	*Ixoreus naevius*	1,2
Townsend's warbler	*Dendroica townsendi*	1,2
MacGillivray's warbler	*Oporornis tolmiei*	1,2
Chipping sparrow	*Spizella arborea*	1,2
MAMMALS		
Hoary bat	*Lasiurus cinereus*	4
Gray wolf	*Canis lupus*	3
Grizzly bear	*Ursus arctos*	3
Canada lynx	*Lynx canadensis*	3
White-tailed deer	*Odocoileus viginianus*	1
AMPHIBIAN		
Columbia spotted frog	*Rana luteiventris*	4
FISH		
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	4
HABITATS		
Aspen stands >2 acres		4
Freshwater wetlands		4
Instream		4
Old-growth and mature forest		4
Riparian		4
Snags and logs		4

[1]The following are values associated with the status column:

1 - Supports purposes for LPONWR.
2 - Migratory bird (trust resource responsibility for FWS).
3 - Federally listed threatened species (trust resource responsibility for FWS).
4 - Contributes to the biological integrity, diversity, and environmental health of LPONWR.

Table 3.2. Resources of Concern Selected as Focal Species and Other Benefiting Wildlife Species on Little Pend Oreille National Wildlife Refuge.

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
White-headed woodpecker	Dry forest (Ponderosa pine and ponderosa pine/Douglas-fir/grand fir)	Large patches of old forest with large trees and snags	Year round	Hammond's flycatcher, hairy woodpecker, brown creeper, white-breasted nuthatch, pygmy nuthatch[3], and northern goshawk[1, 4, 8]
Flammulated owl Chipping sparrow White-headed woodpecker		Old forest with interspersion of grassy openings and dense thickets	Breeding	Great gray owl[7], white- breasted nuthatch, hairy woodpecker, brown creeper, Townsend's solitaire, Hammond's flycatcher, Cassin's finch, western bluebird, western tanager, and pygmy nuthatch[3]
Chipping sparrow		Open understory and regenerating pines	Breeding	Townsend's solitaire, Cassin's finch, American robin, dark-eyed junco, dusky flycatcher, and gray flycatcher
Black-backed woodpecker Olive-sided flycatcher		Patches of burned old forest	Foraging	Lewis' woodpecker[3,4,6], American kestrel, three-toed woodpecker, mountain bluebird, and northern flicker
White-tailed deer	Dry forest	Old forest with closed canopy and abundant shrubs	Wintering	Wild turkey[5]
Western meadowlark	Old fields-managed	Tall herbaceous vegetation	Breeding	Wild turkey[5], hoary bat[1], loggerhead shrike[4,8], merlin[4] Adder's tongue[4,7] and blue-eyed grass [4,7] (Lower Manz meadow only)
Western bluebird White-tailed deer			Foraging and fawning	
Vaux's swift Flammulated owl Varied thrush	Moist forest	Old forest with large snags	Breeding	Hairy woodpecker, great gray owl[7], golden-crowned kinglet, chestnut-backed chickadee, red-breasted nuthatch, winter wren, brown creeper, pileated woodpecker[1,4], and marten[5]
Townsend's warbler	Moist forest	Old forest with overstory canopy closure	Breeding	Great gray owl[7], spruce grouse[5], golden-crowned kinglet, chestnut-backed chickadee, northern goshawk[1,4,8], pileated woodpecker[1,4], and marten[5]

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Varied thrush Hermit thrush	Moist forest	Old forest with multi-layer canopy and structural diversity	Breeding	Golden-crowned kinglet, chestnut-backed chickadee, blue grouse[5], Townsend's warbler[6], and winter wren
MacGillivray's warbler	Moist forest	Dense shrub layer in forest openings or understory	Breeding	Fox sparrow, song sparrow, orange-crowned warbler, spotted towhee, and Wilson's warbler, elk[5], moose[5], and mule deer[5]
White-tailed deer			Foraging	
Olive-sided flycatcher	Moist forest	Old forest with edges and openings created by wildland fire	Breeding	Western tanager, Cassin's finch, western wood-peewee, mountain bluebird, northern flicker, American kestrel, and American robin, elk[5], mule deer[5], and moose[5]
White-tailed deer			Foraging	
Red-naped sapsucker	Dry forest	Large aspen with younger aspen replacements	Breeding	Northern flicker, tree swallow, house wren, northern pygmy owl, western screech owl, mountain bluebird, and ruffed grouse[1]
	Moist forest		Breeding	
	Alluvial riparian		Breeding	
Red-eyed vireo MacGillivray's warbler	Alluvial riparian	Canopy foliage and structure composed of shrubs and cottonwood trees	Breeding	Western wood peewee, warbling vireo, American redstart, orange-crowned warbler, and mountain chickadee
Veery	Alluvial riparian	Understory foliage and structure composed of shrubs	Breeding	Swainson's thrush, calliope hummingbird, song sparrow, spotted towhee, gray catbird, and ruffed grouse[1]
White-tailed deer				
Willow flycatcher MacGillivray's warbler Veery White-tailed deer	Alluvial riparian	Dense willow and alder shrub patches	Breeding	Song sparrow, yellow warbler, lazuli bunting, and spotted towhee

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Lewis' Woodpecker	Riparian woodland and riparian shrub	Large snags	Year around	Tree swallow, downy woodpecker, house wren, northern flicker, bald eagle[1,2,4], and golden eagle[3,4]
Hermit thrush Olive-sided flycatcher Varied thrush	Cold forest	Multi-layered canopy with understory shrubs	Breeding	Chestnut-backed chickadee, three-toed woodpecker, boreal owl, white-crowned sparrow, and marten[5]
Canada lynx	Cold forest	Old forest with large dead and down material	Breeding	Marten[5]
Canada lynx	Landscape connectivity	Corridors connecting habitat via ridges, saddles, and riparian zones	Foraging and dispersal	Grizzly bear[2], gray wolf[2], wolverine[4,7], and fisher[4,8]
Westslope cutthroat trout	Instream	Water temp, pools, bank stability, % sediment, amount of woody debris, riparian vegetation	Total life cycle	Interior redband rainbow trout[7,8], coastal rainbow trout[1], eastern brook trout, brown trout, and mink[5]
Common goldeneye	Freshwater wetlands	Water depth, persistence, amount of vegetation	Reproduction and foraging	Red-necked grebe[5], great blue heron[5], wood duck[5], hooded merganser[5], Wilson's phalarope[3,5], mink[5], moose[5], hoary bat[1], big brown bat[5], California bat[5], long-eared myotis[5,8], little brown myotis[5], long-legged myotis[5], Yuma myotis[5,8], Pallid Townsend's big-eared bat[4,7,8], Columbia spotted frog[1,4], Northern leopard frog[4,7], coastal rainbow trout[1], westslope cutthroat trout[5,7,8], interior redband rainbow trout[7,8], bulb-bearing water hemlock[4,7]

[1]LPONWR CCP (US Fish and Wildlife Service 2000) evaluation species.
[2]Federally listed endangered, threatened, or proposed species.
[3]FWS Birds of Conservation Concern-2002.
[4]Washington endangered, threatened, candidate, or sensitive species.
[5]Washington priority species.
[6]Altman (2000).
[7]USFS Region 6, Colville NF sensitive species list.
[8]FWS Species of concern list-2004.

Table 3.3. Habitat Requirements for Focal Species in Dry Forest Habitats of the Little Pend Oreille National Wildlife Refuge.

Focal Species	Conservation Focus	Key Habitat Relationships			
		Vegetative Composition	Vegetation Structure	Patch Size	Special Considerations
White-headed woodpecker	Large patches of old forest with large trees and snags	Ponderosa pine	>10 trees/ac >21" dbh with >2 trees >31" dbh; 10-40% tree canopy closure; >1.4 snags/ac >8" dbh with >50% >25"[1]	>350 ac	Large high-cut stumps; patch size smaller for old forest
Flammulated owl Chipping sparrow White-headed woodpecker	Old forest with grassy openings and dense thickets	Ponderosa pine and Douglas-fir	>10 snags/100 ac >12" dbh and >6 ft tall; >8 trees/ac >21" dbh[1]	>35 ac	Thicket patches for roosting; grassy openings for foraging
Chipping sparrow	Open understory and regenerating pines	Ponderosa pine, Douglas-fir, and grand fir	10-30% tree canopy cover; 20-60% shrub cover with >20% sapling cover, especially pines[1]		Non-agriculture/grazing landscape due to cowbird parasitism
Black-backed woodpecker Olive-sided flycatcher	Patches of burned old forest	Ponderosa pine	>2% of the landscape as post-fire old forest; >50% of post-fire landscape as unsalvaged; in salvage, retain all trees/snags >20" dbh and >50% of those 12-20"; salvage <50% of dead and down; in old forest, >13% shrub cover and ~ 24 snags/ac >9"[1]		Soft snags for excavation; pesticide spraying may reduce insect prey base
White-tailed deer	Mid-seral with closed canopy and abundant shrubs	Ponderosa pine and Douglas-fir	≥ 70% horizontal concealment cover (5 ft high); ≥70% conifer canopy cover ≥ 35 ft tall; ≥75% canopy cover of shrubs and trees >5 ft high; density of open roads <1.5 mi/sq mi in summer range and < 0.5 mi/sq mi in winter range; 25-60% preferred shrub canopy cover <5 ft tall; preferred shrub/tree composition; shrub diversity; and >30% palatable herbaceous cover[2]		Maintain quality disturbance free fawning areas, maintain road densities <0.5 mi/sq mi on winter range

[1]Altman (2000).
[2]Ashley (1998).

Table 3.4. Habitat Requirements for Focal Species in Moist Forest Habitats of the Little Pend Oreille National Wildlife Refuge.

Focal Species	Conservation Focus	Key Habitat Relationships			
		Vegetative Composition	Vegetation Structure	Patch size	Special Considerations
Vaux's swift Flammulated owl Varied thrush	Old forest with large snags	Grand fir and Douglas-fir	Snags >27" dbh and >80 ft tall and in different stages of decay (including some hollow snags)[1]		Recruitment snags (live trees) with signs of defects (e.g., broken tops); proximity to riparian areas
Townsend's warbler	Overstory canopy closure	Grand fir and Douglas-fir	Old forest dominated by Douglas-fir with > 50% tree canopy closure[1]	>100 ac	
Varied thrush Hermit thrush	Mid/late seral with structurally diverse	Douglas-fir and grand fir	Multiple tree layers with mixed species composition including >25% deciduous cover and tree canopy closure >60%[1]	>75 ac	Area sensitive; avoids edges; and needs dense leaf litter layer for foraging
MacGillivray's warbler White-tailed deer	Early seral with dense shrub layer - understory or openings	Douglas-fir	Dense shrub layer dominated by native species with >40% cover and/or >270 stems/ac); tree canopy cover <25%; herbaceous ground cover <25%[1]		Cowbird host
Olive-sided flycatcher White-tailed deer	Edge and openings created by fire	Grand fir and ponderosa pine	>2% of the landscape as post-fire old forest; >40% of post-fire landscape as unsalvaged; in salvage, remove <50% of dead and down; and retain all trees snags >20" dbh and >40% 12-20" dbh[1]		Patches of mix of live and dead and pesticide spraying may reduce insect prey availability
White-tailed deer	Mid seral with closed canopy and abundant shrubs	Douglas fir and mixed conifer	For elevations ≤3000 ft, ≥ 70% horizontal concealment cover (5 ft high); ≥70% conifer canopy cover ≥ 35 ft tall; ≥75% canopy cover of shrubs and trees >5 ft high; 25-60% preferred shrub canopy cover < 5 ft tall; preferred shrub/tree composition; shrub diversity; and > 30% palatable herbaceous cover[2]		Maintain disturbance-free fawning areas

[1]Altman (2000).
[2]Ashley (1998).

Table 3.5. Habitat Requirements for Focal Species in Alluvial Riparian Habitats of the Little Pend Oreille National Wildlife Refuge.

Focal Species	Conservation Focus	Key Habitat Relationships			
		Vegetative Composition	Vegetation Structure	Patch size	Special Considerations
Lewis' woodpecker	Woodland - large snags	Cottonwood	>0.8 snags/ac >16" dbh; >0.8 trees/ac >21" dbh; tree canopy cover 10-40%; and shrub cover 30-80%[1]		Dependent on insect food supply and competition from starlings detrimental
Red-eyed vireo MacGillivray's warbler	Woodland - canopy foliage	Cottonwood and aspen	Tree canopy closure >60%; riparian zone of mature deciduous trees >160 ft wide; >10% of the shrub layer should be young cottonwoods[1]		Frequent cowbird host
Veery White-tailed deer	Woodland - understory shrub layer	Cottonwood and aspen	Dense, contiguous understory of native vegetation with cover in the shrub layer >40%; riparian zone width >100 ft; unbroken tracts with the aforementioned conditions >1/8 mi long[1]		Common cowbird host and negatively impacted by grazing
Willow flycatcher MacGillivray's warbler Veery White-tailed deer	Shrub - willow/alder shrub patches	Willow and alder	Dense patches of native vegetation in the shrub layer >35 ft X 35 ft in size and interspersed with openings of herbaceous vegetation; shrub canopy cover 40-80%; shrub layer height >3 ft high; and tree cover <30%[1]	>20 ac	Frequent cowbird host; sites >0.6 mi from urban/residential areas and >3 mi from high-use cowbird areas

[1]Altman (2000).

Table 3.6. Habitat Requirements for Focal Species in Unique Habitats of the Little Pend Oreille National Wildlife Refuge.

Focal Species	Conservation Focus	Key Habitat Relationships			
		Vegetative Composition	Vegetation Structure	Patch Size	Special Considerations
Hermit thrush Olive-sided flycatcher Varied thrush	Cold forest	Subalpine fir and Engelmann spruce	Multi-layered tree canopy and dense shrub layer dominated by native species with >40% cover and/or >270 stems/ac[1]		
Canada lynx	Cold forest	Subalpine fir and Engelmann spruce	Mature lodgepole pine and old-growth (150-250 years) fir and spruce in north or northeast aspects and down log density >40 logs/150 ft lying 1-4 ft above ground[1]	1-5 acres	Denning habitat within 3.5 mi of prey habitat isolated from human disturbance
Red-naped sapsucker	Aspen in dry, moist, and cold forests	Aspen	Large trees with >10% cover of saplings in understory as replacements; >4 trees and >1.5 snags/ac > 39 ft in height and 10”dbh; tree canopy 30-70%[1]	Either clumped with patches and openings or relatively evenly distributed	Where appropriate, initiate actions to maintain or provide some areas with natural (e.g. fire) or mechanical disturbance regimes to ensure proper successional development
Western meadowlark Western bluebird White-tailed deer	Old fields (managed)	Desirable native and introduced grasses and forbs	>90% herbaceous cover comprised of 25-75% desirable native and cultivated grasses with the remaining herbaceous cover composed of desirable forbs and <30% canopy cover composed of trees (saplings or seedlings)[4]		500 acres of meadow and old fields maintained in this condition
White-tailed deer	Old fields (passive reforestation)	Dry, moist, or cold forest	Native woody and herbaceous species		≤200 acres old fields may be passively reforested
Common goldeneye	Freshwater wetlands		≥5 snags/ac ≥12” dbh near suitable shallow (≤5 ft deep) wetlands including beaver ponds lakes and low gradient rivers and <50% emergent vegetation with large woody debris, downed logs, and low islands present[3]		Wood ducks prefer 50-75% overhanging woody vegetation and/or emergent vegetation
Western cutthroat trout	Instream		No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the		

			maximum daily temperature of the warmest consecutive 7-day period); maximum water temperatures below 59 F within adult holding habitat and below 48F within spawning and rearing habitats; >20 pieces/mi of large woody debris, > 12" diameter, > 35 feet long (forested systems); > 80% of the banks stable in non-forested systems; >75% of the lower banks with <90 degree angle in non-forested systems; a width/depth ratio < 10 (mean wetted width divided by mean depth); pool frequency of 96 pools/mi for wetted width of 10', 56 pools/mi if wetted width 20', 47 pools/mile if wetted width is 25 feet[5]		
Canada lynx	Landscape connectivity		Maintain travel routes along ridges, saddles, and streams >330 ft wide following existing landscape contours[6]		Roads placed on ridges or saddles through necessity will be minimum width, vegetated on both sides with sight distances >330 ft

[1]Altman (2000).
[2]Ashley (1998).
[3]Lewis and Kraege (2004).
[4]Dechant et al. (1999).
[5]US Forest Service (1996).
[6]Washington Department of Natural Resources (1996).

4.0 HABITAT OBJECTIVES AND MANAGEMENT STRATEGY AND PRESCRIPTIONS

As stated in Section 1.3, this is a step-down plan that is based on the broad habitat objectives and strategies identified within the LPONWR CCP. This HMP provides specificity through the development of habitat objectives that step-down from those included in the CCP which relate to habitat management. For each objective, habitat management strategy(ies) to achieve them are identified along with specific prescriptions that identify how, when, why, and where the strategy will be implemented on refuge lands. The habitat requirements for focal species (Tables 3.3-3.6) that represent Service legislative mandates (refuge purpose; trust resources; and biological integrity, diversity, and environmental health) were used to develop the specific attributes of habitat objectives presented in this section.

4.1 Forest

The CCP defined the annual forest management targets with the following statement, "Restore mature stand structures and fire ecosystem role in dry forest stands on up to 1000 acres per year (or until 90% is under regular fire management)**.** Strive to create open stands dominated by scattered mature pine and larch trees to provide diverse natural habitat for wildlife and to reduce the risk of fire and disease." In addition, the CCP indicated the highest priority for habitat management was within the dry forests. Since completion of the CCP, the LPONWR staff has conducted management activities that contribute to restoring mature stand structure and natural fire regimes on approximately 5000 acres of dry forest habitat (Figure 4.1).

The CCP also stated, "The moist and cold forest zones of the Refuge would be lower priorities for active restoration. However, management actions, including thinning and burning could occur in the moist and cold zones depending on identified needs, such as controlling disease, controlling noxious weeds, or enhancing habitat for special status species such as the lynx." Spatial analyses conducted for the HMP reveal that a higher percentage (96%) of LPONWR is currently in late-seral stage cold forest than was proposed to develop over the long term in the CCP (35%). Because late-seral cold forest is missing at the landscape scale, it is important to wildlife (particularly Service trust resources) and vital to landscape connectivity with private and other agencies lands. Management of this forest type to meet the historic range of variability will not be addressed in this plan except as noted above.

Priorities for forest treatments are based on several changing factors, including but not limited to, wildlife needs, insect and disease occurrence, funding sources, proximity to private land, fuel loads, tree species, and successional stages.

Table 4.1 identifies the approximate numbers of acres within each LPONWR management unit where thinning (pre-commercial, commercial) and prescribed fire will be implemented during the remaining ten years of the CCP to achieve the dry and moist forest management objectives identified below. Because multiple forest entries will be required to achieve these long-term habitat objectives (100-200 years), exact acres of forest to be treated in the next decade cannot be directly tied to the long-term objective acre targets. Tables 4.2 and 4.3 identify existing dry and moist forest seral stage acres and commercial thinning targets (2005-2015) for each management unit. A high priority for assessing potential commercial thinnings within the next two years will

be to identify mid-seral stands in dry and moist forests that are approaching 125 years of age. These stands will receive management emphasis to accelerate mid-seral to late seral structures.

The management strategies and prescriptions identified under each forest habitat objective will be implemented based on inventorying and monitoring to identify the appropriate future application of one or more of these strategies considering the site-specific needs and conditions of each forest stand within management units.

Following are the prescriptions associated with implementation of the three primary management strategies for LPONWR's dry and moist forests: pre-commercial thinning, commercial thinning, and prescribed fire.

4.1.1 Dry forest

CCP Dry Forest Objective

Over the long term (100-200 years), aim for a mosaic of stands of different age and structural classes at approximately the same seral distributions as occurred historically (HRV) within the dry forest zone: ~15 % early seral, ~35 % mid seral, and ~50% old single or old multi-layer.

HMP Late-Seral Dry Forest Objective

Over the long term (100-200 years), increase old, dry forest (>20" dbh) by ≥4561 acres in >350 acre blocks with 10 trees/ac >21" dbh where >2 trees >31" dbh; 10-40% tree canopy cover; >1.4 snags/ac >8" dbh; shrub canopy cover of native species dependent upon the appropriate plant associations for the Dry Forest-Ponderosa pine and Douglas-fir Series (Appendix 5); and herbaceous canopy cover of native species dependent upon the appropriate plant associations for the Dry Forest-Douglas-fir and Ponderosa Pine Series (Appendix 5).

Rationale

Within the Interior Columbia Basin Ecosystem, there has been a 60% decline in single-layer and 27% decline in multi-layered old-forest structures in dry forests (Quigley et al 1996). Within the Colville sub-basin, most of the old, and mature forests are gone with only 10% of the multi-strata forest remaining. Noss et al. (1995) consider ponderosa pine forest ecosystems to be one of the most imperiled forest ecosystems in the western United States resulting in the greatest wildlife species declines. Within Washington State, only 4% of the total acres of the ponderosa pine zone and 8% of the Douglas fir zone are on protected status lands (public lands that are permanently protected from conversion of natural land cover and have a mandated management plan that maintains a them primarily in a natural state). These dry forest types represent the highest conservation priority in Washington's east side forests (Cassidy et al. 1997).

Ponderosa pine has been replaced across much of the landscape by mid-seral forests with a resultant decline in species dependent upon these late-seral habitats. Late-successional ponderosa pine forests are important for several habitat specialists that have suffered large population declines including white-headed woodpecker, white-headed nuthatch, pygmy

nuthatch, flammulated owl, Lewis' woodpecker, and Williamson's sapsucker (Altman 2000). Lack of large trees and snags is believed responsible for these species declines.

The following strategy will be implemented as appropriate to restore mature stand structure and natural fire regimes to dry forest stands.

Strategy for pre-commercial thinning in dry forest

- Thin young stands of trees (pre-commercial) by appropriate method (hand, mechanical, and prescribed fire) to reduce competition for resources, reduce fuel loads, and allow residual trees to develop into healthy advanced stands.
- Engage in active pre-commercial management, where appropriate (i.e. no commercial interest, contracts or funds not available or resource in immediate jeopardy), by falling, girdling, poisoning, and mechanical thinning.

Prescription

- Use hand thinning where generally >2500 stems/acre exists and >75% of trees are ≤ 5.5" dbh. Hand pile and burn or broadcast burn slash when prescriptive elements are favorable to consume 90% of 1-hr fuels, 80-90% of 10-hr fuels, and 40-70% 100-hr fuels.
- Avoid even spacing of trees and groups. Strive for an uneven distribution of trees and groups throughout the stand to maintain naturalness.

Strategy for commercial thinning

- When preparing late seral stage dry forest units for harvesting commercially, ignore traditional timber production tenets such as even spacing and removal of defective stems.
- Use variable density marking when preparing commercial units. Specifically, mark stands to achieve an uneven, naturally appearing distribution where spacing of individual stems and groups is irregular across the stand.
- Leave variable size openings throughout the stand unevenly distributed. This will allow a natural progression of shrub and herbaceous cover to develop based upon site-specific conditions (see Appendix 5).
- Employ a "low thin" or thinning from below technique where overstocked stands of younger commercial size trees are developing under a canopy of older trees. This will serve to reduce competition and fuel loads to benefit the existing overstory trees.

Prescription

- When marking trees of older age classes (>85 years [>13" dbh]) for removal by commercial sale, ignore conventions such as spacing and removal of defective trees. Retain those trees which have favorable characteristics for wildlife such as spike and bayonet tops, cavities, large branches, irregular shapes, and flattened tops. Live trees with these characteristics are more resistant to fire and rot compared with dead ones and they will persist for much longer periods of time especially where prescribed burning is conducted on a rotational basis. Manage for decadence as opposed to traditional management for thrift and vigor.

- Incorporate variable density marking by removing trees from one group or area at a different rate than from similar adjacent groups to maintain the random character of stem distribution in the stand. Do not space trees evenly and create artificial "tree farm" appearance.
- Retain old growth trees or the oldest and largest trees in the stand (≥20"dbh). Develop stands where >10 trees/acre are >21" dbh and >2 trees/acre are >31" dbh. These trees are the obvious survivors of many fires, insects, disease and natural and human caused events that have demonstrated an ability to persist over many years in the forest.
- Retain all standing dead trees and snags*. Recently dead trees provide a variety of species with a source of food in the form of insects and they will, in turn, provide future snags and downed material. ** If safety of personnel may be compromised while operating around standing dead trees, then allow for safety buffer around them where no activity will occur.*
- Create snags if <2/acre >8"dbh are not present in the stand using fire, girdling, or other methods.
- Coordinate habitat manipulations over time in adjacent management blocks to achieve old growth forest patch sizes of ≥350 acres. It may take a decade or more to expand these minimal patch sizes, but in terms of an old growth forest a decade is a relatively short period.
- Strive for a canopy closure of 10 to 40% in old growth ponderosa pine stands. Repeated entries over time may be required to reach and maintain habitat attribute.
- Because stand densities tend to increase over time, periodic entries 25-50 years apart to remove stems may be required to achieve suitable canopy closure and to keep basal areas <120 square ft/acre to guard against mountain pine beetle and other insect infestations. Stands which are overstocked and stressed by competition become ready targets for insects and disease.
- Avoid situations in older stands with larger trees (≥50 years and ≥12" dbh), where basal areas are reduced too severely in a single entry and previously supported canopies are subject to climatic damage such as wind throw and snow breakage.
- Retain *all* downed trees and logs and restrict displacement and removal of this material because it is valuable in creating favorable sites for natural seedling development, breeding areas for amphibians, and denning and cover for small mammals.
- Where overstocked stands (>2500 stems/acre) and ≥25% of trees are ≤5.5" dbh, thin to overall average of 12 ft x12 ft spacing to develop the tree canopy and ≥20 ft x 20 ft average spacing to promote shrub and herbaceous cover. Use mechanical harvesters and forwarders (or other suitable equipment) to remove biomass; boles are removed ≤2.5" top diameter and branches are left on site.
- In commercial low thinning operations, target trees with 6" to 12" dbh. In these diameter classes, even spacing of 16 - 20 ft may be used if trees are occupying areas ≥0.25 acre. If trees are occurring in small groups and clusters (<0.25 acre) with irregular distribution, strive to maintain this natural appearance. Retain some vigorous trees that likely will persist to late-seral stage by selecting retention trees with good growth and vigor characteristics such as sharp crowns, upright branch pattern, crown to stem ratio ≥0.33, and deeply fissured bark. Use mechanical harvesters and forwarders (or other suitable equipment) for harvesting.
- Mimic the natural distribution of old large single trees and groups of ponderosa pine; leave clusters of older age classes manifesting old growth characteristics such as spike and bayonet tops, cavities, large branches, irregular shapes, and flattened tops intact. These groups are natural and distinctive of dry ponderosa pine forest. As mortality occurs within and among

each distinct group, the widely spaced character of very old ponderosa pine forests becomes evident.

- Avoid even spacing of trees and groups except where specified above. Strive for an uneven distribution of trees and groups throughout the stand to maintain naturalness.

Strategy for prescribed burning

- Use rotational prescribed burning for the following: reduce tree competition and create conditions where more fire resistant stems survive; reduce fuel loads giving tree better chance to survive repeated fires; and create situations where simulated natural fire helps tree develop in a natural way by self pruning and developing long clear boles with thick bark. This strategy may be used to maintain forest structure and fuel bed characteristics typical of natural systems. The desired results of these fires will be the consumption of fine fuels (needles, twigs, small branches, and other forest litter) and the stimulation of herbaceous and woody shrub growth. Fires burning at the hotter side of the prescription window may also serve to thin regeneration as it becomes established.
- Allow natural fire (wildland fire use) (wildland fire use) if prescriptive conditions exist and they are being met where fire occurs and policy and regulations allow.

Prescription

- Use rotational prescribed burning on a 5- to 25-year cycle to benefit fire adapted species, reduce competition and susceptibility to insect attack; also, it reduces fuel loads giving trees better chance to survive repeated fires and helps tree develop in a natural way by stimulating self pruning and developing long clear boles with thick insulating bark. Use prescribed fire to reduce 80-100% of 1-hr fuels, 50-60% of 10-hr fuels, and 10-30% 100-hr fuels. Refer to Fire Management Plan for prescriptive elements and details.
- Variable size openings will also be created and maintained through the use of fire and where trees die or are removed by harvest. These openings should range from very small (20 sq.ft) to large (0.25 acres).
- All prescribed fires require detailed, site-specific prescriptions. Because it is not appropriate to include the detail of specific plans in this document, the topics covered for each prescription include the following: site description (topography, aspect, slope, and elevation), location, fuel models, management goals and objectives for the unit and burn objectives, scheduling, drought indicator, weather parameters (temperature, relative humidity, and wind speed), wind direction, fuel moisture (1 hour, 10 hour, 100 hour, woody live fuel, herbaceous live fuel, and litter and duff moisture), desired fire behavior, additional factors, smoke management, sensitive areas in the unit, complexity analysis, monitoring activities, site preparation, required permits, public and media contacts, weather forecasts, staffing and equipment requirements, communication plan, medical plan, ignition plan, holding plan, prescription monitoring, mop up and patrol, contingency plan, and rehabilitation plan.

HMP Mid-Seral Dry Forest Objective

Over the long term (100-200 years), convert ≥2915 acres of mid-seral, dry forest (10-20” dbh) to early or late successional (old) forest. Maintain 3770 acres in mid-seral stage forest with ≥70% conifer canopy cover ≥35 ft tall; 25-60% shrub canopy cover <5 ft tall of native species that may include ceanothus, willow, serviceberry, chokecherry, red-osier dogwood, maple, kinnikinnick, pachistima, Oregon grape, snowberry, and hawthorne for white-tailed deer as forage and cover; >4 snags/ acre ≥10" dbh; and >30% canopy cover of native, herbaceous species dependent upon the appropriate plant associations for the Dry Forest-Douglas-fir Series (Appendix 5).

Rationale

Overstocked mid-seral stages dominate the dry forests of the Colville sub-basin. Management emphasis in mid-seral dry forest habitat will be to convert acres from this structural class to late seral structure with lesser emphasis on increasing the coverage of early seral dry forest. Most of the early seral forest development will occur through planned prescribed burns that will set back succession.

Strategy for pre-commercial thinning

- Thin young stands of trees (pre-commercial) by appropriate method (hand, mechanical, prescribed fire) to reduce competition for resources reduce fuel loads and allow residual trees to develop into healthy advanced stands.
- Engage in active pre-commercial management where appropriate (i.e. no commercial interest, contracts or funds not available or resource in immediate jeopardy) by falling, girdling, poisoning, mechanical thinning of live stems where biomass is left in the forest.

Prescription

- Where overstocked stands (>2500 stems/acre) and ≥25% of trees are ≤5.5” dbh, thin to overall average12 ft x 12 ft foot spacing to develop the tree canopy and ≥20 ft x 20 ft spacing to promote shrub and herbaceous cover. Use mechanical harvesters and forwarders (or other suitable equipment) to remove biomass; boles are removed ≤2.5” top diameter and branches are left on site.
- Use hand thinning where generally >2500 stems/acre exists and >75% of trees are ≤5.5” dbh.

Strategy for commercial thinning preparation

- When preparing units for harvesting commercially in the mid-seral dry forest, apply silvicultural practices designed to increase vigor, growth, and longevity by retaining trees exhibiting the best morphological characteristics such as size (diameter and height), dominance, high crown to stem ratio, full crowns, upright branching, rapid growth as evidenced by distance between branch whorls, relative size, and bark characteristics.
- Employ a “low thin” or thinning from below technique where overstocked stands of younger commercial size trees are developing under a canopy of older trees. This will reduce competition and fuel loads to benefit the existing overstory trees.

- Use variable density marking when preparing commercial units. Mark stands to achieve an uneven, naturally appearing distribution where spacing of individual stems and groups is irregular across the stand.

Prescription

Apply proper spacing guidelines to maintain ≥70% canopy cover ≥35 ft high depending upon species, age, and size in order to advance from mid to late successional forest.

- In openings and where patches of mid-seral dry forest have not attained ≥70% canopy cover ≥35 ft high, allow 25-60% shrub cover <5 ft high to develop from native species as indicated in Appendix 5 for white-tailed deer forage and cover.
- Retain all standing dead trees and snags*. Recently dead trees provide a variety of species with a source of food in the form of insects and they will in turn provide future snags and downed material. ** If safety of personnel may be compromised while operating around standing dead trees, then allow for safety buffer around them where no activity will occur.*
- Retain naturally downed trees and logs and restrict displacement and removal of this material because it is valuable in creating favorable sites for natural seedling development, breeding areas for amphibians, and denning and cover for small mammals.
- When encountering patches, groups, or single trees with late seral stage characteristics in an otherwise mid-seral type, apply prescriptions and Strategy as detailed previously for late-seral dry forest.
- Because stocking densities tend to increase over time, periodic entries of 25 to 50 years to remove stems may be required to achieve suitable canopy closure and maintain basal areas <120 sq ft/acre to guard against mountain pine beetle and other insect infestations. Stands which are overstocked and stressed by competition become ready targets for insects and disease.
- Avoid situations in older stands (≥50 years and ≥12" dbh) where basal areas are reduced too severely in a single entry and previously supported canopies are subject to wind throw and snow breakage.
- In commercial low thinning operations, target trees with 6" to 12" dbh. In these diameter classes, even spacing of 16 - 20 ft may be used if trees are occupying areas ≥0.25 acre. If trees are occurring in small groups and clusters (<0.25 acre) with irregular distribution, strive to maintain this natural appearance. Retain some vigorous trees that likely will persist to late-seral stage by selecting retention trees with good growth and vigor characteristics such as sharp crowns, upright branch pattern, crown to stem ratio ≥0.33, and deeply fissured bark. Use mechanical harvesters and forwarders (or other suitable equipment) for harvesting.

Strategy for prescribed burning

- Use rotational prescribed burning to reduce tree competition and create conditions where more fire resistant stems survive.
- Pile and burn when total fuel bed load is too great to allow broadcast burning. The objective of this strategy is to reduce the "ladder fuels" represented by dense understory layers, and consequently the intensity and severity of subsequent fire. It may be used as a precursor to allowing low intensity surface fires to return to the site.

- In select areas, broadcast burning under the canopy may be done to thin the understory as well as stimulate herbaceous and woody shrub growth. Because the impact of these fires on the residual stand is generally greater than pile burning, thinning in the overstory may be desirable from the standpoint of forest structure (i.e., stocking levels and snag presence). Reduction of "activity fuels" following harvests may also be an objective.
- Allow natural fire (wildland fire use) if prescriptive conditions exist and they are being met where fire occurs and policy and regulations allow.

Prescription

- Use rotational prescribed burning on a 5- to 25-year cycle to benefit fire adapted species and reduce competition and susceptibility to insect attack. It also reduces fuel loads giving trees better chance to survive repeated fires; fire helps tree develop in a natural way by stimulating self pruning and developing long clear boles with thick insulating bark. Use prescribed fire to reduce 80-100% of 1-hr fuels, 50-60% of 10-hr fuels, and 10-30% 100-hr fuels.
- Incorporate variable density marking by removing trees from one group or area at a different rate then from similar adjacent groups to maintain the random character of stem distribution in the stand. Do not space trees evenly and create artificial "tree farm" appearance.
- Following hand thinning, hand pile and burn or broadcast burn slash when prescriptive elements are favorable to consume 90% of 1-hr fuels, 80-90% of 10-hr fuels, and 40-70% 100-hr fuels.
- All prescribed fires require detailed, site-specific prescriptions. Because it is not appropriate to include the detail of specific plans in this document, the topics covered for each prescription include the following: site description (topography, aspect, slope, elevation), location, fuel models, management goals and objectives for the unit and burn objectives, scheduling, drought indicator, weather parameters (temperature, relative humidity, wind speed), wind direction, fuel moisture (10 hour, 100 hour, woody live fuel, herbaceous live fuel, litter and duff moisture), desired fire behavior, additional factors, smoke management, sensitive areas in the unit, complexity analysis, monitoring activities, site preparation, required permits, public and media contacts, weather forecasts, staffing and equipment requirements, communication plan, medical plan, ignition plan, holding plan, prescription monitoring, mop up and patrol, contingency plan, and rehabilitation plan.

HMP Early-Seral Dry Forest Objective

Over the long term (100-200 years), increase early seral, dry forest (<10" dbh) by ≥1270 acres with 20-60% shrub cover with >20% sapling cover; 25-60% shrub canopy cover <5 ft tall of native species that may include ceanothus, willow, serviceberry, chokecherry, red-osier dogwood, Douglas maple, kinnikinnick, pachistima, Oregon grape, snowberry, and hawthorne for white-tailed deer as forage and cover; and >30% canopy cover of native, herbaceous species dependent upon the appropriate plant associations for the Dry Forest-Douglas-fir Series (Appendix 5).

Rationale

Early seral forest development will occur through planned prescribed burns that will set back succession.

Strategy for pre-commercial thinning

- Thin young stands of trees (pre-commercial) by appropriate method (hand, mechanical, and prescribed fire) to reduce competition for resources, reduce fuel loads, and allow residual trees to develop into healthy advanced stands.

Prescription

- In seedling and sapling stage regenerating early seral dry forest where the stems range in size from 0.5" to 3" dbh, thin stems to 6 ft x 6 ft spacing or approximately 1,210 stems/acre.
- In early seral dry forest where the stems range in size from 3.5" to 5" dbh, thin stems to 10 ft x 10 ft spacing or approximately 436 stems/acre.

Strategy for commercial thinning sale preparation

- Use variable density marking when preparing commercial units. Mark stands to achieve an uneven, naturally appearing distribution where spacing of individual stems and groups is irregular across the stand. Openings in the canopy can be created in this manner.
- To encourage early-seral development, it may be necessary create small openings in some of the mid-seral forest.

Prescriptions

- In early seral dry forest where the stems range in size from ≤5.5" to 10" dbh, thin stems to 12 ft x 12 ft spacing or approximately 302 stems/acre. Trees in these diameter classes are merchantable and they may be included in commercial sales depending upon location, amount, associated sale products, markets, and other factors.
- In openings and where regenerating sapling canopy cover is >20%, develop 20-60% shrub cover <5 ft high of native species associated with the dry forest (see Appendix 5). This will provide forage and cover for white-tailed deer.
- Reduce forest canopy closure to 10 to 30% leaving the largest and highest quality trees in 2 to 5 acre irregularly shaped blocks to increase early-seral stage dry forest. Use seed tree, group selection, shelterwood, and variable density marking, as appropriate.
- Retain all standing dead trees and snags*. Recently dead trees provide a variety of species with a source of food in the form of insects and they will in turn provide future snags and downed material. * *If safety of personnel may be compromised operating around standing dead trees, then allow for safety buffer around them where no activity will occur.*
- Retain naturally downed trees and logs and restrict displacement and removal of this material because it is valuable in creating favorable sites for natural seedling development, breeding areas for amphibians, and denning and cover for small mammals.

- When encountering patches, groups, or single trees with late seral stage characteristics in an otherwise mid-seral type, apply prescriptions and strategies as detailed previously for late-seral dry forest. Manage to preserve these late seral characteristics.
- For the larger diameter classes (5.5" to 10" dbh), stocking densities tend to increase over time. Periodic entries every 25 to 50 years may be required to remove stems to achieve suitable canopy closure and to keep basal areas <120 sq ft/acre to protect against mountain pine beetle and other insect infestations. Stands which are overstocked and stressed by competition become ready targets for insects and disease.
- A species hierarchy will be developed for each thinning stand to rank desirability of trees to leave that will develop into older age classes.

Strategy for prescribed fire

- Use rotational prescribed burning to reduce shrub and grass competition and create conditions favorable to natural regeneration, seed germination, and seedling development.
- It is anticipated that naturally ignited wildland fire (wildland fire use) can play a role in increasing the acres of early seral, dry forest (see moderate and high fire intensities in fire suppression prescriptions).
- Allow natural fire (wildland fire use) if prescriptive conditions exist and they are being met where fire occurs and policy and regulations allow

Prescription

- Use rotational prescribed burning on a 5- to 25-year cycle to benefit fire adapted species and reduce competition and susceptibility to insect attack. It also reduces fuel loads giving trees better chance to survive repeated fires; fire helps tree develop in a natural way by stimulating self pruning and developing long clear boles with thick insulating bark. Use prescribed fire to reduce 80-100% of 1-hr fuels, 50-60% of 10-hr fuels, and 10-30% 100-hr fuels.
- Low intensity surface fire characterized by flame lengths ≤2 ft. These low-intensity surface fires may be repeated in an area every 5 to 20 years. This type of maintenance burning would be required on approximately 1000 acres each year in the dry forest habitats after the desired level of "Old Forest" is achieved.
- Hand pile and burn following small "pre-commercial" material or biomass utilization projects. Burning piles is accomplished during fuel moisture regimes which inhibit fire from spreading to adjacent fuels.
- Piles may be constructed by machine following commercial thinning projects. Machine piles should be constructed by grapple to prevent incorporation of soil into piles.
- Broadcast underburns may be preceded by some mechanical fuel treatment when ladder fuel situations exist, particularly where low crown base heights in the overstory would lead to a greater-than-desired fire severity. Burning prescription parameters are derived to produce the desired fire effects in terms of fuel consumption and tree mortality. It is expected that this type of burn would not be repeated often in a given stand especially where it would serve as a treatment to move the stand towards the early-seral stage with young, fire susceptible trees. Subsequent fires would be of lower intensity and severity.

- Jackpot or wind-row burning can reduce "activity fuels" or logging slash following harvest. Fire intensity may vary widely throughout the stand as the fuel bed changes but generally fire severity is planned to be low and tree mortality in the overstory is not the objective.
- All prescribed fires require detailed, site-specific prescriptions. Because it is not appropriate to include the detail of specific plans in this document, the topics covered for each prescription include the following: site description (topography, aspect, slope, elevation), location, fuel models, management goals and objectives for the unit and burn objectives, scheduling, drought indicator, weather parameters (temperature, relative humidity, wind speed), wind direction, fuel moisture (10 hour, 100 hour, woody live fuel, herbaceous live fuel, litter and duff moisture), desired fire behavior, additional factors, smoke management, sensitive areas in the unit, complexity analysis, monitoring activities, site preparation, required permits, public and media contacts, weather forecasts, staffing and equipment requirements, communication plan, medical plan, ignition plan, holding plan, prescription monitoring, mop up and patrol, contingency plan, and rehabilitation plan.

4.1.2 Moist forest

CCP Moist Forest Objective

Over the long term (100-200 years), aim for a mosaic of stands of different age and structural classes at approximately the same seral distributions as occurred historically (HRV) within the moist and cold forest zones: ~25% early seral, ~40% mid seral, and ~35% old single or old multi-layer.

HMP Late-seral Moist Forest Objective

Over the long term (100-200 years), increase old, moist forest (>20" dbh) by ≥4702 acres with tree canopy cover >50%; 9.0 snag/ac with ≥10" dbh where 39% >20" dbh (Bull et al. 1997); recruitment snags >27" dbh and >80 ft tall for Vaux's swift; >40% to <70% cover of native, shrub species dependent upon the appropriate moist forest plant associations (Appendix 5); and >10% to <30% cover of native, herbaceous species dependent upon the appropriate plant associations for the moist forest (Appendix 5).

*Rational*e

Avian species adversely impacted by loss of late seral moist forests include varied thrush, olive-sided flycatcher, Townsend's warbler, golden-crowned kinglet, blue grouse, and red-breasted nuthatch. Increasing the following forest components will improve habitats for these species: large snags, overstory canopy closure, structurally diverse multi-layered forest, a dense shrub layer in forest openings, and edges and openings created by fire (Altman 2000). O'Connell et al. (1997) in their evaluation of managed forests found Townsend's warbler and brown creepers to be positively associated with large trees and closed canopies in mixed conifer forests. Planning for large snags and large tracts of closed canopy mixed conifer forest was viewed by O'Connell et al. (1997) to be a critical element of forest management for several bird species.

Strategy for pre-commercial thinning

- Thin young stands of trees (pre-commercial) by appropriate method (hand, mechanical, and prescribed fire) to reduce competition for resources, reduce fuel loads, and allow residual trees to develop into healthy advanced stands.
- Engage in active non-commercial management, where appropriate (i.e., no commercial interest, contracts or funds not available or resource in immediate jeopardy), by falling, girdling, poisoning, and mechanical thinning.

Prescription

- Where overstocked stands (>2500 stems/acre) and ≥25% of trees are <5.5" dbh, thin to overall average12 ft x 12 ft spacing to develop the tree canopy and a ≥20 ft x 20 ft spacing to promote shrub and herbaceous cover. Use mechanical harvesters and forwarders (or other suitable equipment) to remove biomass; boles are removed ≤2.5" top diameter and branches are left in the woods on site.
- Use hand thinning where generally >2500 stems/acre exists and >75% of trees are ≤5.5" dbh. Hand pile and burn or broadcast burn slash when prescriptive elements are favorable to consume 90% of 1-hr fuels, 80-90% of 10-hr fuels, and 40-70% 100-hr fuels.

Strategy for commercial thinning preparation

- When preparing late seral stage moist forest stands for commercial harvesting, ignore traditional timber production tenets such as even spacing and removal of defective stems.
- Employ a "low thin" or thinning from below technique where overstocked stands of younger commercial size trees are developing under a canopy of older trees. This will reduce competition and fuel loads to benefit the existing overstory trees.
- Use variable density marking to prepare commercial units. Mark stands to achieve an uneven, naturally appearing distribution where spacing of individual stems and groups is irregular across the unit.

Prescriptions

- Retain old growth trees or the oldest and largest trees in the stand that are ≥20" dbh with a tree canopy cover >50%. These are the obvious survivors of many fires, insects, disease, and natural and human caused events which have demonstrated an ability to persist over many years in the forest. Trees >27" dbh and >80 ft tall will be retained as recruitment trees to produce future snags for Vaux's swift. During harvest operations, select retention trees with good growth and vigor characteristics in size classes <20" dbh so that there will be a reasonable expectation of these trees attaining the appropriate sizes.
- Retain all standing dead trees and snags* so ≥1 snag/acre ≥10" dbh occurs and 39% of the snags are >20" dbh. Recently dead trees provide a variety of species with a source of food in the form of insects and will in turn provide future snags and downed material. ** If safety of personnel may be compromised operating around standing dead trees, then allow for safety buffer around them where no activity will occur.*

- Create snags from suitable live trees to meet above standards if they are not present in the late seral moist forest stand being managed.
- In openings and where forest cover is not limiting to shrub growth, develop >40 to <70% shrub cover of native species associated with late-seral moist forest (see Appendix 5) and >10% to <30% herbaceous cover of native species (see Appendix 5). This will provide forage and cover for white-tailed deer.
- Avoid situations in older stands of larger diameter trees (≥50 years and ≥12" dbh) where basal areas are reduced too severely in a single entry and previously supported canopies are subject to climatic damage such as wind throw and snow breakage.
- Retain all naturally downed trees and logs and restrict displacement and removal of this material because it is valuable in creating favorable sites for natural seedling development, breeding areas for amphibians, and denning and cover for small mammals.
- In commercial low thinning operations, target trees from 6" to 12" dbh. In these diameter classes, even 16 ft - 20 ft spacing may be used if trees are occupying areas ≥0.25. If trees are occurring in small groups and clusters (<0.25 acre) with irregular distribution, strive to maintain this natural appearance. Retain some vigorous trees that likely will persist to late-seral stage by selecting retention trees with good growth and vigor characteristics such as sharp crowns, upright branch pattern, crown to stem ratio ≥0.33, and deeply fissured bark. Use mechanical harvesters and forwarders (or other suitable equipment) for harvesting.
- Incorporate variable density marking by removing trees from one group or area at a different rate than similar adjacent groups to maintain the random character of stem distribution in the stand. Do not space trees evenly and create artificial "tree farm" appearance.

Strategy for prescribed fire

- Use rotational prescribed burning to reduce tree competition and create conditions where more fire resistant stems survive. It also reduces fuel loads giving tree better chance to survive repeated fires; creates situation where simulated natural fire helps tree develop in a natural way by self pruning and developing long clear boles with thick bark. This strategy may be used to maintain forest structure and fuel bed characteristics typical of natural systems. The desired results of these fires will be the consumption of fine fuels (needles, twigs, small branches, and other forest litter) and the stimulation of herbaceous and woody shrub growth. Fires burning at the upper end of the prescription window may also serve to thin regeneration as it becomes established.
- Allow natural fire (wildland fire use) if prescriptive conditions exist and they are being met where fire occurs and policy and regulations allow.

Prescription

- Use rotational low intensity surface fire characterized by flame lengths ≤2 ft on a 25- to 100-year cycle to benefit fire adapted species and reduce competition and susceptibility to insect attack; It also reduces fuel loads giving trees better chance to survive repeated fires; fire helps trees naturally develop by stimulating self pruning and developing long clear boles with thick insulating bark. Use prescribed fire to reduce 80-90% of 1-hr fuels, 30-60% of 10-hr fuels, and 10-20% 100-hr fuels.

- Hand pile and burn following small "pre-commercial" material or biomass utilization projects. Burning piles is accomplished during fuel moisture regimes which inhibit fire from moving outside piles. Refer to Fire Management Plan for prescriptive elements and details.
- Piles may be constructed by machine following commercial thinning projects. Machine piles should be constructed by grapple to prevent incorporation of soil into piles. Burning piles is accomplished during fuel moisture regimes which inhibit fire from moving outside piles. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- Broadcast underburns may be preceded by some mechanical fuel treatment when ladder fuel situations exist, particularly where low crown base heights in the overstory would lead to a greater-than-desired fire severity. Burning prescription parameters are derived to produce the desired fire effects in terms of fuel consumption and tree mortality. It is expected that this type of burn would not be repeated often in a given stand and it would move the stand towards the late-seral stage if it already has some larger more fire resistant trees present. Subsequent fires would be of lower intensity and severity. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- Jackpot or wind-row burning can reduce "activity fuels" or logging slash following harvest. Fire intensity may vary widely throughout the stand as the fuel bed changes but generally fire severity is low and tree mortality in the overstory is not the objective. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- All prescribed fires require detailed, site-specific prescriptions. Because it is not appropriate to include the detail of specific plans in this document, the topics covered for each prescription include the following: site description (topography, aspect, slope, elevation), location, fuel models, management goals and objectives for the unit and burn objectives, scheduling, drought indicator, weather parameters (temperature, relative humidity, wind speed), wind direction, fuel moisture (10 hour, 100 hour, woody live fuel, herbaceous live fuel, litter and duff moisture), desired fire behavior, additional factors, smoke management, sensitive areas in the unit, complexity analysis, monitoring activities, site preparation, required permits, public and media contacts, weather forecasts, staffing and equipment requirements, communication plan, medical plan, ignition plan, holding plan, prescription monitoring, mop up and patrol, contingency plan, and rehabilitation plan.

HMP Mid-Seral Moist Forest Objective

Over the long term (100-200 years), convert ≥10,375 acres of mid-seral, moist forest (5-20" dbh) to early or late successional (old) forest. Maintain 10,564 acres in mid-seral stage forest with ≥70% conifer canopy cover ≥35 ft tall; 25-60% shrub canopy cover <5 ft tall of native species that may include willow, serviceberry, red-osier dogwood, Douglas maple, kinnikinnick, pachistima, Oregon grape, snowberry, and hawthorne for white-tailed deer as forage and cover; 9.0 snag/ac with ≥10" dbh where 39% >20" dbh (Bull et al. 1997); and >30% canopy cover of native, herbaceous species dependent upon the appropriate plant associations for the moist forest (Appendix 5).

Rationale

Mid-seral forest structure is currently 70% more abundant compared with historical, native systems (Quigley and Arbelbide 1997). Late-seral forests of shade-intolerant species are now

essentially absent. Twenty percent of Pacific Northwest Douglas-fir, grand fir, western redcedar, western hemlock, and western white pine associations listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson et al. 1998). Because mid-seral moist forest covers about 50% of LPONWR, this is the most abundant forest structural type on LPONWR. Accelerating succession of mid-seral moist forest while retaining canopy cover will benefit several vertebrate species including red-backed vole as well as the masked and vagrant shrews (Hallet and O'Connell 1997).

Strategy for passive management

- Passive management may be appropriate for advanced mid-seral stands that are already transitional to late-seral moist type.
- Allow natural processes (drought, insects, and disease) to create snags.

Strategy for pre-commercial thinning

- Thin young stands of trees (pre-commercial) by appropriate method (hand, mechanical, prescribed fire) to reduce competition for resources reduce fuel loads and allow residual trees to develop into healthy advanced stands.

Prescription

- Where overstocked stands (>2500 stems/acre) and ≥25% of trees are <5.5" dbh, thin to overall average12 ft x 12 ft spacing to develop the tree canopy and ≥20 ft x 20 ft spacing to promote shrub and herbaceous cover. Use mechanical harvesters and forwarders (or other suitable equipment) to remove biomass; boles are removed ≤2.5" top diameter and branches are left on site.
- Use hand thinning where generally >2500 stems/acre exists and >75% of trees are ≤5.5" dbh. Hand pile and burn or broadcast burn slash when prescriptive elements are favorable to consume 90% of 1-hr fuels, 80-90% of 10-hr fuels, and 40-70% 100-hr fuels.

Strategy for commercial thinning preparation

- When preparing mid-seral stage moist forest units for harvesting commercially, apply timber management practices designed to increase vigor, growth, and longevity by retaining trees exhibiting the best morphological characteristics.
- Thin young stands of commercial size moist forest trees to reduce competition for resources, reduce fuel loads, and encourage residual trees to more rapidly develop into late-seral stands.
- Employ a "low thin" or thinning from below technique where overstocked stands of younger commercial size trees are developing under a canopy of older trees. This will reduce competition and fuel loads to benefit the existing overstory trees.
- Use variable density marking when preparing commercial units. Mark stands to achieve an uneven, naturally appearing distribution where spacing of individual stems and groups is irregular across the stand.

Prescription

- Retain old growth trees or the oldest and largest trees in the stand that are ≥21”dbh with ≥70% tree canopy cover ≥35 ft high. Leaving these large trees will encourage the mid-seral moist forests (5” to 20” dbh) to achieve the status of late-seral stage which is deficient on LPONWR and adjacent lands. During harvest operations, select retention trees with good growth and vigor characteristics in size classes <20” dbh so that there will be a reasonable expectation of these trees attaining the appropriate sizes.
- In openings and where forest cover is not limiting, develop 25 to 60% shrub cover of native species associated with mid-seral moist forest (see Appendix 5) as forage and cover for white-tailed deer.
- In areas of this type that are of uniform age and size with closed canopies it may be necessary to reduce the canopy closure to about 20% to attain the shrub component of item 2 above and realize the desired increase of early seral stage moist forest as indicated below.
- When preparing timber sales select leave trees by conventional standards of vigor and quality such as size (diameter and height), dominance, high crown to stem ratio, full crowns, upright branching, rapid growth as evidenced by distance between branch whorls, relative size and bark characteristics.
- Incorporate variable density marking by removing trees from one group or area at a different rate then from similar adjacent groups to maintain the random character of stem distribution in the stand. In other words, do not space trees evenly and create artificial “tree farm” appearance.
- Because this forest type (moist mid-seral) is the most common on LPONWR and late-seral moist is limited, all prescriptive elements and strategies from late-seral moist forest will be used in this series as opportunities arise to create more late-seral stage.
- Reduce forest canopy closure to 20 to 30% leaving the largest and highest quality trees in 2 to 5 acre irregularly shaped blocks for the purpose of increasing early-seral stage moist forest. Use seed tree, group selection, shelterwood and variable density marking as appropriate.
- In commercial low thinning operations, target trees 6” to 12” dbh. In these diameter classes, even 16 ft - 20 ft spacing may be used if trees are occupying areas ≥0.25 acre. If trees are occurring in small groups and clusters (<0.25 acre) with irregular distribution, strive to maintain this natural appearance. Retain some vigorous trees likely to persist to late-seral stage by selecting retention trees with good growth and vigor characteristics such as sharp crowns, upright branch pattern, crown to stem ratio ≥0.33, and deeply fissured bark. Use mechanical harvesters and forwarders (or other suitable equipment) for harvesting.

Strategy for prescribed fire

- Use rotational prescribed burning to reduce tree competition and create conditions where more fire resistant stems survive. It also reduces fuel loads giving tree better chance to survive repeated fires; creates situation where simulated natural fire helps tree develop in a natural way by self pruning and developing long clear boles with thick bark
- Allow natural fire (wildland fire use) if prescriptive conditions exist and they are being met where fire occurs and policy and regulations allow.

Prescription

- Use rotational low intensity surface fire characterized by average flame lengths ≤2 ft on a 25- to 100- year cycle to benefit fire adapted species and reduce competition and susceptibility to insect attack. It also reduces fuel loads giving trees better chance to survive repeated fires; fire helps tree develop in a natural way by stimulating self pruning and developing long clear boles with thick insulating bark. Use prescribed fire to reduce 80-90% of 1-hr fuels, 30-60% of 10-hr fuels, and 10-20% 100-hr fuels.
- Hand pile and burn following small "pre-commercial" material or biomass utilization projects. Burning piles is accomplished during fuel moisture regimes which inhibit fire from moving outside piles. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- Piles may be constructed by machine following commercial thinning projects. Machine piles should be constructed by grapple to prevent incorporation of soil into piles. Burning piles is accomplished during fuel moisture regimes which inhibit fire from moving outside piles. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- Broadcast underburns may be preceded by some mechanical fuel treatment when ladder fuel situations exist, particularly where low crown base heights in the overstory would lead to a greater-than-desired fire severity. Burning prescription parameters are derived to produce the desired fire effects in terms of fuel consumption and tree mortality. It is expected that this type of burn would not be repeated often in a given stand and it would to move the stand towards the late-seral stage. Subsequent fires would be of lower intensity and severity. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- Jackpot or wind-row burning can reduce "activity fuels" or logging slash following harvest. Fire intensity may vary widely throughout the stand as the fuel bed changes but generally fire severity is planned to be low and tree mortality in the overstory is not the objective. Refer to the LPONWR Fire Management Plan for prescriptive elements and details.
- All prescribed fires require a detailed, site-specific plan. Because it is not appropriate to include the detail of specific plans in this document, the topics covered for each prescription include the following: site description (topography, aspect, slope, elevation), location, fuel models, management goals and objectives for the unit and burn objectives, scheduling, drought indicator, weather parameters (temperature, relative humidity, wind speed), wind direction, fuel moisture (10 hour, 100 hour, woody live fuel, herbaceous live fuel, litter and duff moisture), desired fire behavior, additional factors, smoke management, sensitive areas in the unit, complexity analysis, monitoring activities, site preparation, required permits, public and media contacts, weather forecasts, staffing and equipment requirements, communication plan, medical plan, ignition plan, holding plan, prescription monitoring, mop up and patrol, contingency plan, and rehabilitation plan.

HMP Early-Seral Moist Forest Objective

Over the long term (100-200 years), increase ≥5673 acres of early-seral, moist forest (<5" dbh) with tree canopy cover <25%; dense shrub layer dominated by native species (dependent upon the appropriate plant associations for the moist forest in Appendix 5) with >40% canopy cover; and <25% cover of native, herbaceous species dependent upon the appropriate plant associations for the moist forest (Appendix 5).

Strategy for pre-commercial thinning

- Thin young stands of trees (pre-commercial) by appropriate method (hand, mechanical, and prescribed fire) to reduce competition for resources, reduce fuel loads, and allow residual trees to develop into healthy advanced stands.

Prescriptions

- Where overstocked stands (>2500 stems/acre) and ≥25% of trees are ≤5.5" dbh, thin to overall average12 ft x 12 ft spacing to develop the tree canopy and ≥20 ft x 20 ft spacing to promote shrub and herbaceous cover. Where feasible and appropriate use mechanical harvesters and forwarders (or other suitable equipment) to remove biomass; boles are removed ≤2.5" top diameter and branches are left on site.
- Use hand thinning where generally >2500 stems/acre exists and >75% of trees are ≤ 5.5" dbh. Hand pile and burn or broadcast burn slash when prescriptive elements are favorable to consume 90% of 1-hr fuels, 80-90% of 10-hr fuels, and 40-70% 100-hr fuels.
- In seedling and sapling stage regenerating early seral moist forest where the stems range in size from 0.5" to 3" dbh, thin stems to 6 ft x 6 ft spacing or approximately 1,210 stems/acre.

Strategy for commercial thinning

- Reduce forest canopy closure to 20 to 30% leaving the largest and highest quality trees in 2 to 5 acre irregularly shaped blocks to increase early-seral stage moist forest. Use seed tree, group selection, shelterwood, and variable density marking, as appropriate.
- Employ a "low thin" or thinning from below technique where overstocked stands of younger commercial size trees are developing under a canopy of older trees. This will serve to reduce competition and fuel loads to benefit the existing overstory trees.

Prescription

- In early seral moist forest where the stems range in size from 3.5" to 5" dbh, thin stems to an overall average spacing of 10 ft x 10 ft, or approximately 436 stems/acre.
- In openings and where regenerating saplings are patchy or sparse and tree canopy cover is <25%, develop ≥60% shrub cover of native species associated with moist forest (see Appendix 5). If canopy cover is >40%, develop herbaceous cover of <25% to provide forage and cover for white-tailed deer.
- Retain all standing dead trees and snags*. Recently dead trees provide a variety of species with a source of food in the form of insects and they will in turn provide future snags and downed material. * *If safety of personnel may be compromised operating around standing dead trees, then allow for a safety buffer around them where no activity will occur.*
- Retain naturally downed trees and logs and restrict displacement and removal of this material because it is valuable in creating favorable sites for natural seedling development, breeding areas for amphibians, and denning and cover for small mammals.
- When encountering patches, groups or single trees with late seral stage characteristics in an otherwise early-seral moist forest type, apply prescriptions and Strategies as detailed

previously for late-seral moist forest. A species hierarchy will be developed for each thinning stand to rank desirability of trees to leave for developing into older age classes.

- Retain old growth trees or the oldest and largest trees in the stand (≥21”dbh with ≥70% tree canopy cover ≥ 35 ft high). Leaving these large trees will encourage the mid-seral moist forests (5” to 20” dbh) to achieve the status of late-seral stage which is deficient on LPONWR and adjacent lands. During harvest operations, select retention trees with good growth and vigor characteristics in size classes < 20” dbh so that there will be a reasonable expectation of these trees attaining the appropriate sizes.
- Use variable density marking when preparing commercial units. Mark stands to achieve an uneven, naturally appearing distribution where spacing of individual stems and groups is irregular across the unit.
- In commercial low thinning operations, target trees 6” to 12” dbh. In these diameter classes, even 16 ft - 20 ft spacing may be used if trees are occupying areas ≥0.25 acre. If trees are occurring in small groups and clusters (<0.25 acre) with irregular distribution, strive to maintain this natural appearance. Retain some vigorous trees likely to persist to late-seral stage by selecting retention trees with good growth and vigor characteristics such as sharp crowns, upright branch pattern, crown to stem ratio ≥0.33, and deeply fissured bark. Use mechanical harvesters and forwarders (or other suitable equipment) for harvesting.

Strategy for prescribed fire

- Use rotational prescribed burning to reduce shrub and grass competition and create conditions favorable to natural regeneration, seed germination, and seedling development.
- Allow natural fire (wildland fire use) if prescriptive conditions exist and they are being met where fire occurs and policy and regulations allow.

Prescription

- Use rotational prescribed burning to benefit fire adapted species, reduce competition, and susceptibility to insect attack. It also reduces fuel loads giving trees better chance to survive repeated fires; fire helps tree develop in a natural way by stimulating self pruning and developing long clear boles with thick insulating bark.
- All prescribed fires require detailed, site-specific prescriptions. Because it is not appropriate to include the detail of specific plans in this document, the topics covered for each prescription include the following: site description (topography, aspect, slope, elevation), location, fuel models, management goals and objectives for the unit and burn objectives, scheduling, drought indicator, weather parameters (temperature, relative humidity, wind speed), wind direction, fuel moisture (10 hour, 100 hour, woody live fuel, herbaceous live fuel, litter and duff moisture), desired fire behavior, additional factors, smoke management, sensitive areas in the unit, complexity analysis, monitoring activities, site preparation, required permits, public and media contacts, weather forecasts, staffing and equipment requirements, communication plan, medical plan, ignition plan, holding plan, prescription monitoring, mop up and patrol, contingency plan, and rehabilitation plan.

4.1.3 Cold forest

CCP Cold Forest Objective

Over the long term (100-200 years), aim for a mosaic of stands of different age and structural classes at approximately the same seral distributions as occurred historically (HRV) within the moist and cold forest zones: ~25% early seral, ~40% mid seral, and ~35% old single or old multi-layer.

HMP Late-seral Cold Forest Objective

Over the long term (100-200 years), maintain the existing 1162 acres of old growth, cold forest (>10" dbh). Within old growth, cold forest (specifically subalpine fir, lodgepole pine, and Engelmann spruce on north or northeast aspects), create or maintain downed log density >40 logs/150 ft lying 1-4 ft above ground in 1-5 acre patches for Canada lynx.

Rationale

Because late succession, cold forest is not well represented within the lynx management unit that includes LPONWR, the management emphasis in this habitat will be to maintain this seral condition as potential lynx denning habitat.

Strategy

Suppress wildland fires in cold forest habitat.

Prescription

- Maintain late-seral cold forest between 422 acres (35% of total cold type) and 1162 acres (96% of total cold type).

4.1.4 Aspen

HMP Aspen Objective

Over the long-term (100-200 years), restore and enhance existing aspen stands to include large trees with >10% cover of saplings in understory as replacements; >4 trees and >1.5 snags/ac >39 ft in height and 10" dbh; and tree canopy 30-70%.

Rationale

Aspen occurs in most LPONWR forest types. Aspen communities in the western U.S. are considered at risk because of low levels of disturbance (primarily fire) and high levels of herbivory by wild and domestic ungulates (Shaw 2004). LPONWR aspen groves are wildlife oases attracting many vertebrate and invertebrate species. Beaver relish the inner bark of aspen and use small logs and branches in their dams. Aspen stands are important areas for elk calving,

deer fawning, and forage. Snowshoe hares, porcupines, bears, and other mammals eat aspen bark, foliage and buds. Ruffed grouse depend on aspen buds and catkins during spring and use aspen stands for drumming displays and nesting.

Since aspens are susceptible to decay, soft snags are easy targets for excavators like red-naped sapsuckers, flickers, and downy and hairy woodpeckers. These species prefer aspen for nesting to other species. These cavities are used by many other birds and mammals. In addition to red-naped sapsucker and ruffed grouse, other bird species that will benefit from enhancing aspen cover on LPONWR include northern flicker, tree swallow, house wren, northern pygmy owl, western screech owl, and mountain bluebird (Altman 2000).

Strategy

- Locate aspen stands within management units.
- During pre-commercial and commercial thinning operations enhance and protect aspen stands and single trees.
- When using prescribed fire consider any aspen located in burn unit and how fire under any given prescription will affect it.
- Where appropriate use propagation techniques to stimulate aspen clone expansion and growth.

Prescription

- Locate aspen stands in management units when cruising stands for timber sale preparation and note locations of stands on cruise cards and map. Take advantage of situations where aspen trees and stands are discovered during other management activities and locate and map using GPS especially those that are already at risk of decline due to conifer encroachment, overtopping, browsing/grazing, insects or disease.
- In aspen stands where canopy is between 30-70%, trees are ≥10" dbh and there are ≤1.5 snags/acre, create snags by girdling sufficient number of trees to achieve snags density of ≥1.5 snags/acre.
- Aspen is very intolerant to shade. During pre-commercial and commercial thinning operations enhance stands by removing encroaching conifer species (except late-seral) and shrubs if they are overtopping and *shading* aspen stems. If possible, remove all vegetation producing shade so that aspen stand receives 100% of available sunlight during the growing season April through September.
- Protect aspen stands and single trees by requiring contractors to minimize activity in and around the perimeter of the stand or tree by allowing only those operations necessary to remove competing vegetation.
- When using prescribed fire consider any aspen located in burn unit. Aspen stands only burn under very dry conditions so opportunities to reproduce aspen by burning are somewhat rare, however it is an effective tool to regenerate old stands and produce vigorous new growth from suckering when aspen tree mortality approaches 100%, surface soil is blackened, 90% of the litter layer is removed and large areas of mineral soil are exposed. Repeated and severe fires can be detrimental.
- Where appropriate and desirable to increase aspen browse or regenerate deteriorating stands use propagation techniques to stimulate aspen clone expansion and growth by root ripping,

cutting mature trees or girdling. To be effective *most or all* of adult trees must be destroyed to allow sunlight to reach the ground and break apical dominance.

4.2 Old fields

CCP Fields Management Objective

Maintain approximately 500 acres of fields as openings to provide a diversity of habitat structure, grass, and forage for wildlife, for enhanced viewing opportunities, and to maintain certain cultural resources.

Reforestation of Old Fields

There are approximately 584 acres of old fields on LPONWR. Due to location and site characteristics, about 66.6 acres of these cleared areas are best managed by reestablishing the native forest type appropriate for that site such as conifer, aspen or alluvial riparian woodland. The specific fields are described in the following table. For discussion on management strategies and prescriptions to allow these to reestablish the native forest habitats, see the appropriate sections identified within the Strategy column.

Watershed	Field No.	Name	Acres	Strategy
Noman Creek	4	Buffalo Wilson (M)	8.4	Actively reforest to alluvial riparian woodland (See Section 4.6.1)
Noman Creek	5	Buffalo Wilson (N)	0.6	
Noman Creek	6	Buffalo Wilson (S)	2.1	
McDowell Lake	24	Cottonwood	7.7	
Noman Creek	27	W. Headquarters	6.3	
Starvation Lake	25b	Log barn (W)	15.0	
		Subtotal	40.1	
Lower Bear Creek	13	S. Berg	0.6	Actively reforest to aspen (See Section 4.1.4)
Lower Bear Creek	14	W. Weir	1.5	
Lower Bear Creek	15	Weir Barn	4.3	
Lower Bear Creek	16	E. Weir	2.0	
Lower Bear Creek	17	Berg Lane	12.5	
		Subtotal	20.9	
Starvation Lake	26	N. Log Barn	1.4	Passively reforest to conifers (See Section 4.1.1- 4.1.3)
Olson Creek	70	Olson Creek Road (S)	1.3	
Olson Creek	71	Olson Creek Road (N)	1.9	
Lower Bear Creek	81	Section 19	1.0	
		Subtotal	5.6	
		Total	66.6	

HMP Objective for old fields

Annually maintain approximately 500 acres of old fields with >90% herbaceous cover, providing early-spring forage and fawning cover for white-tailed deer as well as structure for foraging and nesting landbirds, comprised of 25-75% desirable native (e.g., blue bunch wheatgrass) and cultivated grasses (e.g., orchard grass, timothy); remaining herbaceous cover composed of desirable forbs (e.g., clover, small burnet, alfalfa). Maintain <30% canopy cover of trees, saplings, or seedlings.

Rationale

Old fields provide nesting, hiding and foraging habitat for a diversity of wildlife species including migratory birds and white-tailed deer. Many of the forest openings and meadows date from the Euro-American settlement period of the late 1800s and thus contribute to understanding the history of LPONWR and the surrounding area. These open areas also provide excellent wildlife-viewing opportunities.

The following tables identify management strategies that initially will be used to achieve this objective. The tables represent the initial application of these strategies to old fields to achieve the objective. Based on analysis of monitoring results, adaptive management will be used to identify the appropriate future application of one or more of these strategies considering the site-specific needs and conditions of individual old fields to collectively contribute toward achievement of the objective.

Strategy for alfalfa

Continue the current special use permit with a LPONWR permittee to maintain the fields (numbers 1 and 2) as alfalfa.

Rationale

These fields provide high-quality forage for white-tailed deer and other species, particularly ground-nesting birds, at little expense to LPONWR.

Prescription

The permittee is allowed to harvest one cutting of alfalfa from each of these two fields each year leaving subsequent growth as wildlife food and cover. Permittee will as necessary control invasive plants and insects. The LPONWR staff will work with the permittee to manage the alfalfa farming program to best achieve LPONWR wildlife and habitat objectives, and provide a fair return to the permittee, consistent with applicable policy.

Strategy for perennial native and desirable non-native grasses and forbs

Till the fields numbers 19, 32, and 33 and plant to a mix of perennial native and desirable non-native grasses and forbs.

Rationale

Using perennial plants reduces the costs of the project while providing a more natural-looking vegetative cover.

Prescription

- Till the fields using a disk harrow beginning in spring and repeat over 1 to 2 growing seasons or as needed to exhaust the weed seed bank.
- Conduct soil testing to determine if any soil amendments are required to improve soil fertility immediately prior to planting.
- Plant a seed mix of forbs and grasses recommended by the Natural Resource Conservation Service based on their suitability to the local conditions and value to wildlife.
- Spot spray for invasive plants as necessary.
- Evaluate the vegetative cover and reseed as necessary to meet LPONWR objectives for these fields.
- Vegetation maintenance techniques (including prescribed fire, prescribed grazing, and mowing) may be required to sustain the health of the crop.

Watershed	Field No.	Name	Acres	Strategy
Moran Creek	1	N. Slide Creek	7.3	Maintain Alfalfa
Moran Creek	2	S. Slide Creek	20.3	
McDowell Lake	19	E. Christensen	65.3	Maintain a mix of perennial native and desirable non-native grasses and forbs
Durlan Springs	32	Chester Field	34.6	
Starvation Lake	33	Starvation Flat	8.5	
		Total	136	

Strategy for prescribed fire

Use prescribed fire in field numbers 3, 7, 12, 20, 22, 23, 28, 29, 35, 36, 38, 47, 48, 49, 50, 53, 55, 58, 59, 68, 72, 73, 74, 75, 76, 79, 80, and 82 to reduce fine fuels, retard conifer encroachment, reduce litter, improve plant vigor, increase aspen suckering, and improve deer forage by enhancing early spring green-up.

Rationale

Prescribed fire is the preferred vegetation management technique in these fields. Many of these fields are small (<5 acres) and widely scattered. Several have potential for prescribed fire to expand and rejuvenate existing aspen clones, which the grazing and mowing cannot do. Other factors such as a paucity of water available for livestock or presence of wetlands, riparian strips, streams, and associated plants make livestock grazing less desirable. However, carefully controlled prescribed grazing may be useful in certain circumstances on a few areas. Mowing may also be a useful tool in some situations. Selective mowing allows beneficial conifers (those providing thermal and hiding cover) to remain while maintaining the open nature of the site.

Prescription

Site-specific prescribed fire plans that will meet the above objective for this habitat while meeting standards for safety and smoke management will be written for each field. Burning can occur in either spring or fall depending on the weather and other factors. Fields will be burned once every 3-5 years. Fields will be scheduled for treatment so that freshly burned areas are distributed across LPONWR. Objectives for these fields vary depending on whether they are predominantly herbaceous cover or if there is significant conifer encroachment.

Fields without Conifer Encroachment

- Reduce grass matting depth ≥60% immediately after burning.
- Maintain or reduce cover of non-native forbs within one year post-burn.
- Maintain herbaceous cover visual obstruction of ≥8" one year post-burn.
- Reduce density of conifer seedlings (<1" dbh) 80% within one year post-burn.

Fields with Conifer Encroachment

- Reduce 1- and 10-hour fuel loading by 60-90% immediately after burning.
- Reduce 100-hour fuel loading by 50-70% immediately after burning.
- Reduce grass matting depth ≥60% immediately after burning.
- Maintain or reduce cover of non-native forbs within one year post-burn.
- Maintain herbaceous cover visual obstruction of ≥8" one year post-burn.
- Reduce density of conifer seedlings (<1" dbh) 80% within one year post-burn.
- Limit reduction in density of pole trees (1-6" dbh) to ≤15% within 5 years post-burn.
- Limit reduction in density of overstory trees (>6" dbh) to ≤15% within 5 years post-burn.

Watershed	Field No.	Name	Acres	Strategy
Moran Creek	3	Alphabet/Happy Valley	23.1	Initially maintain openings using prescribed fire. Based upon adaptive management, use one or more of the following strategies (as appropriate): prescribed fire, rotational prescribed grazing, mowing, or selective thinning to manage encroaching conifers.
Noman Creek	7	Cable Gate	9.5	
Bear Creek	12	North Berg	16.6	
Lower bear Creek	20	Brown House	17.4	
Lower Bear Creek	22	E. Kidney Pond	5.3	
Lower Bear Creek.	23	W. Kidney Pond	1.9	
Noman Creek	28	S. LPO River	18.5	
Noman Creek	29	W. LPO River	3.6	
Starvation Lake	35	N. Pahlke	3.1	
Starvation Lake	36	Pahlke Place	2.2	
Cedar Creek	38	Schumaker Meadow	19.8	
Cedar Creek	47	Prospect Cr. 1	0.8	

Ceder Creek	48	Prospect Cr. 3	1.1	
Cedar Creek	49	Prospect Cr.	0.8	
Cedar Creek	50	Prospect Cr.	0.7	
McDowell Lake	53	Sampson Orchard	46.8	
McDowell Lake	55	Knutson Meadow	4.2	
Upper Bear Creek	58	Potter's Pond	8.8	
Upper Bear Creek	59	N. Potter's Pond	5.3	
Upper Bear Creek	68	Lenhardt Meadow	2.3	
Olson Creek	72	Snow Park	6.5	
Cedar Creek	73	Scrabbler's Flat	2.4	
Cedar Creek	74	Cedar Creek (W)	3.6	
Cedar Creek	75	Cedar Creek (E)	1.0	
Cedar Creek	76	Cedar Creek (S)	0.7	
Lower Bear Creek	79	Cliff Ridge Rd. (S)	2.0	
Lower Bear Creek	80	Cliff Ridge Rd. (N)	1.0	
McDowell Lake	82	Walnut Meadow	4.0	
		Total	213	

Strategy for rotational prescribed grazing

In fields numbers 18, 21, 25a, 30, 37, and 52, use rotational prescribed livestock grazing to reduce litter and fine fuels, improve plant vigor, and improve deer forage by enhancing early spring green-up.

Rationale

Rotational prescribed grazing may be the best tool for managing these fields. Ample water is available nearby, and there are no other habitat types sensitive to grazing such as aspen or wetland plants. Drawbacks to using this tool for vegetation management include the close proximity of riparian areas with the potential for damage from straying livestock, and for livestock to attract brown-headed cowbirds. Prescribed fire and mowing may also be useful management tools in these areas. Selective thinning will use the current conifer encroachment as a habitat enhancement while helping maintain the open nature of the site.

Prescription

- Rotational livestock grazing will be used with each field receiving two full seasons of rest between grazing bouts.
- Grazing privileges will be awarded as a contract or as an annual Special Use Permit according to procedures outlined in Refuge Manual 6 RM 9.1.
- In order to minimize impacts to ground nesting birds and to retain hiding cover for deer fawns and turkey poults, livestock grazing will not begin before July 15th. Grazing will conclude by September 30.
- Grazing may be suspended on a field indefinitely due to higher management priorities.
- During the grazing period, temporary electrical or equivalent fencing will be used to contain the cattle within the field and out of sensitive habitats such as wetlands, streams, riparian areas, and aspen groves. Fencing will be removed simultaneous with or immediately following removal of livestock.
- Livestock water must be provided inside the grazing area in a temporary tank. Water can be trucked in or, under conditions approved by LPONWR, pumped from a local water source.
- Livestock will be removed when herbaceous stubble height averages 6-8". Stubble height will be determined using a standard protocol.
- Depending upon forage availability in the specific fields involved in rotational grazing each year, an estimated 22-32 AUMs will be required to achieve the objective. The stocking rate will be adjusted to achieve the stubble height objective in the shortest time possible.
- In Field 52, Lower Manz Meadow, livestock exclusion fencing will be erected around the sedge wetland containing Adder's tongue to protect this sensitive area from livestock trampling.

Watershed	Field No.	Name	Acres	Strategy
McDowell Lake	18	W. Christiansen	27.1	Initially maintain openings using rotational prescribed grazing. Based upon adaptive management, use one or more of the following strategies (as appropriate): rotational prescribed grazing, prescribed fire, mowing, or selective thinning to manage encroaching conifers.
McDowell Lake	21	N. Christiansen	23.7	
Starvation Lake	25a	Log Barn (E)	35.0	
Durlan Springs	30	Chimney	30.5	
Starvation Lake	37	Upper Manz Meadow	21.9	
Starvation Lake	52	Lower Manz Meadow	30.2	
		Total	168.4	

Strategy for selective thinning in all fields

Use selective thinning when appropriate to reduce conifer encroachment, encourage development of desirable deciduous trees, and provide travel and security cover for wildlife.

Rationale

Maintaining existing fields provides forage areas for deer and other wildlife. For maximum use by deer, forage areas should have no point farther than 600 ft from the edge of cover. Use of the openings increases with decreasing distance to cover (Thomas 1979). Many of the fields designated to remain open have significant amounts of conifer invading from the surrounding forest; a natural process that will result in the forest totally reclaiming the opening if unchecked. This management strategy suspends this reforestation, but with judicious thinning, the existing trees can be used to increase the value of the opening for wildlife by providing escape and screening cover.

Prescription

Selective cutting using chainsaws or other appropriate equipment may be used to:

- Release deciduous trees by removing conifers shading the trees.
- In order to improve herbaceous cover while maintaining horizontal concealment cover, create irregularly shaped, 0.25 acre openings inside thick conifer stands that have already recolonized portions of fields.
- Remove conifers overtopping aspen to improve the vigor of the aspen.
- Remove invading conifer seedlings.

Strategy for rotational mowing

In all fields where rotational grazing or prescribed fire are the primary vegetation management tools, rotational mowing may also be use to reduce fine fuels, improve plant vigor, and increase the nutritional quality of deer forage by enhancing early spring green-up.

Rationale

Rotational mowing may be an alternative tool for old fields where rotational prescribed grazing or prescribed fire is not effective or appropriate. Mowing is also useful where precise treatment of existing vegetation is necessary such as near sensitive plants, wetlands, or riparian areas. Mowing can be accomplished very quickly with little site preparation and it applicable to small, isolated sites where prescribed grazing or prescribed fire is not practical. It is also a very effective method of controlling conifer tree encroachment. This technique will only be used in areas with topography and soils suitable for the use of large, rubber-tired tractors.

Prescription for rotational mowing

- Each field will receive at least two full seasons of rest between mowing treatments.
- To minimize impacts to native, ground–nesting, migratory birds, mowing will only occur before spring growth has started or after July 15th.
- Vegetation will be mowed to a height of 6-8”.

4.3 Marsh

CCP Marsh Maintenance Objective

Maintain or restore at least 100 acres of permanently flooded emergent marsh habitat, to benefit certain wading birds, ducks and amphibians.

HMP Marsh Objective

Annually maintain 100 acres of permanently flooded marsh with <50% emergent vegetation with large woody debris, downed logs, and low islands present; ≥5 snags/ac ≥12" dbh near suitable shallow (≤5 ft deep) wetlands including beaver ponds, lakes, and low gradient rivers.

Rationale

Over 15 species of waterfowl have been observed on LPONWR, including all five cavity nesting ducks expected to occur in Washington (Barrow's golden eye, common goldeneye, hooded merganser, bufflehead and wood duck). Cavity-nesting ducks are vulnerable to loss of nesting habitat. These species require nesting cavities within trees and snags, which are commonly lost through commercial forestry, firewood cutting and shoreline development. All but the wood duck exhibit low productivity and low population sizes, breed for the first time at an older age, and are poor pioneers of unoccupied habitats. Loss of suitable nesting sites will eliminate use of an area by breeding birds (Lewis and Kraege 2004).

LPONWR lakes and ponds provide approximately 152 acres (depending annual runoff) of open water habitat with less than 50% emergent vegetation, according to the National Wetland Inventory (1987).

Strategy for Marsh Maintenance

- Maintain maximum water levels in Bayley Lake, Potter's Pond and McDowell Lake to the extent possible based on the availability of annual runoff, while maintaining flow in the diverted streams. Maintaining water levels at or near full pool will likely maintain emergent vegetation cover at <50% of the surface area.
- Inventory the number and condition of snags around the water bodies suitable for cavity nesting ducks.
- Provide nesting sites in suitable locations.
- Maintain <50% cover of emergent vegetation in Bayley Lake as measured during a normal water level year.

Prescriptions

- Protect all snags >12" dbh near suitable nesting areas by enforcing firewood cutting regulations.
- Where snag densities are <5 snags/acre, create >5 snags/acre in suitable trees near potential nesting areas by girdling, inoculation, or topping.

- In the interim, in areas where insufficient snags are available, install >5 suitable nesting boxes per acre, and maintain them annually.
- If necessary, reduce the amount of emergent vegetation in Bayley Lake by biological, chemical or mechanical means, as dictated by the best alternative available at the time action is required.
- Inspect annually and maintain as necessary the water diversion structures, dams and water level control structures associated with Potter's Pond, Bayley Lake, McDowell Lake, and McDowell Marsh.

4.4 Instream habitat

CCP Stream Habitat Objective

Improve stream habitat conditions for native fish and other aquatic wildlife, specifically aiming to meet or exceed the standards set for stream habitat components in the federal Inland Native Fish Strategy (INFISH) including: pool frequency, water temperature, large woody debris, bank stability, lower bank angle, and width/depth ratio (US Forest Service 1995). Adopt newer standard when one is approved.

HMP Instream Habitat Objective

For all perennial streams, restore or maintain, where appropriate, the following INFISH standards: no measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period); maximum water temperatures below 59◦ F within adult holding habitat and below 48F within spawning and rearing habitats; >20 pieces per mile of large (>12" diameter and >35 ft long) woody debris in forested systems; >80% of the banks stable in non-forested systems; >75% of the lower banks with <90 degree angle in non-forested systems; a width/depth ratio <10 (mean wetted width divided by mean depth); and pool frequency of 96 pools/mi for wetted width of 10 ft, 56 pools/mi if wetted width 20 ft, 47 pools/mi if wetted width is 25 ft. Ensure flows in original channels of diverted streams take priority over diversion flows.

Rationale

The USFS, in cooperation with the BLM and FWS, prepared an Environmental Assessment (EA) for a proposal to protect habitat and populations of native inland fish. The strategy known as INFISH, strives to reduce the risk of loss of populations and reduce negative impacts to aquatic habitats for native fishes outside of anadromous fish habitat. Intended as an interim strategy to cover the area encompassed in the ICBEMP, INFISH remains the current standard for instream habitat management to benefit inland native fish. A new standard currently under development (Tom Shudha Colville National Forest Fish Program Manager, personal communication) may be applied to LPONWR instream habitat once it is completed.

Fish population analysis of the Little Pend Oreille River and Bear Creek within LPONWR during 1996 and 1997 revealed that the following native fish species occurred in aquatic habitats: rainbow trout, cutthroat trout, shorthead sculpin, red-sided shiner. Nonnative species include

brook trout, brown trout, yellow perch. Fish habitat evaluations showed that LPONWR streams lack large woody debris, pools per mile and water temperature were below standard, and bank erosion was excessive in some reaches. The focal species for instream habitats, westslope cutthroat trout as well as other trout species will benefit from management efforts designed to meet this objective.

Strategy

- Eliminate impacts such as livestock grazing and unnecessary roads to stream channels and associated riparian areas.
- Prioritize the reaches of the Little Pend Oreille River, Bear Creek and North Fork Bear Creek most in need of restoration efforts to meet the above objective based on fish habitat assessments (Kelly Ringel 1998, 1999).
- Collect data on water temperature.
- Develop projects to reestablish or increase herbaceous and woody riparian vegetation were necessary, control invasive plants, install large woody debris, and reslope steeply cut banks.
- Maintain adequate flow to natural channels impacted by water diversion structures.
- Repair or replace culverts or bridges that impair fish passage or that are not adequate to handle a 100-year flood event.
- Evaluate roads to determine if they are contributing sediment to the streams; take corrective action if necessary.

Prescriptions

- Establish a monitoring program including permanent photo points and hydraulic cross sections to monitor changes in bank position, stream width and depth, flood plain width, and substrate composition. Reaches should be resurveyed in 2010 using the techniques employed in the 1996 and 1997 surveys assess the effect of the recovery actions.
- Using a backhoe or track excavator, reslope banks along critical reaches to reduce erosion and provide a site for reestablishing native vegetation.
- Remove reed canarygrass and other unwanted exotic plants and immediately replant the site with appropriate native herbaceous riparian species.
- Plant willow, alder, dogwood or other appropriate riparian shrubs in areas prioritized in the fish habitat assessments.
- Place large woody debris in the river or stream channel at appropriate sites. Logs should be western cedar, Douglas fir or western hemlock, and sized and installed based on best available techniques.
- Where lacking, future sources of large woody debris, i.e. suitable tree species, should be planted on appropriate sites within 150 feet of the stream or river bank.
- Where feasible, stabilize eroding banks by removing non-native grasses such as Kentucky bluegrass and replacing it with more densely rooting species plants such as native sedges.

4.5 Landscape connectivity

CCP Landscape Connectivity Objective

Maintain or establish mature forest connectivity on a landscape scale with adjoining agencies and landowners.

HMP Landscape Connectivity Objective

Over the duration of the HMP, maintain existing wildlife travel corridors greater than 330 feet wide along ridges, saddles, and streams following existing landscape contours.

Rationale

Healthy ecological systems require connections to keep them functional. Connectivity is the relative degree to which individual animals and genes can move across a landscape. Connected populations have a higher likelihood of persistence over time (Noss 1991). Canada lynx is one focal species that ranges widely and requires connected habitats for safe travel routes. Travel routes follow linear features that already exist on the landscape and provide connectivity between habitat elements, facilitating dispersal of kittens and adult movements (WDNR 1996). Habitat fragmentation is considered to be one of the most significant threats to natural biological diversity (Noss 1991). Roads, converting native cover to agricultural fields, clearcuts, and human settlements all contribute to fragmentation. Fragmentation isolates habitats and, for some species, limits dispersal and colonization (Primack 1993). Maintaining and, where appropriate, creating connected landscapes will benefit a host of wildlife species.

Strategy

- Consider the presence wildlife corridors when planning projects. Refrain from actions in travel corridors that could jeopardize their value to wildlife.
- Work with LPONWR in-holders and neighbors to preserve wildlife travel corridors as much as possible.

4.6 Alluvial riparian

CCP Alluvial Riparian Restoration Objective

Restore 7 miles of unsatisfactory alluvial riparian habitat along Little Pend Oreille River and Bear Creek, by the year 2015. Reestablish native vegetation and strive to achieve the following characteristics:

- A minimum of 80% stable banks with deep-rooted streambank vegetation (INFISH Standard);
- A regular source of large woody debris within 25 feet of the stream banks (available at least every 150 feet of stream length);

- A natural mixture of riparian vegetation seral stages including a recruitment source for large trees;
- Productive (non-weedy) wildlife habitat/native cover in artificial openings
- Restore mixed-deciduous riparian forest to their natural distribution within LPONWR and restore the native composition of trees, shrubs, sedges, rushes, grasses and forbs within these plant communities.

HMP Alluvial Woodland Riparian Objective

Based upon site-specific characteristics within the 422-acre alluvial riparian floodplain over the long-term (100-200 years), restore >1 snag/ac >16" dbh; >1 trees/ac >21" dbh; tree canopy cover >25%; shrub cover >40%; and riparian zone of mature deciduous trees >160 ft wide and >⅛ mi in length. Refer to Appendix 6 for native tree and shrub species appropriate for plant associations dependent upon site-specific conditions.

Rationale

The value of woodland riparian habitat cannot be over emphazsized. Alluvial riparian trees, combined with alluvial shrubs results in a three dimensional habitat that provides structural complexity, abundant edge habitat, connectivity to other ecosystems, moist and moderate microclimates, and abundant food and water sources of high value to amphibians, reptiles, birds, small mammals, bats, carnivores and ungulates. Since the early 1800's, 50 – 90% of riparian habitat has been lost or extensively modified (Knutson and Naef 1997). Protecting and restoring riparian habitat may yield the greatest gains for fish and wildlife across the landscape.

Strategy

- Determine the existence, extent and condition of any alluvial riparian woodland that currently fits the objective.
- Protect any current or potential alluvial riparian woodland areas from negative impacts including livestock grazing.
- Develop an active reforestation plan for suitable sites.
- Concentrate active forest restoration activities around existing cottonwood trees and in fields 4, 5, 6, 24, 27 and 25b.

Prescriptions

- Protect any existing cottonwood trees regardless of size or condition.
- Locate opportunities for new stand development emphasizing fresh scour and deposition sites.
- Plant cottonwood cuttings taken from local stock using planting guidelines from reliable sources. Protect new plantings from big game browsing for at least 3 years.

HMP Alluvial Shrub Riparian Objective

Based upon site-specific characteristics within the 422-acre alluvial riparian floodplain over the long-term (50 years), restore 20-acre blocks with dense patches of native shrub layer (>35 ft x 35 ft) in size, interspersed with openings of herbaceous vegetation; shrub layer cover 40-80%; shrub layer height >3 ft high; and tree canopy cover <30%. Refer to Appendix 6 for native tree, shrub, and herbaceous species appropriate for plant associations dependent upon site-specific conditions.

Rationale

Wildlife occurs more often and in greater variety in riparian habitats than in any other habitat type. Although riparian areas constitute a small portion of the landscape (1% of the LPO NWR) approximately 85% of Washington's terrestrial vertebrate species use riparian habitat for essential life activities (Thomas et al. 1979 *in* Knutson and Naef 1997.) Neotropical migrant birds are particularly attracted to riparian habitat. Andelman and Stock (1994 *in* Knutson and Naef 1997) document that of the 118 species of neotropical migrants occurring in Washington, 67 (57%) use riparian habitat while in North America. The importance of mountain alder communities for streambank protection, cover, and thermal protection cannot be overemphasized (Kovalchik and Clausnitzer 2004).

Strategy

- Determine the existence, extent and condition of any alluvial riparian shrub stands that currently or could potentially fit the objective.
- Protect any current or potential alluvial riparian shrub stands from negative impacts including livestock grazing.
- Develop an active restoration plan for suitable sites.
- Concentrate active forest restoration activities around existing shrub stands and in fields 4, 5, 6, 24, 27, and 25b.

Prescription

- Remove non-native herbaceous species like reed canary grass to reduce competition to desired herbaceous vegetation.
- Focus efforts on herbaceous recovery, (especially sedges and their relatives) allowing willows to regenerate naturally.
- Plant alders using bare root or container stock using planting guidelines from reliable sources. Protect new plantings from big game browsing for at least 3 years.
- Strive to expand existing shrub patches to meet the above objective.

4.7 Integrate weed management in all LPONWR habitats

CCP/HMP Noxious Weed Objective

Develop an Integrated Weed Management Plan that addresses treatment methods, inventory and monitoring for existing noxious weeds, and minimizes new weed introductions and conditions that favor weed establishment and spread. Until establishment of the Plan, treat any Class A and B-designate weeds or new invaders with the most effective treatment and contain the spread of existing noxious weeds. Treat approximately 50 roadside miles, 250 acres of old field openings, and 250 acres of forest openings annually.

Rationale

Integrated Pest Management (IPM) employs a practical, economical, and scientifically based combination of biological, physical, cultural, and chemical control methods. IPM emphasizes exploration of a variety of methods in order to identify a method or combination of methods that is effective and reduces or eliminates the need for chemical pesticides. IPM is a balanced approach that considers hazard to the environment, efficacy, costs, and vulnerability of the pest.

Prescription

Survey, inventory, and mapping

- Survey pathways which could include waterways, roads, and recreation areas
- Survey areas where natural and/or artificial landscape disturbances have occurred from fire, construction, farming, grazing, logging, or other public uses
- Use modern GPS and GIS technology to generate a comprehensive inventory and map(s)
- Store GPS data in a geodatabase

Prioritize invasive species management activities using the following criteria

- Based upon the current extent of the infestation, highest priorities are assigned to 1) prevent the establishment of new species; 2) eliminate small infestations using early detection/rapid response approach; 3) contain large infestations; and 4) reduce or eliminate large infestations.
- Current and potential impacts of the invasive species
- Value of the infested habitats or areas and surrounding or adjacent areas
- Effectiveness of available control technologies

Monitoring and adaptive management

- Use standard monitoring protocols to evaluate and improve invasive species management programs consistent with the principles of adaptive management

Table 4.1 Estimated Forest Treatment Acres by Strategy for Management Units on Little Pend Oreille National Wildlife Refuge.

Management Unit	Pre-commercial Thinning[1]	Prescribed Burn	Commercial Thinning
Moran Creek	100	180	750
Noman Creek	453	213	596
Lower Bear Creek	100	911	750
Durlan Springs	--	800	499
Starvation Lake	--	860	750
McDowell Lake	--	300	750
Bayley Lake	30	57	236
Upper Bear Creek	90	40	--
North Fork Bear Creek	--	--	--
Cedar Creek	240	560	750
Olson Creek	--	--	569
Totals	1013*	3921	5650

[1]Pre-commercial estimates are based on treatments planned for 2005-2010 only.

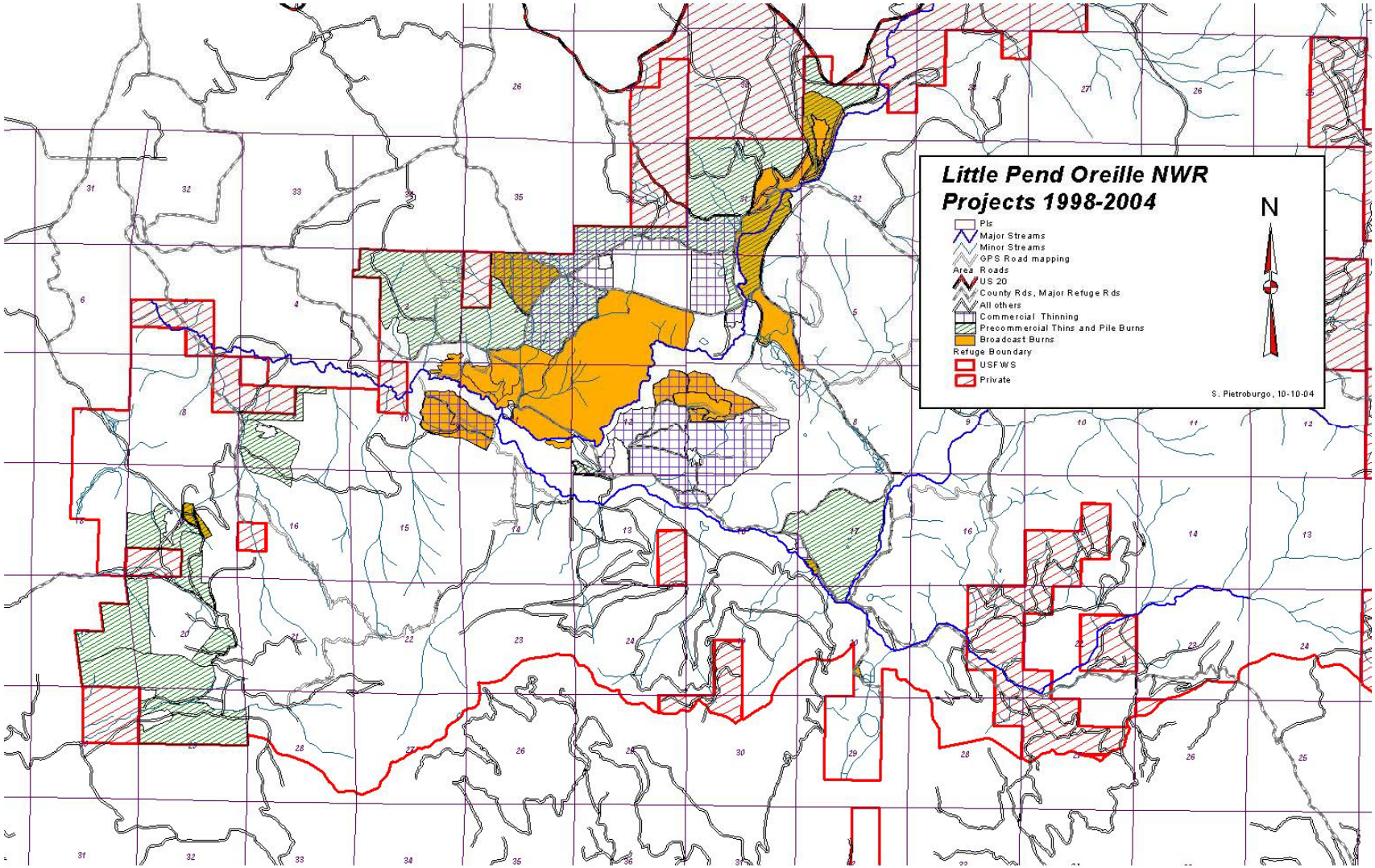
Table 4.2. Dry Forest Seral Stage Acres in 2005 and Commercial Thinning Target Acres (2005 – 2015) for Management Units on Little Pend Oreille National Wildlife Refuge.

Management Unit	Early Seral	Mid-Seral	Late-Seral	Target 2005-2015		
				Early-Seral	Mid-Seral	Late-Seral
Moran Creek	10	583	37	0	500	0
Noman Creek	15	347	6	0	347	0
Durlan Springs	17	396	6	0	396	0
Lower Bear Creek	44	653	59	0	500	0
Starvation Lake	25	1346	25	0	500	0
McDowell Lake	70	1288	158	0	500	0
Bayley Lake	6	57	3	0	57	0
Upper Bear Creek	65	1819	196	0	0	0
North Fork Bear Creek	57	1939	218	0	0	0
Cedar Creek	22	856	80	0	500	0
Olson Creek	14	319	37	0	319	0
Totals	345	9602	826	0	3619	0

Table 4.3. Moist Forest Seral Stage Acres in 2005 and Commercial Thinning Target Acres (2005 – 2015) for Management Units on Little Pend Oreille National Wildlife Refuge.

Management Unit	Early Seral	Mid-Seral	Late-Seral	Target 2005-2015		
				Early-Seral	Mid-Seral	Late-Seral
Moran Creek	11	1290	336	0	250	0
Noman Creek	36	2642	494	0	250	0
Durlan Springs	8	103	5	0	103	0
Lower Bear Creek	221	2764	555	0	250	0
Starvation Lake	26	617	42	0	250	0
McDowell Lake	64	1596	239	0	250	0
Bayley Lake	23	179	26	0	179	0
Upper Bear Creek	25	2092	436	0	0	0
North Fork Bear Creek	24	3302	730	0	0	0
Cedar Creek	11	3510	704	0	250	0
Olson Creek	23	2111	332	0	250	0
Totals	470	20204	3898	0	2032	0

Figure 4.1. Habitat Management Activities within Forest Habitat on Little Pend Oreille National Wildlife Refuge, 1998-2004.



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Appendix 1. An Assessment of Wildland fire Suppression, Timber Harvest, and Livestock Grazing on Forest and Alluvial Riparian Habitats on Little Pend Oreille National Wildlife Refuge (LPONWR)

Effects of fire suppression and timber harvest on forest habitats

The pre-settlement composition and structure of forest in the Pacific Northwest were greatly influenced by natural fire regimes. The persistence of many species in these forests is attributed to fire adaptations. However, natural fire has been excluded from these forests since the early 1900s (Norris 1990) primarily as a result of timber harvest and agriculture development. Hall (1977), Parsons and DeBenedetti (1979), and Agee (1990) found that fire suppression resulted in the following alterations of structure, function, and succession of forest ecosystems:

- Short-lived species which depend on sprouting may be eliminated;
- Results in decedent or disappearing quaking aspen stands being replace by shade-tolerant conifers;
- Accumulations of course woody debris especially in ponderosa pine and mixed conifer forest;
- Increased fuel loads (surface and ladder);
- Increased fire severity (stand replacement fires);
- Altered nutrient pools;
- Increased stress on canopy trees;
- Increased insect outbreaks;
- Changed forest succession to shade-tolerant conifers and loss of species such as ponderosa pine;
- Alteration of horizontal and vertical structure;
- Loss of landscape mosaic characterized by uneven aged stands; and
- Reduced productivity of herbaceous layer.

Fire suppression and timber harvest (historically focused upon high-value large diameter trees) along with livestock grazing are the primary anthropogenic factors that have contributed to the changes in forest structure within the Colville sub-basin (Williams et al. 1995, Kovalchik and Clausnitzer 2004). There has been a clear shift in fire regimes throughout the Colville sub-basin from frequent to infrequent fires (Table A1.1 and Figure A1.1). Specifically, fires regimes have also become more lethal (infrequent, stand replacement) with a decline in frequent and mixed frequency fires. The frequent, low intensity fires historically contributed to the maintenance of large trees with open understories characteristic of old growth conditions such as single-layer ponderosa pine. The loss of frequent, non-lethal fires has resulted in increasing fuel loads, crowded and over-stocked forest stands, and increased risk of catastrophic (lethal, stand-replacement) fire occurrence.

Fire suppression and timber harvesting have blurred the relatively distinct historical elevational zones of forest vegetation on LPONWR. Douglas-fir, grand fir, and Engelmann spruce have expanded their range to lower elevations beyond the normal moist forest zone. Old-growth stands of ponderosa pine have been harvested, and fire suppression and encroachment of other species has resulted in denser stands of Douglas-fir and grand fir-dominated forest where

ponderosa pine historically occurred on the LPONWR landscape. Similarly, there are overstocked stands of ponderosa and lodgepole pine in dry forests primarily as a result of fire suppression. Specifically, fire suppression has resulted in overstocked ponderosa pine stands producing advantageous conditions for shade-tolerant species (e.g., Douglas-fir and the true firs) that are perpetuated through the unnatural absence of frequent, low-intensity fire. Moreover, there is increased fragmentation and a loss of connectivity within and among blocks of old forests on LPONWR as noted throughout the interior Columbia Basin by Wissmar et al. (1994).

In addition to fire suppression, timber harvest has been the greatest influence on the dry and moist forest portions of the LPONWR. Timber harvesting before the establishment of LPONWR focused on large specimens in late-seral forest. Today this is evidenced by the scarcity of large trees on LPONWR. Stands at all seral stages that are the result of this type of harvest tend to lack snags, have a high tree density, and are composed of smaller trees. In the moist forest, more shade-tolerant trees resulted (Johnson and O'Neil 2001). The remaining early-seral stands also lacked snags and other legacy features.

History of livestock grazing on LPONWR

Livestock have been grazed on the area that would eventually become LPONWR around 1900 before the area was officially homesteaded. Most homesteaders cared for some livestock including cattle, horses, mules, sheep, goats, and pigs. A livestock grazing program has been managed to some degree on LPONWR since its establishment in 1939. When the Washington Department of Fish and Wildlife (WDFW formally known as Washington Department of Game) assumed management during 1965, it maintained the existing grazing program, and a grazing program was used by the FWS after it resumed management of the area in 1994.

In 1978, the Little Pend Oreille Wildlife and Recreation Area (as it was called under State management) entered into a Coordinated Resources Management Plan (CRMP) process with the Soil Conservation Service (now the Natural Resources Conservation Service). An initial inventory of resources was begun during 1981 and it was completed during 1983. This inventory provided an up-to-date forage resource evaluation for use in making forage management decisions. In 1985, a CRMP was adopted that determined the maximum number of animal unit months (AUMs) for each existing grazing unit as they existed based on the forage type available and the accessibility of the unit to livestock. Inventoried AUMs represented the estimated total amount of forage available for all herbivores (domestic livestock and wildlife) while retaining adequate residual vegetation to maintain plant health. This original plan was slightly modified in 1990 to reflect the reorganization of some of the grazing units. Table A1.2 illustrates the available AUMs as inventoried during 1985 and the leased number of AUMs allocated to the then three permittees where grazing unit numbers correspond to areas in Figure A1.1.

From 1990 through 1996, the AUMs made available to the then four permittees gradually decreased until 1,141 AUMs were available for annual grazing from June 1 through September 30. The average number of AUMs used by all permittees combined was 747, primarily cow/calf pairs with some bulls. Pastures included both upland coniferous forest and large portions of the alluvial riparian floodplain along both Bear Creek and the Little Pend Oreille River. Several horses were allowed to graze in portions of the Little Pend Oreille River riparian zone from

about October through May from 1983 through 1994. In 1997, the total number of AUMs allotted to the four permittees on LPONWR was reduced to 635, primarily as a result of one permittee selling most of his herd. By 2000, the death of a permittee and subsequent retirement of his grazing permit along with minor adjustments to allotted AUMs reduced the total number of available AUMs to 460 through the 2004 grazing season. The three remaining permittees used an average of 346 AUMs during the last four years. Several pasture units in alluvial riparian were retired from the LPONWR grazing program between 1996 and 2004; however, trespass grazing from cattle in adjacent grazing units with inadequate fencing hindered attempts to completely protect and initiate restoration of riparian areas.

According to special-use permits for grazing permittees on LPONWR, cattle were to be removed from grazing units when the stubble height of grass was reduced to 6 inches. This treatment was selected to represent relatively light grazing and it was not expected to result in browsing on shrubs that are important forage for wintering deer as well as cover and nesting habitat for migratory birds.

For the purposes of discussing past grazing practices on LPONWR, the landscape can be divided into two broad but distinct habitat types: alluvial riparian valleys and forested uplands.

Approximately 6 miles of Bear Creek and about 2 miles of the Little Pend Oreille River (LPO River) occurring on LPONWR are low-gradient streams flowing through relatively broad alluvial valleys formed from the deposition of material. Seven grazing units include portions of each of these valleys. Approximately 338 acres of alluvial valleys are now grazed or have been grazing units since 1996.

With the exception of the Starvation Flats area, the remainder of the upland portion of LPONWR is divided into grazing units. However, a lack of forage, steep terrain, and inadequate fencing as well as other factors cause livestock to concentrate within the lower elevation areas. Unmanaged grazing currently occurs on a majority of the private inholdings owned by Boise Cascade and Stimson Lumber Company because very few fences exist to exclude cattle from these areas and they fall under Washington State open range laws. In contrast to pastures associated with the alluvial riparian, upland allotments are very large with most encompassing at least several square miles. Grazed forested areas range in elevation from 2,000 to 5,200 ft and they are characterized by ponderosa pine, Douglas-fir, larch, lodgepole pine, western redcedar, and western hemlock. Most of the upland grazing occurs in overstocked ponderosa pine and Douglas-fir stands with suppressed understory vegetation. In addition to the Little Pend Oreille River, these upland areas are dissected by numerous other small perennial streams. Due to their gradient, the riparian zone associated with them is quite narrow.

Within the next two sections, discussions of grazing impacts were extensively derived from Kovalchik and Clausnitzer (2004). In some cases, text was taken verbatim from these sources.

Effects of grazing on alluvial riparian and instream habitats

Riparian ecosystems are considered the most sensitive to environmental change (Naiman et al. 1993) with high vulnerability to alteration (Thomas et al. 1979). These ecosystems are formed

and maintained by natural disturbances (e.g., landslides, debris torrents, flooding) which serve to contribute resources (e.g., woody debris, spawning gravel, nutrients) to riparian and instream habitat. A natural disturbance that erodes features in one area may create or revitalize habitat conditions elsewhere in a watershed. Stable channels and optimal stream habitat conditions occur when balance exists between the supply of resources and the ability of the channel to store or transport them.

Natural systems evolved with natural disturbances over long periods. Land uses alter stream channel processes and disturbance regimes that affect aquatic and riparian habitat (Montgomery and Buffington 1993). Human-induced disturbances are often of greater magnitude and/or frequency compared to natural disturbances. These higher rates may reduce the ability of riparian and instream systems, and their fish and wildlife populations, to sustain themselves at the same productive level compared with areas subjected to natural rates of disturbance.

Other characteristics also make riparian habitats vulnerable to degradation from anthropomorphic disturbances. Their small size, topographic location, and linear shape make them prone to disturbances when adjacent uplands are altered. The unique microclimate of riparian and associated aquatic areas supports vegetation, fish, and wildlife that have narrow environmental tolerances. This microclimate is easily affected by vegetation removal within or adjacent to the riparian area, which changes the habitat suitability for sensitive species (Thomas et al. 1979, O'Connell et al. 1993).

Overgrazing is considered to be one of the most destructive forces in riparian ecosystems (Davis 1982). Grazing can affect all characteristics of riparian and associated aquatic systems, including vegetative cover, soil stability, bank and channel structure, instream structure, and water quantity and quality. Overgrazing is considered one of the primary factors contributing to the decline of native salmonids in the Pacific Northwest (Behnke and Zarn 1976, Armour et al. 1991).

Because livestock concentrate in riparian areas that are more sensitive to overuse, upland management schemes have usually caused substantial degradation of riparian habitat even if associated uplands remain in good condition (Behnke and Raleigh 1978, Debano and Schmidt 1989, Elmore 1989, Platts 1989, Platts 1990). Livestock are attracted to riparian areas for the following reasons: availability of drinking water; tender, palatable, and high-protein forage throughout most of the year; and protection from the elements (shade), particularly summer heat as a result of relatively dense vegetation (McLean et al. 1963, Skovlin 1967, Paulsen 1969, Ames 1977, Severson and Boldt 1978, Marlow and Pogacik 1986, Winward 1994, Edelen 1996). Platts (1990) found cattle spend 20-30% more time in riparian areas than elsewhere on their range. Similarly, Skolvin (1984 *in* Ohmart 1996) found cattle spent 5-30 times longer in riparian habitats compared with adjacent uplands. Rivier and Drueger (1982) found riparian habitat covered only about 2% of a Blue Mountain grazing allotment but, riparian vegetation accounted for 81% of the total herbaceous vegetation removed by cattle.

Consumption of shrubs, saplings, and herbaceous vegetation by livestock along with compaction and trampling of soils has impacted riparian and instream habitats in the following ways (Behnke and Raleigh 1978, Duff 1979, Kaufman and Krueger 1984, Davis 1986, Taylor 1986, Kovalchik

1987, Clary and Webster 1989, Kinch 1989, Platts 1989, Armour et al. 1991, Myers and Swanson 1991, Kovalchik and Elmore 1992, Goguen and Mathews 1993, Busch and Scott 1995, Leonard and Karl 1995, Clary et al. 1996):

- Reduced or eliminated regeneration of woody vegetation;
- Changed plant species composition (e.g., xeric species and highly competitive exotic species invade, perennials are replaced by annuals, and trees/willows/sedges are replaced by brush and bare soil);
- Reduced overall riparian vegetation;
- Reduced overall plant vigor;
- Increased bank and instream deformation and erosion from loss of protective vegetation;
- Increased soil compaction and churning by hoof action, which leads to reduced water quality and changes in bank and channel integrity;
- Caused stream channel widening, shallowing, trenching, or braiding associated with increased stream bank erosion;
- Reduced the ability of riparian habitat to trap and filter sediments and pollutants that leads to increased sedimentation and pollution from fecal matter of livestock;
- Increased stream temperatures as a result of lost cover provided by both woody and herbaceous plants;
- Resulted in loss of nutrient inputs, especially invertebrate food sources, to streams;
- Lowered the water table with subsequent loss of riparian vegetation and stream flow;
- Increased the magnitude of high- and low-stream flow events;
- Reduced shrub and ground-nesting habitat for migratory landbirds and other wildlife;
- Caused declines of amphibians, small mammals, and other ground-dwelling animals that need herbaceous and woody vegetation for food and cover;
- Increased songbird nest predation and brown-headed cowbird parasitism due to loss of protective vegetation;
- Resulted in loss of structural and compositional diversity of plant communities, thereby reducing overall wildlife diversity; and
- Reduced forage available for wild ungulates and other herbivores.

Many of these impacts resulted from heavy or unmanaged grazing where large numbers of cattle were given unrestricted access to riparian areas on a year-round basis (Kinch 1989, Chaney et al. 1993). However, impacts to riparian habitat quality and fish and wildlife use also have been found for light to moderate grazing (Schmidly and Ditton 1978, Thomas et al. 1979, Marlow 1988, Platts 1989).

Grazing impacts the species composition and structural riparian vegetation as well as the geomorphology of stream banks and channels. Ammon and Stacey (1997) found greater vertical diversity of vegetation and bankside cover of willows (*Salix spp.*) and greater vertical diversity for the ungrazed (rested for 30 years) compared with the grazed (season-long) side of Franktown Creek (Nevada); willow reductions on the grazed side resulted from browsing, trampling, and erosion. Heavy, season-long grazing by livestock in riparian habitats of central Idaho caused significant changes in streambank structure (width, bank angle, bank retreat) and vegetation (plant biomass reduced by 51-87% approximately 1 year after grazing) compared with ungrazed (control) plots (Clary and Kinney 2002). For a study assessing the effects of changing from

historic heavy grazing to light or moderate seasonal grazing by livestock within Stanley Creek (central Idaho), Clary (1999) found stream morphology (bank stability, width/depth ratio, bottom embeddedness) and the vegetative community (willow height and cover and plant species richness) improved with less-intensive utilization by cattle. Uresk et al. (1987) found the exclusion of liverstock grazing (season-long) and removal of low-vigor trees from woodlands in upper reaches of Magpie Creek (southwestern North Dakota) resulted in height increases in some woody species (Saskatoon serviceberry, green ash, and Wood's rose) after 7 years. For a small, perennial desert stream in south-central Washington, woody vegetation (peach leaf willow) was re-established in riparian habitat within 10 years after complete removal of heavy livestock grazing (Rickard and Cushing 1982). Scrimgeour and Kendall (2002, 2003) found seasonal (early or late) and season-long livestock grazing negatively affected bank stability, biomass of riparian vegetation, and the benthic invertebrate community for streams at Cypress Hills Provincial Park (Alberta, Canada). Based on several studies, Ohmart (1996) concluded that the removal of livestock is the only means to eliminate degradation in riparian habitats caused by cattle.

Sedimentation from bank erosion caused by livestock grazing affects instream communities of invertebrates as a result of habitat degradation (Newcombe and McDonald 1991, Waters 1995, Strand and Merritt 1999). Sedimentation associated with livestock grazing causes silt accumulation on stream beds (Quinn et al. 1992) resulting in decreased depth of pools (Sidle and Sharma 1996). Long-term siltation, which is typically associated with livestock (Armour et al. 1991), can reduce the quality of food resources for invertebrates that forage on algae and micro-organisms that cover exposed substrates (Davies-Colley et al. 1992) and can interfere with filter-feeding invertebrates (Rosenberg and Wiens 1978). Excrement addition and consumption of emergent aquatic vegetation by cattle may cause instream accumulations of filamentous green alga (Armour et al. 1991, 1994; Mathews et al. 1994) that displace diverse assemblages of attached photosynthetic organisms (e.g., diatoms, protests, blue-green alga) and many herbivorous insects (Li et al. 1994). High ammonia levels may displace sensitive invertebrates (Hazel et al. 1979, DeGraeve et al. 1980). Strand and Merritt (1999) found anthropomorphic activities (livestock grazing and deforestation) caused dramatic changes in abundance, taxonomic richness, reach-specific residency, and the proportions of taxa representing different functional-feeding groups in Carlson Creek (Michigan).

Use of the various alder associations by livestock depends on stand accessibility, stand density, the palatability of other browse species, and the availability and condition of other forage on the Wentachee, Okanogan, and Colville National Forests (Crowe and Clausnitzer 1997). With overuse, the mountain alder canopy becomes disrupted and clumpy on these NF lands (Kovalchik 1987). The mountain alder decreases in vigor as indicated by dead shrubs and stems, high lining, and lack of younger age classes. The competitive ability of associated understory dominants also is reduced through grazing and trampling, favoring introduced and increaser herbs. Overgrazing and excessive trampling seriously reduces mountain alder's ability to maintain streambank stability during spring runoff and flooding. The stream reacts by becoming wider and shallower because of streambank trampling and subsequent erosion.

With continued overuse, mountain alder and associated understory vegetation become uncommon, restricted to protected locations or moist microsites, or absent on the Wentachee,

Okanogan, and Colville National Forests (Kovalchik 1987). Kentucky bluegrass, other introduced grasses, and increaser forbs then dominate the site. Mountain alder cover becomes extremely discontinuous, and the shade provided to the understory and stream channel is reduced. The stream channel becomes even wider and shallower, and most of the streambanks erode owing to the lack of alder and other natural dominants (Kovalchik 1987).

Assessments of riparian and in-stream fish habitat were conducted on LPONWR during the late 1990s. Specifically, the alluvial riparian survey was conducted on LPONWR-owned portions of the Little Pend Oreille (LPO) River, Bear Creek, and North Fork of Bear Creek using survey and classification procedures described by the FWS and BLM (Pyle 2000). Riparian resource and functional conditions were assessed based on a thorough examination of site characteristics resulting in classification as either properly functioning or functioning at risk.

Approximately 5 of the 8.5 miles for Bear Creek surveyed were classified as being in unsatisfactory condition. Of the approximately 7.5 miles of the LPO River surveyed, about 2 miles were classified as being in unsatisfactory condition. These unsatisfactory areas were mostly in the alluvial, low-gradient troughs that comprise >50% of the total riparian habitat occurring on LPONWR (Figure A1.1). A majority of the livestock grazing activity on LPONWR occurs within alluvial riparian habitat. This grazing has resulted in unsatisfactory riparian conditions including the following: excessive stream-bank erosion, increased channel entrenchment, lowered water tables, reduced extent of active flood plain, and a diminished composition of the hydric riparian species expected to occur in a fully functional riparian system (Pyle 2000).

Alluvial valleys within LPONWR have been degraded by grazing along with logging and farming, and fire suppression. Kentucky bluegrass and reed canarygrass currently are the most conspicuous grass species. Alder is the dominant woody species along the edges of the streams. Most stands of alder appear to be of even age with little observable regeneration. Willow species are scarce. However, in areas where livestock have been effectively excluded, some tree sprouting has been occurring on LPONWR. There are some scattered stands of mature cottonwoods and aspen, but very little sprouting is evident. Although these alluvial riparian pastures only constitute a small portion of the LPONWR total land base (422 acres or 1%), they provide the highest quality forage available to livestock. Their use by cattle is disproportional to their availability.

On LPONWR, cows concentrating along streams, foraging along the stream banks, and crossing the stream cause extensive physical damage to the banks and channel. This, combined with the reduction or removal of sedges, grasses and woody vegetation through grazing and browsing along these banks, results in degraded stream morphology. As the shape of the stream channel changes, the stream's ability to access its flood plain on a 1-3 year interval is impaired, which diminishes its ability to dissipate energy during high-flow periods as well as to recharge groundwater. The loss of herbaceous and woody root systems lessens the ability of the bank to resist erosion resulting in increased sediment entering the stream. These impacts were identified by biologist, other scientists, and resource management experts who participated in a wildlife and habitat management workshop for this HMP that was conducted on October 15-16, 2004.

The low percentage of stable banks along reach 2 of the LPO River appeared to be associated with cattle grazing. Cattle were present along the stream and there were many areas where their hooves had sheared off the banks. As a result of erosion, banks were down-cut, which increased the entrenchment of the stream and width/depth ratio. Non-native reed canarygrass was present throughout this reach. Because it is not as deeply rooted as some native grasses, alders, and willows, reed canarygrass does not provide adequate bank stabilization. In addition, reed canarygrass outcompetes native plant species in active riparian floodplains.

Sediment was high in reaches 2 and 6 of the LPO River and all reaches of the North Fork (except 2) of Bear Creek. The large percentage of fine substrate indicates both local soils, which contain a high percentage of granitic sands, and low stream gradients. Other sources of sediment input include roads, timber harvest, and fire. These activities can cause loss of native vegetation, changes in hydrology, and bank instability; all of which contribute to sediment input. Lee et al. (1997) indicated numerous roads in a watershed contribute more sediment to steams than any other land management activity.

In 1998, a study was conducted by the University of Idaho examining the effects of livestock grazing on the structure and composition of riparian vegetation within selected pastures on LPONWR (Nielson and Lohman 1999). The objective was to assess the short-term response of the structure and composition of streamside vegetation to livestock exclusion. The authors generally found no differences between pastures where grazing was continued and those where grazing had been removed (1-2 years) from areas that had been subjected to season-long grazing for decades. The authors indicated that plant species composition and structure requires additional time (at least five years without grazing) for recovery on LPONWR. In addition, the authors noted impacts of grazing (e.g., spread of invasive species) that were consistent with other published studies concerning the detrimental effects of grazing in riparian areas.

In 1996, a grazing review was conducted on the LPONWR to determine if the annual livestock grazing program was supporting refuge purposes and fulfilling wildlife and habitat objectives. Resource management professionals from the FWS, USFS, Natural Resource Conservation Service, and WDFW evaluated the effects of the existing grazing program in a variety of LPONWR habitats including riparian, forest openings, low-elevation ponderosa pine forest, and mid-elevation mixed conifer. The review report prepared by the FWS indicated that the annual grazing program did not support refuge purposes and was not consistent with NWRS policies because of detrimental impacts to wildlife habitat. The review team members from the FWS were unable to identify any positive benefit for habitat or wildlife associated with the grazing program on LPONWR (US Fish and Wildlife Service 1997).

Because riparian habitats are highly productive, most of these ecosystems can recover from the effects of excessive grazing with complete rest through total livestock exclusion (Kinch 1989, Platts 1990, Altman 2000). In many cases, ceasing or modifying human activities that negatively impact riparian habitat in conjunction with restoration efforts can result in dramatic recovery of lost ecosystem structure and function (Hair et al. 1978, Kinch 1989, Clary and Medin 1990). A full complement of riparian vegetation may naturally return to streams, and bank structure as well as water quality and quantity may be much improved within 4-15 years (Skovlin 1982, Kinch 1989, Clary and Medin 1990, Chaney et al. 1993). However, some habitat parameters are

slower to recover to pre-grazing conditions. Channel and bank morphology, instream cover, tree regeneration, snag recruitment, plant species composition, and downed woody debris that have been highly altered by heavy grazing likely will require a longer time to recover (Platts and Raleigh 1984, Evans 1989, Clary and Medin 1990). High-gradient streams with unstable channels, areas with shallow soils and limited sediment transportation needed to rebuild banks, high-elevation glaciated stream basins with little soil building potential, or seriously incised streams may require centuries to fully recover (Chaney et al. 1993). For riparian areas that are badly degraded or have low recovery potential as well as those sites that are important to landbird populations, Altman (2000) recommended permanent removal (exclusion) of livestock from the riparian zone. The invasion of exotic plant species may delay or even preclude re-establishment of the natural plant community. Jansen and Robertson (2001) found invasive plants were ubiquitous in heavily grazed areas even many years after livestock were removed.

Recovery of instream habitat may be greatly impeded or precluded unless anthropomorphic disturbances (including grazing) are stopped throughout the entire watershed. In North Fork Cottonwood Creek (California), no change was found in channel width within and downstream 24 years after exclusion of grazing although stream bank vegetation was vigorous; restoration of channel morphology likely did not occur because livestock grazing was not eliminated from the entire watershed (Kondolf 1993). Within the Columbia River Basin, McIntosh (2000) found that large- and deep-pool frequencies in streams did not change unless grazing or timber harvesting were removed from entire watersheds or headwaters.

The importance of riparian areas to fish and wildlife far exceeds their availability. Birds reach higher breeding densities in riparian than any other habitat in the contiguous United States (Carothers et al. 1974 *in* Ohmart 1996); 60-70% of the total species of western birds are dependent on this habitat to survive and breed, and another 15% use riparian habitat some time in their annual cycle. Knopf (1985) reported 82% of the bird species in northern Colorado were found in riparian areas. Neotropical migrant (land) birds make up 60-70% of western riparian breeding birds (Bock et al. 1993 *in* Ohmart 1996). Many species of small mammals, amphibians and reptiles are dependant on these areas. Large mammals such as deer, moose, elk and others use them as thermal and hiding cover, travel corridors, and foraging areas. Heavy livestock grazing adversely affects wildlife (small mammals, reptiles, amphibians, ungulates, fish, and many birds particularly shrub- and ground-nesting herbivores and granivores) through the loss of cover, forage, and breeding structures as well as competition with invasive, non-native species (Crouch 1981, Kauffman et al. 1982, Mosconi and Hutto 1982, Ohmart and Anderson 1986, Taylor 1986, Medin and Clary 1989). Many species (including songbirds, upland gamebirds, waterfowl, raptors, deer, and small mammals) experience dramatic population increases when livestock are excluded from riparian areas (Winegar 1977, Duff 1979, Van Velson 1979, Crouch 1981).

Studies conducted in the West indicate negative effects of livestock grazing on fish in streams associated with degradation of the associated riparian-instream habitat complex. In Summit Creek (Idaho), Keller and Burnham (1982) found larger rainbow and brook trout in creek sections that were ungrazed compared with grazed areas. In addition, these authors concluded trout preferred stream areas in ungrazed habitat. Knapp and Matthews (1996) found large differences in physical characteristics (canopy shading and width/depth ratio) between grazed

and ungrazed areas (exclosures) after 2 years within streams in the Golden Trout Wilderness (California). In addition, these authors found California golden trout density and biomass were higher in areas without grazing. Clarkson and Wilson (1995) found bank trampling associated with livestock grazing resulted in population declines for Apache trout in east-central Arizona. Behnke and Raleigh (1978) found a three- to four-fold decrease in the trout biomass in grazed compared with ungrazed areas. After removal of heavy livestock grazing (exclusion by fencing) from Sheep Creek (Colorado), instream habitat (width/depth ratio) improved along with increased standing crop and stock density of trout and a higher proportion of non-game fish (Stuber et al. 1985). Livestock grazing in riparian areas reduced invertebrate availabilities in streams that reduced or eliminated populations of blackstripe topminnows (McAllister 1987).

Fish habitat assessments of the Little Pend Oreille River and Bear Creek were conducted during 1996 and 1997, respectively (Kelly Ringel 1998, Kelly Ringel 1999). The rivers were divided into reaches (a relatively homogeneous section of stream that contains attributes of common character) based on landform characteristics such as valley form, valley floor width, side slope angles, estimated stream length, and other watershed characteristics. The LPO survey included six reaches along about 9.5 miles of the River from the western boundary of LPONWR to below Crystal Falls. Reaches 2 and 7 were further subdivided when measuring fine sediment. The Bear Creek survey was completed with five reaches designated along 5.2 miles of the Creek, from the confluence with the LPO River upstream to the confluence with the North Fork of Bear Creek. Two reaches along the North Fork of Bear Creek (reach 1 and 2) were also comprehensively surveyed (Figure A1.3).

Data for the fish habitat assessments were collected using a modified Hankin-Reeves (1988) stream survey method (US Forest Service 1996). This method was selected because it identifies and measures key stream characteristics that have been identified as the most critical for defining existing watershed conditions (US Forest Service 1996). These characteristics include the following: pool frequency, quality, and proportion; amount of woody debris; proportion of fine sediment; bank erosion; entrenchment; sinuosity; width/depth ratio; riparian vegetation species, seral stage, and amount of stream shading; and water temperature. As part of these studies, stream conditions were compared to criteria and guidelines from the Inland Native Fish Strategy (INFISH [US Forest Service 1995]), which is current direction for Forest Service and BLM lands located east of the Cascade Crest (US Forest Service 1996), and the ICBEMP standards that were established in the original preferred alternative for the Eastside EIS released in May 1997 (US Forest Service and US Bureau of Land Management 1997).

The results of the fish habitat surveys (Tables A1.2 and A1.3) highlight certain trends indicating the general condition of LPONWR aquatic habitats. Water temperatures measured during the survey are not directly comparable to the standards because they were not taken continuously over at least 7 days. However, 4 of 6 reaches on the LPO River exceeded the maximum recommended temperature of <59°F for adult fish holding habitat. All reaches of the surveyed streams exceeded the maximum temperature (<49° F) for spawning and rearing habitat. Water temperature monitors were placed at six locations on LPONWR during summer 2005 (Brea Creek [2], North Fork Bear Creek [1], Little Pend Oreille River [3]); the maximum water temperatures recorded during July and August ranged from 62° to73° F (LPONWR files). Water temperatures are influenced by local climate, snow runoff, and the amount of solar warming of

the stream. Lack of overhead cover increases water temperature by solar warming. Alteration of riparian vegetation has occurred in the past through logging and channelization, and continues in the present mainly through herbivory by both native wildlife and livestock.

Studies indicate negative effects of livestock grazing on avian communities in riparian habitat associated with the loss of food, nesting structures, and habitat diversity (Overmire 1963, Owens and Meyers 1973, Buttery and Shields 1975, Evans and Krebs 1977, Behnke and Raleigh 1978, Crouch 1978, Reynolds and Trost 1980, Saab et al. 1995). Along the Blitzen River in southcentral Oregon, increased intensity of annual grazing was correlated with decreases in landbird abundance, shrub volume, shrub height (Taylor 1986). Taylor and Littlefield (1986) noted populations of willow flycathers and yellow warblers increased after removal of annual grazing along the Blitzen River (Malheur NWR in southeastern Oregon) that eliminated or severely impacted bank willows. Mosconi and Hutto (1982) found heavy livestock grazing negatively affected willow flycatcher and veery in riparian stands (cottonwood/pine). Page et al. (1978) indicated the hermit thrush and MacGillivray's warbler negatively responded to livestock grazing that affected aspen stands. In riparian meadows of the northwestern Great Basin, Dobkin and Pyle (1998) found increased cover of sedges and forbs and increased foliar height of herbaceous species on plots where livestock grazing was removed for >30 years compared with plots where grazing had just been removed at the start of the study. In addition, these authors found the avian species richness and relative abundance was greater within plots where grazing had been excluded for >30 years. For riparian habitats in southwest Pennsylvania, Popotnik and Giuliano (2000) found that abundance of and nest densities for wetland- and riparian-dependent, avian species was greater for ungrazed streams compared with those that were grazed as a result of improved vegetative cover and structure. Bock et al. (1993) reported the following for 43 avian species dependent on riparian woodlands: 17 species (nest or forage in heavy shrub or herbaceous ground cover) were negatively affected by grazing, 18 had no or mixed responses, and 8 species were positively affected. Those that benefited from grazing included aerial foragers associated with open habitats (e.g., Lewis' woodpecker, mountain bluebird); ground foragers that prefer relatively little cover (e.g., American robin, killdeer); and species directly attracted to livestock (e.g., brown-headed cowbird). Similarly, DeSante and George (1994) indicated overgrazing and destruction of riparian habitat as the causes of population declines in 8 and 15 western avian species, respectively. Other researchers have reported that grazing may provide habitat for avian species adapted to open environments, particularly in areas with dense vegetation where grazing opens up the canopy (Burgess et al. 1965, Kirch and Higgins 1976, Crouch 1981).

Because livestock grazing threatens native species and counters habitat management objectives (Minshall et al. 1989; Armour et al. 1991, 1994; Fleischner 1994), grazing in riparian has been viewed as harmful to aquatic ecosystems (Resh et al. 1988; Armour et al. 1991, 1994; Fleischner 1994, Leonard and Karl 1995, Waters 1995). Although considerable experimentation with the use of various grazing systems (e.g., rest-rotation, deferred-rotation, short-duration) to reduce damage to riparian habitat has occurred, no one system has emerged that is effective in all cases (Laycock and Conrad 1981, Blackburn et al. 1982, Dwyer et al. 1984, Pieper and Hietschmidt 1988, Clary and Webster 1989, Knutson and Naef 1997). A grazing strategy that maintains riparian habitat integrity in one situation may be damaging in another, even if it appears closely related (Kauffman et al. 1983). Platts (1989) evaluated various grazing strategies and techniques

and rated them according to their compatibility with fish requirements. Systems with the greatest negative effects were continuous, season-long cattle grazing and short duration, high-intensity cattle grazing. In contrast, those least damaging to riparian and instream habitats were grazing by sheep with a carefully controlled seasonal rest-rotation system as well as complete rest and closure. Consequently, permanent removal of livestock grazing is recommended for protection and recovery of riparian habitat (Leonard and Karl 1994, Knutson and Naef 1997, Altman 2000).

Effects of grazing on forest habitats

In similarity with riparian habitat, studies have found impacts to dry and mixed conifer forests associated with livestock grazing. In Douglas-fir/ninebark habitat on the west slope of the Bitterroot Mountains (northern Idaho), heavy, season-long livestock grazing increased tree density; decreased biomass, cover, and frequency of major palatable grasses; altered dominance of shrub and forb species; increased accumulation of downed woody fuels; increased duff; and decreased herbaceous fuels. As a consequence of these plant community and environmental changes, historic fire frequency and intensity were altered (Zimmerman and Neuenschwander 1984). Belsky (1997) noted livestock grazing altered natural ecosystem processes by reducing cover of herbaceous plants and litter , disturbing and compacting soils, reducing water infiltration rates, and increasing soil erosion. The reduced herbaceous plant cover allows increased conifer seedling recruitment and results in overstocked stands. Belsky and Blumenthal (1997) and Hobbs (1996) found that livestock grazing in western forests likely reduced biomass and density of understory grasses and sedges and reduced abundance of fine fuels that formerly supported low-intensity, high-frequency ground fires.

After timber harvest within a mixed coniferous forest on the west slope of the Sierra Nevada, livestock grazing caused a long-term reduction in shrub and herbaceous canopy cover (Allen and Bartolome 1989). In eastern Oregon and northern Idaho, livestock grazing in ponderosa pine/snowberry stands eliminated all native shrubs and herbs that resulted in swords of Kentucky and Canada bluegrass (Daubenmire and Daubenmire 1968). Mayer et al. (2003) noted livestock selected grass species for foraging compared with forbs and shrubs based upon differences in digestibility in forested habitats. Daubenmire and Daubenmire (1968) noted that grazing caused a permanent shift in understory dominance of ponderosa pine/Idaho fescue to cheatgrass, Dalmatian toadflax, and St. Johnswort. In addition, successful regeneration of the herbaceous understory required the elimination of grazing for several years after tree plantings (Heidman 1988). One year with late-season grazing almost completely eliminated regeneration (suckering) within Aspen stands of a previously burned forest of western Canada (Fitzgerald and Bailey 1984). Consequently, heavy livestock grazing affects understory vegetation opposite to those associated with burning (Franklin and Dyrness 1973).

Livestock use of quaking aspen communities on the Wenatchee, Okanogan, and Colville NFs differs with species composition of the understory and relative age of the quaking aspen stand. Aspen is highly palatable to all browsing ungulates. It is especially valuable in fall and winter, when protein levels are high relative to other browse species and herbs. Young stands generally provide the most browse as aspen crowns can grow out of reach of ungulates in 6 to 8 years. Some of these sites produce moderate to high amounts of palatable forage, and use by livestock

can be high. This is especially true of aspen associations with its relatively dense ground cover of the palatable woolly sedge and other herbs. Other aspen associations can have a rather dense layer of shrubs that both suppresses the herbs and restricts access to livestock.

The aspen overstory is a dyanamic resource on the Wenatchee, Okanogan, and Colville NFs. Aspen groves are perhaps the hardest to retain under the usual impacts of livestock grazing. Livestock concentrate in these areas and use them for forage, shade, and bedding areas. If the aspen suckers are repeatedly grazed, the aspen clone will eventually be lost. Fencing livestock from declining groves for an 8- to 10-year period should allow adequate sucker regeneration to establish, at least for younger stands. The ability to easily re-establish aspen, shrubs, and herbs may be lost when they have been extremely stressed or eliminated by long periods of overgrazing and soil compaction. In this situation, disking and planting may be the only effective means to regenerate the aspen stand and its understory.

Cattle preferentially graze old homesteads and natural forest openings on both upland and riparian sites on LPONWR. These areas have the greatest potential for expansion and regeneration of aspen and other desirable shade-intolerant hardwoods. However, little aspen sprouting is seen in these areas although parent trees are available for suckering. Aspen inclusions are valuable habitat for grouse, deer, woodpeckers, and other migratory landbirds.

Quaking aspen occurs within wet sites within all three forest zones on LPONWR. Many aspen stands on LPONWR tend to be mature and even-aged with little or no regeneration. Vegetative reproduction by suckering is the primary mechanism by which aspen stands are maintained and enlarged. For vigorous sucker reproduction to occur, light and radiant energy must reach the forest floor. This can be prevented by shading from competing conifers. This may be an important factor on LPONWR, especially in the dry forests where fire suppression has allowed conifers to encroach into sites previously dominated by the more fire-adapted aspen. In addition to fire suppression, annual browsing of aspen suckers by livestock (native ungulates to a lesser extent) suppresses suckering that results in decadent, non-sustaining stands. Aspen suckers growing up through a downed tree, and thereby protected from browsing by its trunk and branches, are now 6-8 ft tall while nearby suckers not protected remain <2 ft tall and display browse-related damage to their terminal buds (LPONWR files).

Concern for deteriorating aspen stands on LPONWR necessitated an assessment of aspen health. During 2002, James Hadfield (Plant Pathologist with the Wenatchee Forestry Sciences Laboratory) conducted an aspen condition assessment survey (US Forest Service 2003) to characterize the amount of tree mortality within aspen clones, identify damage to stems, and rate the condition of LPONWR aspen clones. Clone condition status was rated as stable, successional to conifers, or decadent using definitions developed by Bartos (2001). Twenty-seven clones less than one acre in size were surveyed between 2,028 and 3,839 ft in elevation. Of the 27 sampled clones, nine were stable, 15 were successional to conifer, and three were decadent. Results of the aspen assessment indicated that the majority of the aspen clones sampled are declining and lacked recruitment primarily as a result of conifer competition.

Aspen inclusions and deciduous browse such as evergreen ceanothus, serviceberry, and snowberry also are generally degraded or depressed on LPONWR. Most existing browse for

wintering deer is decadent and more palatable species are often over-browsed on LPONWR. The existing densely treed forest likely resulted from fire suppression, selective logging, and livestock grazing.

Low-elevation sites within Douglas-fir forest types on the Colville NF have often received a century or more of intensive use (roads, season-long grazing, logging, flooding) because they are readily accessible. The majority of Douglas-fir stands are highly altered. Past disturbance has lowered the competitive ability of native trees, shrubs, and herbs, which has allowed invasive plants to become dominant. Pinegrass is well grazed by livestock in Douglas-fir stands within the Colville NF (Williams et al. 1995). In ponderosa pine-Douglas-fir associations on the Colville NF, grazing has reduced cover of native grasses (e.g., bluebunch wheatgrass, Idaho fescue) while increasing cover of invasive species such as cheatgrass and diffuse knapweed (Williams et al. 1995).

Browse and forage in the shrub and herb layers are greatly reduced in late-successional (old) stands of grand fir on the Wenatchee, Okanogan, and Colville NFs. Because early-seral stands of grand fir may produce moderate amounts of palatable browse and forage, use by livestock can be high. However, most use of these sites by livestock depends on the availability of cover, shade, and water. Because many of these sites have moist, fine-textured soils, overuse (muddy, trampled areas in early summer or compaction) has been an issue. Both lead to a significant decline in vegetative cover. Eliminating grazing will often allow the remnant shrub and herb populations to sprout and re-establish the stand. The potential to re-establish desired shrubs and herbs may be lost if they have been eliminated by overgrazing or if the water table has been lowered by stream downcutting or lateral erosion.

On the Wenatchee, Okanogan, and Colville NFs, cool, moist-to-wet sites within western hemlock generally have little forage for domestic livestock, except in early successional stages when forage production may be high (in the absence of shrubs). With forage potential generally poor, sites in mid- to late-successional stages primarily represent sources of water and shade. Where water tables are high and soils moist or wet, sites are vulnerable to livestock trampling. In addition, where grazing is particularly heavy, shrub and herb composition may be altered over the years with a trend toward dominance by invasive plants such as Kentucky bluegrass and white clover. The ability to easily re-establish desired shrubs and herbs may be lost when these native species have been eliminated as a result of disturbance (e.g., clearcutting, overgrazing) or lowered water table from stream downcutting or lateral erosion.

Both cattle- and sheep-browsed western redcedar can cause considerable damage to its regeneration (Minore 1983). In most cases, these cool, wet sites on the Wenatchee, Okanogan, and Colville NFs have little utility for livestock except as shade or where forage production is high in early successional stages. Where grazing has occurred, shrub and herb composition has been highly altered with a trend toward dominance by invasive plants such as Kentucky bluegrass and white clover. Sites are susceptible to trampling resulting from high water tables and moist or wet soils. The ability to easily re-establish desired shrubs and herbs may be lost when they have been eliminated as a result of overgrazing and the water table has been lowered because of streambed downcutting or lateral erosion.

The palatability of subalpine fir to livestock is low (Dittberner and Olson 1983). Most subalpine fir stands on the Wenatchee, Okanogan, and Colville NFs generally have little utility for domestic livestock. Forage potential may be fair in early successional stages or on some of the wetter, open associations, but it is generally poor in late-successional stages. Without suitable forage, these sites primarily represent sources of water and shade. In any case, sites are susceptible to trampling from high water tables and moist or wet soils. The ability to re-establish shrubs can be lost if the shrubs have been eliminated from overgrazing, when the soil has been compacted, or the water tables lowered from stream downcutting.

Many of the plant associations for Engelmann spruce on the Wentachee, Okanogan, and Colville NFs lack suitable forage. They primarily represent sources of water and shade. Forage potential on the drier associations may be fair in early-successional stages, but is generally poor in later successional stages. Wetter sites within Engelmann spuce stands may provide an abundant supply of forage, but they are susceptible to trampling resulting from high water tables and wet soils. Overuse is possible as livestock seek shelter from the heat during hot summer months. Livestock generally avoid these wet sites until they can walk on the soil surface in late August or September (Kovalchik 1987). At this time, most plants are physiologically mature and can withstand light to moderate grazing pressure. Few sample stands were highly impacted by livestock grazing. The ability of shrubs to easily re-establish may be lost when they have been eliminated from overgrazing and the water table has been lowered as a result of stream downcutting or lateral erosion.

Browsing by livestock on forest shrubs, particularly snowberry, has been observed and documented by Refuge staff on numerous occasions in several grazing allotments (LPONWR files). The long term negative result of this livestock browsing is readily apparent when viewing the fenceline along the east side of the Durlan Springs allotment. The fence was built on a section line, arbitrarily dividing the south facing slope of ponderosa pine forest, and allowing livestock grazing on the west side but not the east. The diversity, density, and vigor of shrub community is observably greater on the un-grazed side. (LPONWR files).

The Durlan Springs allotment is an example of the negative impacts of livestock grazing and browsing on native riparian hardwood sites. The spring giving the allotment its name arises from a draw historically dominated by birch, aspen, possibly cottonwood, and various deciduous shrubs. Development of the site as a livestock watering area has resulted in a nearly complete loss of hardwood shrubs. Few aspen and birch remain. The herbaceous vegetation is composed of mostly exotic Kentucky bluegrass, and several noxious weeds including hound's tongue resulting from disturbance caused by livestock grazing (LPONWR workshop 2004, LPONWR files).

Hound's tongue is an introduced noxious weed that appears to be spreading on LPONWR, particularly in the grazed areas. It is found in pastures, along roadsides and in disturbed habitats (Whitson et al. 2000). It spreads when its ripe seeds clinging to passing animals are transported to uninfested areas. LPONWR files contain photos of livestock with hundreds of hound's tongue seeds attached to their coats. Although deer and other wildlife probably contribute to the spread of the plant, the creation of disturbed sites associated with cattle loafing and watering areas likely contributes greatly to its spread.

Historically, the rationale for maintaining the grazing program on the LPONWR was that it promoted early green up and improved forage quality of grasses in spring for white-tailed deer. During early spring, deer energy reserves are at their lowest level and reliance on grasses is highest. This is especially true for females that require increasing amounts of energy in preparation for fawning. However, cattle switch their diet to increasing amounts of browse on LPONWR by mid summer when grass forage cures (dry and less palatable) and becomes scarce. During this time, palatability of browse improves. Because browse is one of the most important food sources for wintering deer with evergreen and deciduous woody plants comprising more than half the mid-winter diet in Montana and Idaho (Peek 1984), there likely is competition between deer and livestock for forage on the LPONWR.

Maintaining a grazing program on the LPONWR has required the construction of a large number of fences throughout LPONWR, especially within the alluvial river bottoms and traditional white-tailed deer winter range. Many of these fences are in poor condition and they are not conducive to deer passage.

Livestock grazing and browsing likely have negative effects upon ruffed grouse habitat on LPONWR. Ruffed grouse within this part of their range depend very heavily on the flower buds of mature aspens for winter food. Immature aspen as well as other species of woody vegetation serve as an important fall to spring habitat by providing visual obstruction from predators, especially around drumming sites (Cade and Sousa 1985). This important aspen component (smaller diameter sizes from sprouts to about 4" dbh) is rare on the LPONWR. As previously stated, aspen groves show a very low rate of reproduction. Almost all of the suckers available to livestock have been browsed heavily. Although wildlife such as deer browse in aspen, cattle are contributing to the suppression of these stands.

There have been few studies that have assessed the effects of grazing forest habitat on avian communities. In a mixed conifer habitat of northeastern New Mexico, Goguen and Mathews (2000) found high rates (80%) of nest losses for plumbeous vireo attributed to cowbird parasitism resulting from active livestock grazing. However, declining trends in populations of forest-dependent landbirds likely is attributable to loss of structure and functional integrity of forest habitats from the cumulative effects of anthropogenic factors including livestock grazing, fire suppression, and timber harvesting. For example, the flammulated owl, which requires old growth dry forest with interspersed grassy openings and dense thickets (Altman 2000), likely is negatively affected by forest grazing that reduces cover of shrubs and grasses. The current population trend for the flammulated owl is declining or stable in the Northern Rocky Mountains of eastern Oregon and Washington.

It is likely that forest-dependent landbirds on LPONWR are negatively affected by livestock grazing, especially those species dependant on herbaceous and shrubby ground cover for nesting and/or foraging. Losses of herbaceous and shrubby cover in forest areas on LPONWR that are grazed were noted by participants during the wildlife and habitat management review (1997) and habitat management workshop (2004).

Livestock grazing on LPONWR attracts brown-headed cowbirds that likely are impacting migratory landbirds. Brown-headed cowbirds are nest parasites that do not build their own nest, but they lay their eggs in the nest of other migratory landbirds. The cowbird usually hatches

earlier than the host eggs. The result of this parasitism is often the loss of the host's young. Because a female cowbird lays an average of 30-40 eggs per season, a relatively small number of cowbirds can parasitize many nests. Several species of birds breeding on the LPONWR are susceptible to this form of nest parasitism For example, three studies in British Columbia found between 62 and 79% of warbling vireo nests parasitized by cowbirds (Campbell and Meugens [1971] *in* Gardali and Ballard [2000]). By adapting from an association with buffalo to domestic cattle, the cowbird has expanded its range into many new areas, including northeast Washington. Brown headed cowbirds are found on LPONWR (LPONWR files). Because brown-headed cowbirds will generally not travel more than 2 miles from agricultural areas with cattle herds, removing cattle from the LPONWR likely would reduce or eliminate much of this problem on LPONWR.

Assessment of grazing as a management strategy to achieve CCP and HMP objectives for alluvial riparian and forest habitats on LPONWR

The Preferred Alternative for the LPONWR CCP stated "The annual livestock grazing program will continue at its present intensity for five additional years [2000-2004], after which it will be discontinued. Subsequent grazing would be used only as a wildlife habitat management tool and its use would fall under the umbrella of benefiting habitat objectives."

As reported within the 1996 review of the grazing program at LPONWR, there were detrimental effects from annual grazing on riparian and forested habitats with few, if any, benefits to fish and wildlife resources. The identified impacts to alluvial riparian and instream habitats were corroborated by riparian and instream assessments conducted by Pyle (2000), Kelly Ringel (1998, 1999), and Nielson and Lohman (1999) as well as the published scientific studies discussed above. Because the riparian and forest systems of LPONWR and its surrounding landscape did not evolve with significant grazing from native herbivores, livestock grazing has contributed to a departure from historic forest structure and function resulting in the modification in species composition as well as the complete loss of some habitat components including the shrub and grass understory. These understory components are important in providing habitat and forage for migratory birds as well as white-tailed deer which are species that contribute to achievement of LPONWR purposes as well as biological integrity, diversity, and environmental health of LPONWR and its surrounding landscape.

Tables 3.3-3.6 identify focal species and their habitat requirements for management on LPONWR that were selected because they support Service legislative mandates and policies that identify management priorities for NWRS. Annual grazing at historic levels was not identified as an appropriate management strategy for any of the forested or alluvial riparian habitats because it impacts the habitat structure and function needed to support these species. Because of impacts to other important wildlife and plant species that contribute to the biological integrity and diversity of the area, annual grazing in forest and alluvial riparian habitats is not an appropriate management tool to use on these LPONWR habitats. The grazing compatibility determination completed for the CCP indicated annual grazing was not compatible. However, it stated, "A prescribed livestock grazing program, properly managed, can have benefits to wildlife habitats." The published scientific literature indicates that grazing strategies are available that when implemented will reduce the impacts to fish, wildlife, and their habitats. However,

selective prescriptive grazing, as proposed in the HMP, can be used as a management tool to help achieve refuge objectives and contribute to the maintenance of biological integrity at the ecosystem landscape scale.

Section 3.7E of the Biological Integrity, Diversity, and Environmental Health Policy states, "Management, ranging from preservation to active manipulation of habitats and populations, is necessary to maintain biological integrity, diversity, and environmental health. We favor management that restores or mimics natural ecosystem processes or functions to achieve refuge purpose(s)." "Some refuges may differ from the frequency and timing of natural processes in order to meet refuge purpose(s) or address biological integrity, diversity, and environmental health at larger landscape scales." In order to maintain and restore the biotic composition as well as the natural structure and function of the LPONWR landscape, natural processes will be favored for management of forest and alluvial riparian habitats of LPONWR. Unlike some other systems of Federal lands which are managed on a sustained-yield basis for multiple uses, the NWRS is a primary-use network of lands and waters. First and foremost, refuges are managed for fish and wildlife. Therefore, management will focus on the use of prescribed fire as well as forest management strategies (e.g., removal of ladder fuels, selective thinning) that will facilitate the restoration of natural ecosystem processes and forest conditions that support native species of fish, wildlife, and plants that are important in achieving LPONWR purposes as well as maintaining and, where appropriate, restoring biological integrity, diversity, and environmental health. However, when properly used, prescriptive grazing can be used to achieve some appropriate refuge habitat and wildlife management objectives.

Table A1.1. Changes in Fire Regimes Throughout the Colville Sub-basin, Circa 1900 – Present (US Fish and Wildlife Service 2000).

FIRE REGIME	Current Acres (1991)	Current Percent	Historic Acres (~1900)	Historic Percent	Absolute Change	Approximate Ratio of Current to Historic
Lethal /frequent	6905	1%	83512	13%	-12%	1:13
Lethal/infrequent	299256	46%	2224	0%	46%	134:1
Lethal/very infrequent	99172	15%	29322	5%	11%	3:1
Mixed/frequent	247	0%	202524	31%	-31%	1:82
Mixed/infrequent	71559	11%	1218	0%	11%	59:1
Non-lethal/very frequent	0	0%	253653	39%	-39%	1:254,000
Non-lethal/frequent	0	0%	36346	6%	-6%	1:36,000
Non-lethal/infrequent	166417	26%	35791	6%	20%	5:1
Rarely/n.a.	2455	0%	1423	0%	0%	2:1
Total	646011	100%	646011	100%		

Table A1.2. Little Pend Oreille National Wildlife Refuge grazing units based on 1985 summary of unit size and inventoried AUMs. Leased AUMs based on 1990 WDFW grazing plan adjustments based on 1985 CRMP (US Fish and Wildlife Service 2000).

Grazing Unit	Approximate Acres	Inventoried AUMs	Leased AUMs	Grazing History
1	440	88	50	Rotational grazing[1]
2	5,060	1,170	0	Not grazed
3	587	101	0	Not grazed
4	28	9	5	Combined with 5 and 6. Rotational grazing.[2]
5	97	37	21	“
6	1,477	219	123	“
7w	2,914	87	49	Rotational grazing.
7e	5,828	99	0	Not grazed.
8	8,742	186	105	Rotational grazing.
9a	32	19	11	Rotational grazing.
9b	5,226	178	100	Mixed ownership with Boise Cascade. Rotational grazing.
10	1,720	112	52	Mixed ownership with Boise Cascade. Rotational grazing
11e	173	87	41	Rotational grazing.
11w	172	169	79	Rotational grazing.
12	50	35	17	Rotational grazing.
13 a	173	70	39	Rotational grazing.
13b,c,e	206	293	0	Not grazed
13d	33	15	8	Rotational grazing.
14e	33	22	19	Rotational grazing.
14w	1,460	55	48	Rotational grazing.
15e	680	15	8	Rotational grazing.
15w	4,480	145	126	Rotational grazing.
16e	240	75	65	Rotational grazing.
16w	1,440	102	89	Rotational grazing.
16s	280	20	17	Rotational grazing.
Total	41,571	3431	1072	

[1] Refers to grazing a unit only part of the grazing season, then rotating livestock to another grazing unit.
[2] Previously separate units, fences separating units 4, 5 and 6 were removed by 1990.

Table A1.3. Summary of Standards[1] for Stream Condition Assessments Conducted on Little Pend Oreille National Wildlife Refuge (US Fish and Wildlife Service 2000).

Water Temperature (degrees Fahrenheit, measured as 7-day moving average of daily maximum temperature)	
INFISH:	< 59 ° F within adult holding habitat < 48 ° F within spawning and rearing habitats
ICBEMP:	<64 ° F
Pools per Mile (varies by wetted width)	
INFISH:	47 per mile for streams 25-49 feet wide (LPO River) 96 per mile for streams 10-19 feet wide (Bear & N.Fk. Bear Creek)
ICBEMP	same as INFISH
Bank Stability (percent linear bank non-eroding)	
INFISH:	> 80%
ICBEMP	N/A
Sediment (percent fine particles in stream bed)	
INFISH:	N/A
ICBEMP	<20% fines < 6.4 mm in spawning areas or <30% cobble embeddedness in rearing habitat
Large Woody Debris	
INFISH:	> 20 pieces per mile. Each piece must be at >12 inches diameter and > 35 foot length to be counted.
ICBEMP	Same as INFISH

[1]Interior Columbia Basin Ecosystem Project (ICBEMP) standards were taken from the Eastside Assessment (US Forest Service and US Bureau of Land Management 1997). INFISH standards were taken from US Forest Service (1995).

Table A1.4. Stream Conditions as Compared to Standards in the Little Pend Oreille River, Bear Creek, and North Fork of Bear Creek within Little Pend Oreille National Wildlife Refuge (US Fish and Wildlife Service 2000).

	Little Pend Oreille River						**Bear Creek**				**North Fork of Bear Creek**	
Habitat Parameter	**Reach Number (See Figure A1.3)**											
	2	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**4**	**5**	**1**	**2**
Water Temperature *	68	65	66	57	54	62	57	55	55	59	54	56
met INFISH adult holding habitat?	No	No	No	4	4	No	4	4	4	4	4	4
met INFISH spawning/rearing?	No	No	No	No	No	No	No	No	No	No	Np	No
met ICBEMP?	No	No	No	4	4	4	4	4	4	4	4	4
Pools per mile	35	23	25	33	24	28	36	59	11	23	26	45
met INFISH / ICBEMP?	No	No	No	No	No	No	No	No	No	No	No	No
Bank Stability	66	93	89	85	98	99	99	95	99	100	100	100
met INFISH?	No	4	4	4	4	4	4	4	4	4	4	4
Sediment in Riffles (percent sand, silt, and clay < 2 mm)	2a: 45 2b: 26	8	8	19	31	7a: 11 7b: 22	23	25	79	37	57	14
Met ICBEMP?	No	4	4	4	No	4 7a	No	No	No	No	No	4
Large Woody Debris	1	14	32	9	192	33	71	7	32	128	29	131
Met INFISH /ICBEMP?	No	No	4	No	4	4	4	No	4	4	4	4

'Indicates that the reach met the specified standard.
*Water Temperature measurements were not performed all summer or were 7-day moving averages completed on all reaches. The numbers presented were measured in July and may re present only a one day high temperature.

Figure A1.1. Changes in Fire Regimes Throughout the Colville Sub-basin, Circa 1900 – Present (US Fish and Wildlife Service 2000).

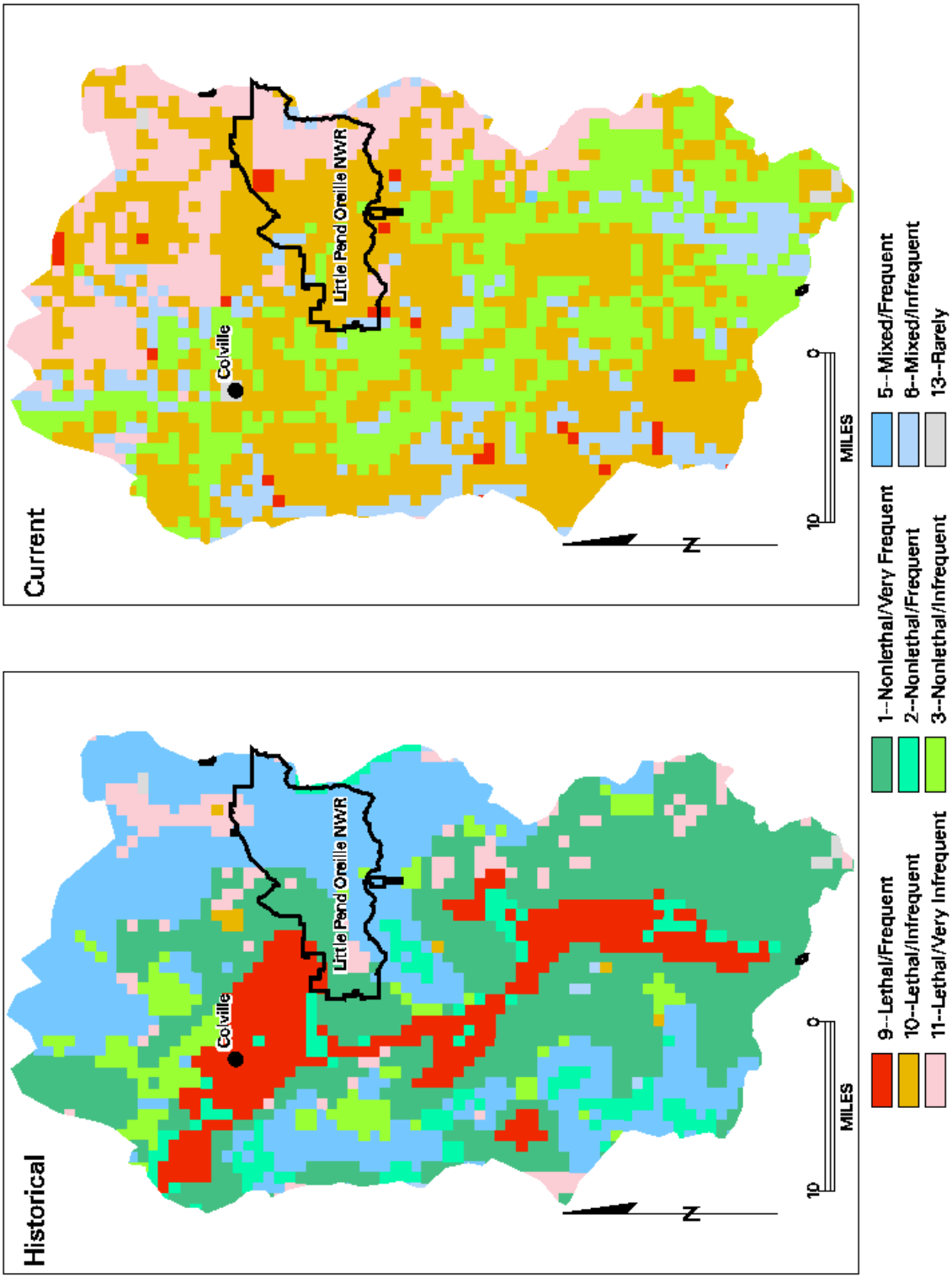


Figure A1.2. Grazing Units on Little Pend Oreille National Wildlife Refuge (US Fish and Wildlife Service 2000).

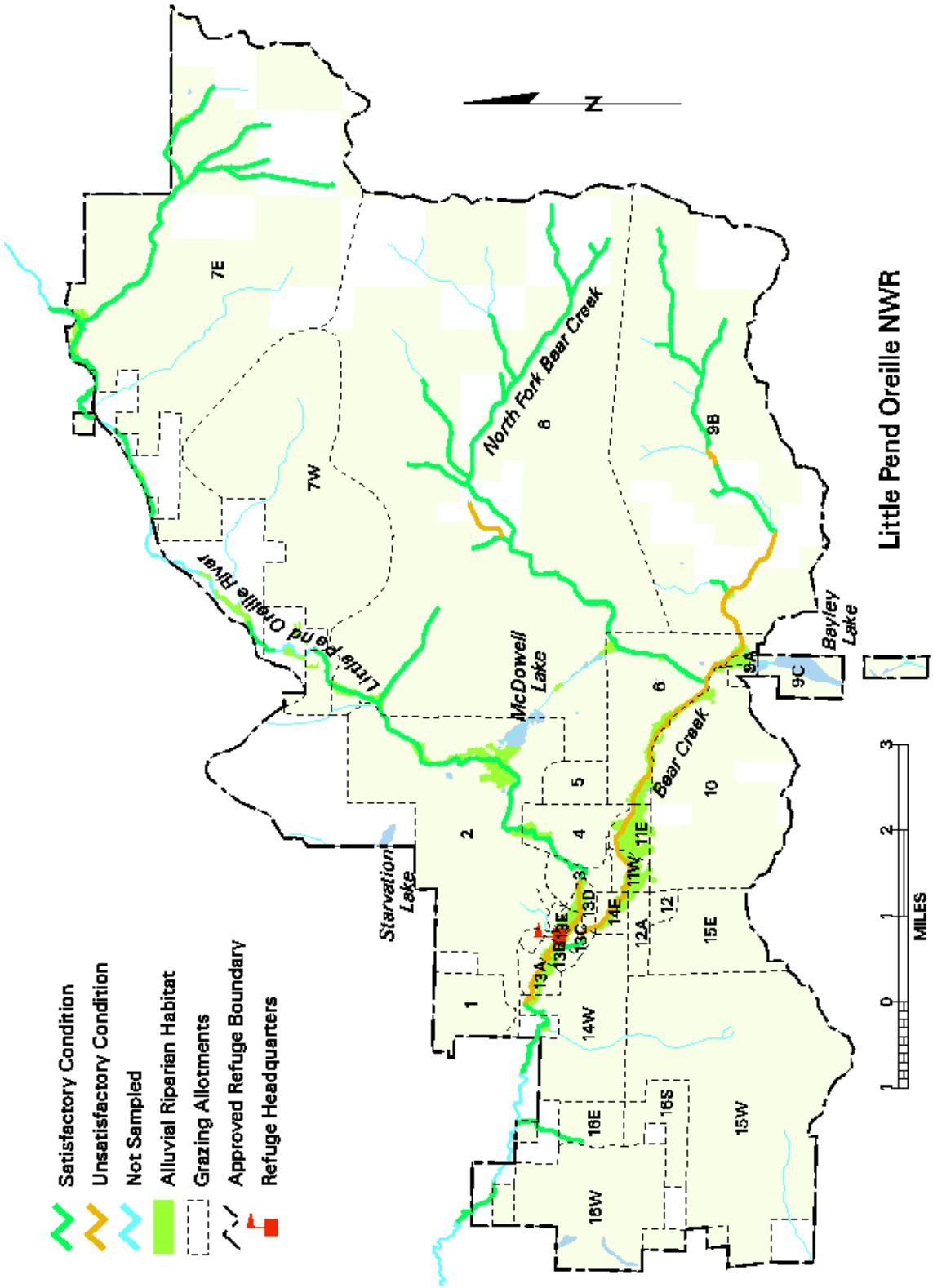
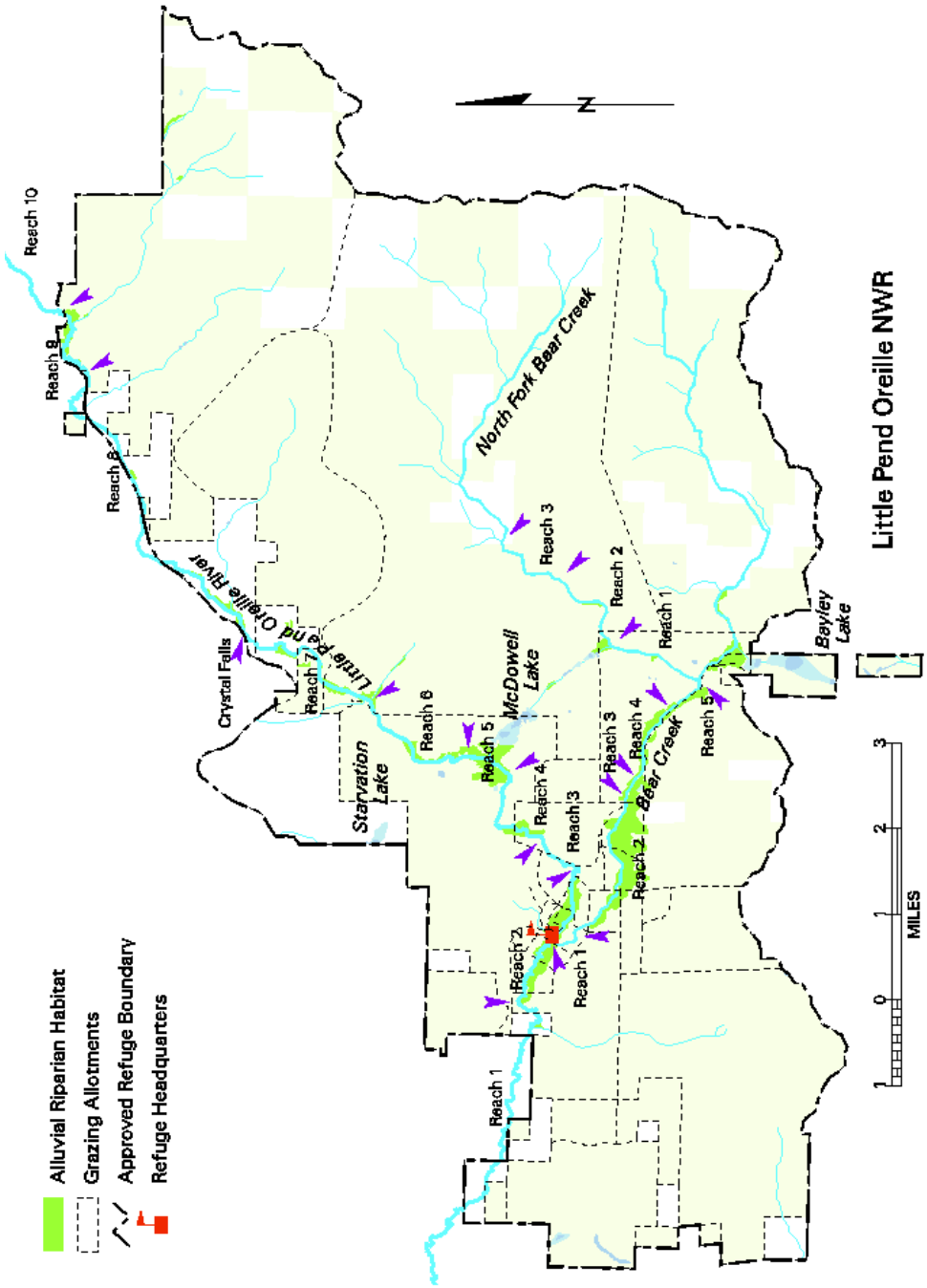


Figure A1.3 Instream Habitat Assessment on Little Pend Oreille River, Bear Creek, and North Fork of Bear Creek within the Little Pend Oreille National Wildlife Refuge (US Fish and Wildlife Service 2000).



Appendix 2. Environmental Action Statement for the Little Pend Oreille National Wildlife Refuge Habitat Management Plan.

UNITED STATES FISH AND WILDLIFE SERVICE

ENVIRONMENTAL ACTION STATEMENT

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500-1508), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action does not require additional NEPA documentation.

Proposed Action, Alternatives, and NEPA Documentation

The proposed action is to implement a Habitat Management Plan (HMP) (USFWS 2005) for the Little Pend Oreille National Wildlife Refuge (LPONWR). This HMP is a refinement of the April 2000 Comprehensive Conservation Plan (CCP) and associated Environmental Impact Statement (EIS) for the Refuge (USFWS 2000a). This HMP provides more-specific guidance for habitat management of LPONWR fish, wildlife, plant, and habitat resources to fulfill the LPONWR's purposes and help achieve LPONWR goals and objectives. The HMP steps-down goals and objectives from the CCP and includes specific, measurable objectives for major LPONWR habitats such as dry forest, moist forest, cold forest, aspen, old fields, wetlands, and aquatic and riparian areas. The HMP will also include a description of the appropriate role of different management techniques including but not limited to forest thinning, prescribed fire, prescribed grazing, and noxious weed treatments to help achieve the LPONWR goals and objectives.

The EIS for LPONWR's CCP included goals and objectives for the LPONWR and assessed the impacts associated with a range of five reasonable alternatives to achieve those goals and objectives. The rationale for selection of one specific alternative for implementation is explained in the Record of Decision (ROD) accompanying the final CCP and EIS (USFWS 2000b). The goals, objectives, and habitat management strategies included in this HMP fall within the bounds of those described and assessed in the CCP and EIS.

Appended to the CCP and EIS was a step-down Fire Management Plan, a plan which, like the HMP, includes more-specific LPONWR management guidance. Also appended to the CCP and EIS were compatibility determinations for public and economic uses of LPONWR. To the extent that they are compatible and the best or most appropriate techniques, some of those uses - such as haying, commercial timber harvest, and livestock grazing - may potentially be used for habitat management. Once again, information contained in this HMP is consistent with and may further step down LPONWR management guidance included in these CCP/EIS appendices.

Pursuant to 40 CFR 1502.9, no additional NEPA documentation is required to implement this HMP beyond the EIS and ROD prepared concurrently with the CCP. No substantial changes to the proposed action alternative that was identified, analyzed, and selected for implementation within the CCP, EIS, and ROD are proposed through this HMP. Similarly, no significant new information or circumstances exist relevant to environmental concerns and bearing on the proposed action or its impacts.

Permits/Approvals

To implement the HMP, a range of uses may be utilized, including, but not limited to, commercial tree harvest, livestock grazing, and haying. As noted earlier, the LPONWR CCP and EIS included compatibility determinations for these uses, which as described were determined to be compatible with the purposes for which LPONWR was created and the mission of the National Wildlife Refuge System (Appendix F of CCP and EIS). Other applicable permits and approvals are also addressed within LPONWR's CCP and EIS. Therefore, at this time, no additional permits or approvals are required to implement the HMP.

Public Involvement/Interagency Coordination

A substantial number of opportunities were afforded the public, other agencies, and Native American Tribes to become involved in development of the LPONWR CCP and EIS. These are described in chapter 5 of the CCP and EIS.

In October 2004, during the early stages of developing the HMP, the LPONWR staff hosted a field tour and associated workshop for biologists and other scientists with wildlife habitat management expertise. These experts provided the LPONWR staff with suggestions regarding the effectiveness, constraints, impacts, and other considerations associated with potential use of a diversity of habitat management strategies and techniques to achieve LPONWR goals and objectives.

In January 2005, a letter was sent to approximately 400 parties potentially interested in issues associated with the HMP for LPONWR. The purpose of the letter was to advise these parties of the planning effort and secure from them any new, scientific information developed since completion of the CCP and EIS that would be relevant to LPONWR habitat management.

The draft HMP was made available for a 30-day public review and comment period at the end of February 2005. The draft was provided by mail to 15 parties, made available through three local public libraries, and posted on the LPONWR website. Following this review and comment period, the LPONWR staff incorporated and responded to comments received, as appropriate, and finalized the HMP.

Supporting Documents

USFWS. April 2000 (2000a). Final Comprehensive Conservation Plan and Environmental Impact Statement, Little Pend Oreille National Wildlife Refuge, Sherwood, OR and Colville, WA.

USFWS. May 2000 (2000b). Record of Decision for the Final Comprehensive Conservation Plan and Environmental Impact Statement for the Little Pend Oreille National Wildlife Refuge. Sherwood, OR and Colville, WA.

USFWS. 2005. Little Pend Oreille National Wildlife Refuge, Habitat Management Plan, Colville, WA.

Steven L Fowler (acting) 6/21/2005

(LPONWR Project Leader) (date)

Appendix 3. Cover Types associated with Seral Stages of Dry, Moist, and Cold Forest within Management Units on Little Pend Oreille National Wildlife Refuge.

Table A3.1. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Moran Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	0.2	0.2	-	-	-	-	-	-
Ponderosa pine	1.9	236.7	-	-	-	-	-	-	-
Ponderosa pine/Douglas-fir	1.5	38.3	-	-	-	-	-	-	-
Douglas-fir	0.8	11.1	9.9	1.1	103.8	7.3	-	-	-
Douglas-fir/grand fir	-	5.9	0.2	-	24.4	41.5	-	-	-
Douglas-fir/western larch	-	4.5	0.2	-	14.1	0.5	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	3.4	88.3	16.2	5.1	495.3	167.5	-	-	-
Western larch	0.8	5.4	-	1.9	57.1	-	-	-	-
Western hemlock	-	-	-	-	-	-	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	0.8	37.7	2.6	2.3	246.9	92.0	-	-	18.2
Engelmann spruce	-	-	-	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	-	-	-	0.3	-	-	-	-
Subalpine fir	-	-	-	-	-	-	-	-	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	-

Lodgepole pine	0.5	66.6	2.6	0.3	218.8	0.2	-	-	6.0
Lodgepole pine/Douglas-fir	-	3.7	-	-	1.6	-	-	0.5	-
Lodgepole pine/western larch	-	84.3	5.4	-	127.2	26.7	-	-	2.5
Whitebark pine	-	-	-	-	-	-	-	-	-
TOTALS by SERAL STAGE	9.7	582.7	37.3	10.7	1289.5	335.7	-	0.5	26.7
PERCENTAGE by SERAL STAGE	*1.54%*	*92.54%*	*5.92%*	*0.65%*	*78.83%*	*20.52%*	*0%*	*1.84%*	*98.16%*
TOTALS by FOREST TYPE		629.7			1635.9			27.2	
PERCENTAGE by FOREST TYPE		*27.46%*			*71.35%*			*1.19%*	

Table A3.2. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Noman Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	0.5	-	-	-	-	-	-	-
Ponderosa pine	7.2	257.8	3.2	-	-	-	-	-	-
Ponderosa pine/Douglas-fir	4.8	55.5	-	-	-	-	-	-	-
Douglas-fir	0.5	3.9	1.0	5.4	392.0	75.2	-	-	-
Douglas-fir/grand fir	-	-	-	-	30.0	21.1	-	-	-
Douglas-fir/western larch	-	-	-	-	33.3	4.7	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	1.6	12.9	2.0	19.3	886.7	298.7	-	-	-
Western larch	0.2	0.3	-	11.1	34.3	-	-	-	-
Western hemlock	-	-	-	-	-	0.2	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	0.2	0.5	-	-	289.9	86.2	-	-	-
Engelmann spruce	-	-	-	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	-	-	-	0.5	-	-	-	-
Subalpine fir	-	-	-	-	0.2	-	-	-	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	-
Lodgepole pine	0.5	14.0	-	0.3	798.6	-	-	-	-

Lodgepole pine/Douglas-fir	-	-	-	-	4.2	-	-	-	-
Lodgepole pine/western larch	-	1.5	-	0.2	171.8	7.7	-	-	0.5
Whitebark pine	-	-	-	-	-	-	-	-	-
TOTALS by SERAL STAGE	15.0	346.9	6.2	36.3	2641.5	493.8	0.0	0.0	0.05
PERCENTAGE by SERAL STAGE	*4.07%*	*94.24%*	*1.68%*	*1.14%*	*83.29%*	*15.57%*			*100.00%*
TOTALS by FOREST TYPE		368.1			3171.6			0.5	
PERCENTAGE by FOREST TYPE		*10.40%*			*89.59%*			*0.01%*	

Table A3.3. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Lower Bear Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	0.2	-	-	-	-	-	-	-
Ponderosa pine	7.9	346.8	-	-	-	-	-	-	-
Ponderosa pine/Douglas-fir	0.6	115.9	0.2	-	-	-	-	-	-
Douglas-fir	17.9	19.7	3.4	11.6	307.8	74.3	-	-	-
Douglas-fir/grand fir			-	-	107.0	75.3	-	-	-
Douglas-fir/western larch		0.2	-	-	160.4	14.3	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	10.0	77.8	49.2	33.0	916.0	191.8	-	-	-
Western larch	3.7	4.2	-	173.2	112.0	-	-	-	-
Western hemlock	-	-	-	-	4.2	12.8	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	0.6	7.1	-	0.9	545.2	152.8	-	0.2	6.7
Engelmann spruce	-	-	-	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	0.3	-	-	11.1	1.9	-	-	0.6
Subalpine fir	0.2	-	-	0.3	1.2	-	-	-	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	-
Lodgepole pine	3.4	78.0	6.0	1.7	421.3	1.9	-	-	2.7

Lodgepole pine/Douglas-fir	-	0.3	-	-	4.8	2.3	-	0.1	
Lodgepole pine/western larch	-	2.0	0.2	-	172.7	27.5	-	-	4.0
Whitebark pine	-	-	-	-	-	-	-	-	-
TOTALS by SERAL STAGE	44.3	652.5	59.0	220.7	2763.7	554.9	0.0	0.3	14.0
PERCENTAGE by SERAL STAGE	*5.86%*	*86.33%*	*7.81%*	*6.24%*	*78.09%*	*15.68%*		*2.10%*	*97.90%*
TOTALS by FOREST TYPE		755.8			3539.3			14.3	
PERCENTAGE by FOREST TYPE		*17.54%*			*82.13%*			*0.33%*	

Table A3.4. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Durlan Springs Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest		
	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	-	-	-	-	-
Ponderosa pine	0.6	244.1	-	-	-	-
Ponderosa pine/Douglas-fir	-	12.6	-	-	-	-
Douglas-fir	10.7	21.8	4.3	4.7	17.9	2.2
Douglas-fir/grand fir	-	-	-	-	-	-
Douglas-fir/western larch	-	-	-	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	5.6	88.3	1.4	2.5	56.6	2.3
Western larch	-	0.9	-	-	0.9	-
Western hemlock	-	-	-	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	-	-	-	-	-	-
Engelmann spruce	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	-	-	-	-	-
Subalpine fir	-	-	-	-	-	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-
Lodgepole pine	0.5	28.1	0.2	0.3	27.5	-
Lodgepole pine/Douglas-fir	-	-	-	-	-	-
Lodgepole pine/western larch	-	-	-	-	-	-
Whitebark pine	-	-	-	-	-	-
TOTALS by SERAL STAGE	17.4	395.8	5.9	7.5	102.9	4.5
PERCENTAGE by SERAL STAGE	*4.15%*	*94.44%*	*1.41%*	*6.53%*	*89.56%*	*3.92%*
TOTALS by FOREST TYPE		419.1			114.9	
PERCENTAGE by FOREST TYPE		*78.48%*			*21.52%*	

Table A3.5. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Starvation Lake Management Unit on Little Pend Oreille National Wildlife Refuge.

	Dry Forest			Moist Forest		
Cover Type	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	0.3	-	-	-	-
Ponderosa pine	5.4	951.9	-	-	-	-
Ponderosa pine/Douglas-fir	2.3	76.2	-	-	-	-
Douglas-fir	6.1	34.2	6.8	7.2	115.9	7.3
Douglas-fir/grand fir	-	-	-	-	1.2	-
Douglas-fir/western larch	-	-	-	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	6.5	130.0	16.9	14.8	230.5	32.2
Western larch	1.1	8.8	-	1.7	8.8	-
Western hemlock	-	-	-	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	0.5	6.3	0.1	-	14.7	1.7
Engelmann spruce	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	-	-	-	-	-
Subalpine fir	-	-	-	-	-	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-
Lodgepole pine	2.8	133.9	1.4	2.5	225.8	1.2
Lodgepole pine/Douglas-fir	-	-	-	-	-	-
Lodgepole pine/western larch	-	3.9	-	-	19.7	-
Whitebark pine	-	-	-	-	-	-
TOTALS by SERAL STAGE	24.7	1345.5	25.2	26.2	616.6	42.4
PERCENTAGE by SERAL STAGE	*1.77%*	*96.42%*	*1.81%*	*3.82%*	*89.99%*	*6.19%*
TOTALS by FOREST TYPE		1395.4			685.2	
PERCENTAGE by FOREST TYPE		*67.07%*			*32.93%*	

Table A3.6. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the McDowell Lake Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest		
	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	0.4	-	-	-	-
Ponderosa pine	18.7	451.9	-	-	-	-
Ponderosa pine/Douglas-fir	4.5	97.7	0.2	-	-	-
Douglas-fir	15.5	54.4	39.0	7.4	132.9	26.1
Douglas-fir/grand fir		19.7	0.2		6.0	0.2
Douglas-fir/western larch		4.9			26.6	3.6
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	15.1	296.4	105.8	17.2	673.7	146.2
Western larch	11.2	13.6	-	31.1	47.2	-
Western hemlock	-	0.2	-	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	4.6	93.3	8.2	2.2	315.3	58.1
Engelmann spruce	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	-	-	-	0.3	-
Subalpine fir	-	-	-	0.3	0.3	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-
Lodgepole pine	0.8	182.4	2.5	5.3	328.6	0.8
Lodgepole pine/Douglas-fir	-	1.0	-	-	0.7	1.8
Lodgepole pine/western larch	-	72.3	2.4	-	64.6	1.9
Whitebark pine	-	-	-	-	-	
TOTALS by SERAL STAGE	70.4	1288.2	158.3	63.5	1596.2	238.7
PERCENTAGE by SERAL STAGE	*4.64%*	*84.92%*	*10.44%*	*3.34%*	*84.08%*	*12.57%*
TOTALS by FOREST TYPE		1516.9			1898.4	
PERCENTAGE by FOREST TYPE		*44.41%*			*55.59%*	

Table A3.7. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Bayley Lake Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest		
	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	-	-	-	-	-
Ponderosa pine	3.1	28.1	-	-	-	-
Ponderosa pine/Douglas-fir	2.0	23.1	-	-	-	-
Douglas-fir	0.5	1.2	2.5	11.2	34.9	4.8
Douglas-fir/grand fir	-	-	-	-	-	-
Douglas-fir/western larch	-	-	-		0.3	2.2
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	0.2	1.5	-	4.2	43.9	13.5
Western larch	0.2	-	-	2.5	15.6	-
Western hemlock	-	-	-	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	-	0.8	-	3.4	43.2	5.9
Engelmann spruce	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	-	-	-	0.2	-
Subalpine fir	-	-	-	0.2	0.2	-
Subalpine fir/Engelmann spruce	-	-	-	-	-	-
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-
Lodgepole pine	-	1.7	-	1.5	22.4	-
Lodgepole pine/Douglas-fir	-	-	-	-	0.1	-
Lodgepole pine/western larch	-	0.9	-	-	18.1	-
Whitebark pine	-	-	-	-	-	-
TOTALS by SERAL STAGE	6.0	57.3	2.5	23.0	178.9	26.4
PERCENTAGE by SERAL STAGE	*9.12%*	*87.08%*	*3.80%*	*10.07%*	*78.36%*	*11.56%*
TOTALS by FOREST TYPE		65.8			228.3	
PERCENTAGE by FOREST TYPE		*22.37%*			*77.63%*	

Table A3.8. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Upper Bear Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	1.2	1.5	0.3	-	-	-	-	-	-
Ponderosa pine	2.8	72.8	-	-	-	-	-	-	-
Ponderosa pine/Douglas-fir	0.6	90.1	0.8	-	-	-	-	-	-
Douglas-fir	9.2	106.5	44.0	5.8	78.4	50.0	-	-	-
Douglas-fir/grand fir	0.3	60.8	0.6	0.3	138.6	49.5	-	-	-
Douglas-fir/western larch	0.2	34.1	0.3	-	46.1	14.1	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	7.5	272.3	84.4	3.2	469.0	123.8	-	-	-
Western larch	14.3	27.8	-	9.4	100.2	0.2	-	-	-
Western hemlock	-	0.2	0.3	-	1.7	0.3	-	-	-
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	7.6	225.7	16.4	2.3	474.4	163.3	-	-	38.1
Engelmann spruce	-	-	-	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	7.7	-	-	15.4	0.5	-	-	4.3
Subalpine fir	0.2	-	-	0.2	-	-	-	-	4.8
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	6.2
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	13.7
Lodgepole pine	18.8	284.4	15.9	1.1	415.7	1.5	-	16.6	70.1

Lodgepole pine/Douglas-fir	1.1	26.3		0.8	25.6	0.2	-	1.9	-
Lodgepole pine/western larch	1.1	609.0	32.6	1.4	326.9	32.3	-	0.2	38.0
Whitebark pine	-	-	-	-	-	-	-	-	-
TOTALS by SERAL STAGE	64.9	1819.2	195.6	24.5	2092.0	435.7	0.0	18.7	175.2
PERCENTAGE by SERAL STAGE	*3.12%*	*87.47%*	*9.41%*	*0.96%*	*81.97%*	*17.07%*	*0.00%*	*9.64%*	*90.36%*
TOTALS by FOREST TYPE		2079.7			2552.2			193.9	
PERCENTAGE by FOREST TYPE		*43.10%*			*52.89%*			*4.02%*	

Table A3.9. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the North Fork Bear Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	0.6	3.9	0.2	-	-	-	-	-	-
Ponderosa pine	0.2	87.5	-	-	-	-	-	-	-
Ponderosa pine/Douglas-fir		76.6	4.7	-	-	-	-	-	-
Douglas-fir	5.7	148.8	76.6	7.4	137.9	58.6	-	-	-
Douglas-fir/grand fir		77.9	11.7	0.3	311.7	67.3	-	-	-
Douglas-fir/western larch	0.6	57.5	0.5		87.3	14.5	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	7.3	282.6	55.5	0.8	504.7	184.2	-	-	-
Western larch	14.0	57.3	-	10.5	271.9	1.6	-	-	-
Western hemlock	-	2.5	-	-	12.7	2.3	-	-	0.2
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	9.9	322.9	22.3	3.1	1004.9	317.5	0.3	4.2	103.9
Engelmann spruce	-	-	-	-	-	-	-	-	0.3
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	6.5	-	-	27.6	0.2	-	0.2	31.0
Subalpine fir	-	-	-	-	-	-	-	-	10.5
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	6.2
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	23.6

Lodgepole pine	13.6	234.1	6.9	0.6	344.9	2.5	-	12.1	161.6
Lodgepole pine/Douglas-fir	3.1	41.5	0.5	0.8	42.1	1.9	-	1.2	
Lodgepole pine/western larch	2.2	539.3	39.4	0.5	556.0	79.0	-	0.3	35.9
Whitebark pine	-	-	-	-	-	-	-	-	0.8
TOTALS by SERAL STAGE	57.2	1938.9	218.3	24.0	3301.7	729.6	0.3	18.0	374.0
PERCENTAGE by SERAL STAGE	*2.58%*	*87.56%*	*9.86%*	*0.59%*	*81.42%*	*17.99%*	*0.08%*	*4.59%*	*95.34%*
TOTALS by FOREST TYPE		2214.4			4055.3			392.3	
PERCENTAGE by FOREST TYPE		*33.24%*			*60.87%*			*5.89%*	

Table A3.10. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Cedar Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

Cover Type	Dry Forest			Moist Forest			Cold Forest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	0.6	1.7	0.2	-	-	-	-	-	-
Ponderosa pine	-	19.2	-	-	-	-		-	-
Ponderosa pine/Douglas-fir	0.3	62.6	0.5	-	-	-	-	-	-
Douglas-fir	1.4	30.4	20.5	2.3	137.3	27.3	-	-	-
Douglas-fir/grand fir	-	19.0	2.8	-	285.9	124.2	-	-	-
Douglas-fir/western larch	-	7.0	0.2	0.2	69.5	33.6	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	6.3	114.1	26.5	2.2	521.8	141.4	-	-	-
Western larch	6.5	36.4	-	0.6	244.3	0.8	-	-	-
Western hemlock	-	-	-	-	18.4	7.9	-	-	0.5
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	3.9	174.6	7.3	3.1	1149.8	264.4	-	0.5	91.6
Engelmann spruce	-	-	-	-	-	-	-	-	0.6
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	5.3	-	-	12.9	0.3	-	-	12.2
Subalpine fir	-	-	-	-	-	-	-	-	17.3
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	0.3
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-	-	38.6

Lodgepole pine	1.8	113.5	3.3	0.8	331.3	2.3	-	0.6	45.6
Lodgepole pine/Douglas-fir	0.2	7.6	-	0.2	20.5	2.7	-	0.2	
Lodgepole pine/western larch	0.9	264.4	19.1	1.1	718.2	99.4	-	0.6	9.5
Whitebark Pine		-	-	-	-	-	-	-	0.2
TOTALS by SERAL STAGE	21.9	855.8	80.4	10.5	3509.9	704.3	0.0	1.9	216.4
PERCENTAGE by SERAL STAGE	*2.29%*	*89.32%*	*8.39%*	*0.25%*	*83.08%*	*16.67%*	*0.00%*	*0.87%*	*99.13%*
TOTALS by FOREST TYPE		958.1			4224.7			218.3	
PERCENTAGE by FOREST TYPE		*17.74%*			*78.22%*			*4.04%*	

Table A3.11. Acres of Cover Types for Seral Stages of Dry, Moist, and Cold Forest within the Olson Creek Management Unit on Little Pend Oreille National Wildlife Refuge.

	Dry Forest			Moist Forest			Cold Forest		
Cover Type	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Deciduous/conifer	-	0.2	0.2	-	-	-	-	-	-
Ponderosa pine	0.3	2.7	-	-	-	-	-	-	-
Ponderosa pine/Douglas-fir	0.2	35.0	-	-	-	-	-	-	-
Douglas-fir	0.9	11.4	8.5	7.1	93.7	28.5	-	-	-
Douglas-fir/grand fir	0.3	8.5	0.3	0.3	224.1	24.4	-	-	-
Douglas-fir/western larch	0.3	2.2	0.6	0.3	43.4	38.0	-	-	-
Douglas-fir/western larch/ponderosa pine/lodgepole pine/grand fir/western white pine	1.2	27.2	8.5	5.9	176.2	23.0	-	-	-
Western larch	2.7	8.2	-	0.8	186.4	0.7	-	-	-
Western hemlock	-	0.2	-	0.2	6.0	3.7	-	-	1.0
Western hemlock/Douglas-fir	-	-	-	-	-	-	-	-	-
Western redcedar/western hemlock/Douglas-fir/western larch/grand fir	4.5	62.8	9.7	3.6	615.4	170.5	-	2.6	140.5
Engelmann spruce	-	-	-	-	-	-	-	-	-
Engelmann spruce/subalpine fir/Douglas-fir/western larch/lodgepole pine/grand fir/western white pine	-	0.8	-	-	13.0	1.2	-	-	95.3
Subalpine fir	-	-	-	-	-	-	-	-	16.2
Subalpine fir/Engelmann spruce	-	-	-	-	-	-	-	-	14.6
Subalpine fir/Engelmann spruce/lodgepole pine/mountain hemlock	-	-	-	-	-	-	-		14.0

Lodgepole pine	1.7	50.0	-	1.5	293.7	2.3	3.4	-	60.8
Lodgepole pine/Douglas-fir	0.2	5.7	-	-	24.7	-	-	0.3	-
Lodgepole pine/western larch	1.3	104.1	9.3	3.6	434.6	39.7	-	-	4.9
Whitebark Pine	-	-	-	-		-	-	-	7.4
TOTALS by SERAL STAGE	13.6	319.0	37.1	23.3	2111.2	332.0	3.4	2.9	354.7
PERCENTAGE by SERAL STAGE	*3.68%*	*86.29%*	*10.04%*	*0.94%*	*85.59%*	*13.46%*	*0.94%*	*0.80%*	*98.25%*
TOTALS by FOREST TYPE		369.7			2466.5			361.0	
PERCENTAGE by FOREST TYPE		*11.56%*			*77.15%*			*11.29%*	

Appendix 4. Geographic Information System Data Used for Little Pend Oreille National Wildlife Refuge.

Vegetation mapping for the Okanogan and Colville National Forests (NFs) was developed as a collaborative effort between the US Forest Service (USFS) Okanogan and Colville NFs (USFS), the Region 6 USFS Office, Utah State University Remote Sensing/GIS Laboratories (USU), and private contractors (BIO/WEST, Incorporated and GEO/Graphics, Incorporated)(Utah State University 1999). The coverage of this vegetation mapping encompasses LPONWR which is situated between these USFS lands. The following types (layers) of spatial data are available in ArcInfo format as part of this geographic information system (GIS): vegetation, geomorphology, and infrastructure.

Cover-type (vegetation) data was derived from 1:24,000 and 1:15,840 scale color (Landsat TM) photographs (1992 through 1994) taken during mid-to-late summer that were photo-interpreted based upon ground-truthed data collections. These images were stereoscopically interpreted (8x magnification) to differentiate tree species along with life form (shrub or herbaceous) of non-tree vegetation. Identification of tree species was accomplished through a combination of visual analysis of crown (and overall, where possible) shape, branching characteristics, or distinctive tone, texture, or density of the boughs. In addition to visual clues, site-specific characteristics such as elevation, slope, aspect, land form, gross soil properties, hydrology, and precipitation were used for species identification. Consequently, the process combined knowledge of species morphology with ecological site characteristics to achieve greater accuracy in differentiating similar-looking species.

The cover-type classification was structured in accordance with approved recommendations from the Vegetation Strike Team (VST) of the Inter-organizational Resource Information Coordinating Council (IRICC). The following classification systems were also considered for deriving cover types: the Montana & Idaho Vegetation & Land Cover Classification (December 1995); the Integrated Satellite Vegetation Database (ISAT) classification used for the 1988 Colville NF mapping; the cover type classification used by ICBEMP for the Eastside Assessment; and the vegetation classification proposed by the Federal Geographic Data Committee (FGDC [1995]). A total of 38 cover types were identified within the GIS layer for species (Table A1.1). Alluvial riparian habitat was delineated based upon the spatial extent of alluvial soils (Narcisse silt loam [No. 164]) on LPONWR. In addition, old fields on LPONWR were delineated using geo-referenced data collected by the LPONWR staff. Please note that the acreages for cover and habitat types provided in this plan were generated using GIS data layers of varying accuracies. Therefore, the appropriate use of these data is for general planning purposes only, and more precise estimates can only be obtained by on-the-ground survey and field data collection.

The cover-type classification was structured for image processing methods which designate individual map pixels (25 m x 25m) for size, structure, crown closure, and species. The GIS system included individual pixel layers for the following four vegetation attributes: tree overstory size class, tree canopy structure, total tree crown closure, and species (cover types).

Tree overstory size classes are intended to correlate with the VST recommendation and display breaks where conspicuous changes in structure naturally occur within the forest. A size class was assigned based on the class of dominant crown closure. If two classes have equal crown closures, then the larger size class was assigned. Tree size was measured as diameter at breast height (dbh). The following dbh classes were used for tree dominated cover types: 0-5", 5-10", 10-15", 15-20", 20-30", and >30". The 10-20" VST class was split to approximate the typical size class of dominant trees in natural stands of several cover types as they transition from young- to old-forest structural stages.

Tree canopy structure indicates the number of different tree sizes or cohorts. There must be >10% crown closure in each of two or more size classes for a pixel to be classed as multi-layer. The following classes were used for tree dominated cover types: single-layer and multi-layer.

Total tree crown closure was defined as the percentage of the total natural spread of foliage, including interstitial spaces of branches. Total crown closure was classified in 10% intervals (0-10%, 11-20%, etc.) for vegetated cover. Because VST recognized the low accuracy associated with 10% classes, it recommended data be grouped into 30% classes for analytical use.

Table A4.1. Descriptions of Cover Types and Their Attributes Used for the Little Pend Oreille National Wildlife Refuge.

USFS Cover Type[1]	Cover Attributes[2]	HMP Classifications[3]
Urban		Other
Snow		Other
Water		Water
Agriculture		Other
Burn	Large burn areas from fires in 1994	Other
Rock	Less than 25% vegetation	Other
Herbacious		Other
Shrub	Shrub cover >Herbacious cover	Other
Lowcc/Shrub	Tree canopy 1-9% and shrub cover >25%	Other
Lowcc/Herbacious	Tree canopy 1-9% and herbacious cover >25%	Other
Lowcc/Rock	Tree canopy 1-9% and vegetation cover <25%	Other
Deciduous	Deciduous tree canopy cover >75% of total tree canopy cover.	Other
Deciduous/Conifer	Deciduous tree canopy cover <75% and >50% of total tree canopy cover.	Other
Ponderosa pine	Ponderosa Pine > 60% of total tree canopy cover.	Dry forest
Ponderosa pine/Douglas-fir	Ponderosa Pine and Douglas-fir > 80% of total tree canopy cover.	Dry forest
Douglas-fir	Douglas-fir > 60% of total tree canopy cover.	Dry and moist forest
Douglas-fir/Grand fir	Douglas-fir and Grand fir > 80% of total tree canopy cover.	Dry and moist forest
Douglas-fir/Western Larch	Douglas-fir and Western larch > 80% of total tree canopy cover.	Dry and moist forest

Douglas-fir/Western larch/Ponderosa pine/Lodgepole pine/Grand fir/Western white pine	Three or more of the species listed >40% of total tree canopy cover.	Dry and moist forest
Western larch	Western larch > 60% of total tree canopy cover.	Dry, moist, and cold forest
Western hemlock	Western hemlock > 60% of total tree canopy cover.	Moist forest
Western hemlock/Douglas-fir	Western hemlock and Douglas-fir > 80% of total tree canopy cover.	Moist forest
Western redcedar/Western hemlock/Douglas-fir/Western larch/Grand fir	Three or more of the species listed >40% of total tree canopy cover.	Moist forest
Engleman spruce	Engleman spruce > 60% of total tree canopy cover.	Cold forest
Engleman spruce/Subalpine fir/Douglas-fir/Western larch/Lodgepole pine/Grand fir/Western white pine	Three or more of the species listed >40% of total tree canopy cover.	Cold forest
Pacific silver fir/Noble fir	Pacific silver fir and/or Noble fir > 60% of total tree canopy cover.	Not found on LPONWR
Pacific silver fir/Western hemlock	Pacific silver fir and Western hemlock > 80% of total tree canopy cover.	Not found on LPONWR
Pacific silver fir/Noble fir/Douglas-fir/Grand fir	Three or more of the species listed >40% of total tree canopy cover.	Not found on LPONWR
Mountain hemlock	Mountain hemlock > 60% of total tree canopy cover.	Moist forest
Subalpine fir	Subalpine fir > 60% of total tree canopy cover.	Cold forest
Subalpine fir/Engleman spruce	Subalpine fir and Engleman spruce > 80% of total tree canopy cover.	Cold forest
Subalpine fir/Engleman spruce/Lodgepole pine/Mountain hemlock	Three or more of the species listed >40% of total tree canopy cover.	Cold forest
Lodgepole pine	Lodgepole pine > 60% of total tree canopy cover.	Dry, moist, and cold forest
Lodgepole pine/Douglas-fir	Lodgepole pine and Douglas-fir > 80% of total tree canopy cover.	Dry and moist forest
Lodgepole pine/Western larch	Lodgepole pine and Western larch > 80% of total tree canopy cover.	Dry, moist, and cold forest
Whitebark pine	Whitebark pine > 60% of total tree canopy cover.	Cold forest
Whitebark pine/Subalpine fir/Engleman spruce/Subalpine larch	Three or more of the species listed >40% of total tree canopy cover.	Cold forest
Subalpine larch	Subalpine larch > 60% of total tree canopy cover.	Cold forest

[1]Cover types developed by USFS applicable to the Okanogan, Wenatchee, and Colville National Forests (Davis 2004).
[2]Habitat attributes associated with cover types (Davis 2004).
[3]Classifications of USFS cover types utilized within this HMP.

Appendix 5. Canopy Cover[1] (%) for Species in Climax Plant Associations (Lillybridge et al. 1995, Williams et al. 1995) within Dry, Moist, and Cold Forest Zones Identified on the Little Pend Oreille National Wildlife Refuge.

Species	Dry Forest-Ponderosa Pine Series[2]	Dry Forest-Douglas-fir Series[3]							
	PIPO/ CARU-AGSP	PSME/ PHMA-LIBOL	PSME/ PHMA	PSME/ VACA	PSME/ SYAL	PSME/ SYOR	PSME/ CARU	PIPO-PSME/ AGSP	PSME/ VAME
Tree overstory:									
western larch	-	8	47	12	40	-	17	-	16
Douglas-fir	-	43	-	24	26	36	29	8	23
Ponderosa pine	33	-	11	19	35	16	18	29	-
lodgepole pine	-	-	-	-	-	-	-	-	22
Tree understory									
Douglas-fir	1	7	4	11	4	3	8	2	7
Ponderosa pine	2	-	-	-	-	-	-	4	-
Shrubs and subshrubs									
Ninebark	-	23	29	-	-	-	-	-	-
shiny-leaf spirea	-	9	6	11	-	-	-	-	6
Bitterbrush	3	-	-	-	-	-	-	-	-
serviceberry	1	3	7	2	4	4	-	-	3
common snowberry	-	5	8	5	43	-	-	-	-
Oregon grape	-	4	5	1	3	-	-	-	5
mountain snowberry	-	-	-	-	-	11	-	-	-
pachystima	-	3	2	2	-	-	3	-	14
baldhip rose	-	5	5	-	-	-	-	-	6
bearberry	-	5	-	7	-	-	3	-	5
Twinflower	-	5	-	14	-	-	-	-	15
oceanspray	-	-	6	-	-	-	-	-	-
dwarf huckleberry	-	-	-	5	-	-	-	-	-

Russet buffaloberry	-	-	-	9	-	-	-	-	-
Utah honeysuckle	-	-	-	5	-	-	-	-	-
w. prince's pine	-	-	-	4	-	-	-	-	-
big huckleberry	-	-	-	-	-	-	-	-	18
low huckleberry	-	-	-	-	-	-	-	-	18
Scouler's willow	-	-	-	-	-	-	-	-	6
Herbs:									
Pinegrass	21	22	11	27	14	29	46	7	21
Strawberry spp.	-	4	4	4	2	5	3	-	2
heartleaf arnica	-	6	9	6	5	-	4	-	-
feather solomonplume	-	2	3	3	-	1	-	-	-
wartberry fairybells	-	3	3	-	-	-	-	-	-
Sweetroot	-	-	-	-	2	-	-	-	-
Yarrow	3	-	-	-	2	2	2	3	-
Hook violet	-	-	-	2	-	-	-	-	-
white hawkweed	-	-	-	-	-	-	-	-	2
elk sedge	11	-	-	-	-	-	-	-	-
Northwestern sedge	-	-	-	-	-	-	-	-	2
beardless b. wheatgrass	15	-	-	-	-	-	-	-	-
Bluebunch wheatgrass	22	-	-	-	-	-	-	33	-
Lupines	5	-	-	-	-	-	-	-	-
silky lupine	-	-	-	-	-	5	-	13	-
arrowleaf balsamroot	4	-	-	-	-	-	-	12	-
Idaho fescue	14	-	-	-	-	-	-	7	-
Junegrass	-	-	-	-	-	-	-	2	-
rosy pussytoes	-	-	-	-	-	-	-	3	-
woodrush pussytoes	-	-	-	-	-	-		3	-
cheatgrass	-	-	-	-	-	-	-	2	-
Ross sedge	-	-	-	-	-	-	-	1	-
Awnless b.b. wheatgrass	-	-	-	-	-	-	-	35	-
tall pussytoes	-	-	-	-	-	3	-	-	-
little flower collinsia	-	-	-	-	-	2	-	-	-

[1]Mean canopy cover within plots where the species occurred during sampling.
[2]Because plant associations for the Colville NF (Williams et al. 1995) did not include one for only ponderosa pine, it was derived from the Wenatchee NF (Lillybridge et al. 1995).
[3]The following are seven associations and one community type identified for the Douglas-fir series in the dry forest zone (Williams et al. 1995): Douglas-fir/ninebark-twinflower (PSME/PHMA-LIBOL), Douglas-fir/ninebark (PSME/PHMA), Douglas-fir/dwarf huckleberry (PSME/VACA), Douglas-fir/common snowberry (PSME/SYAL), Douglas-fir/mountain snowberry (PSME/SYOR), Douglas-fir/pinegrass (PSME/CARU), ponderosa pine-Douglas-fir/bluebunch wheatgrass (PIPO-PSME/AGSP), and Douglas-fir/big huckleberry (PSME/VAME).

Species	Moist Forest-Grand Fir Series[4]			
	ABGR/ACGLD/ CLUN	ABGR/PHMA	ABGR/VACA	ABGR/VAME/CLUN
Tree overstory:				
western larch	17	5	20	12
Douglas-fir	24	37	10	38
ponderosa pine	-	22	-	-
lodgepole pine	-	-	19	-
grand fir	24	-	-	23
Tree understory				
Douglas-fir	-	-	4	-
ponderosa pine	-	-	-	-
grand fir	4	2	4	3
Shrubs and subshrubs				
Oceanspray	-	9	-	-
shiny-leaf spirea	-	7	7	6
serviceberry	2	2	-	3
baldhip rose	-	6	5	10
Douglas maple	11	2	-	-
Big huckleberry	-	2	-	23
pachystima	3	3	3	3
Oregon grape	5	-	4	-
twinflower	20	-	10	-
bearberry	-	-	8	-
mountain ash	-	-	-	2
trumpet honeysuckle	-	-	3	-
Utah honeysuckle	-	-	-	4
common snowberry	4	-	7	-
Dwarf huckleberry	-	-	3	-
Bunchberry dogwood	-	-	9	-
Russet buffaloberry	-	-	9	-
ninebark	-	13	-	-
w.prince's pine	4	-	-	-
Herbs				
pinegrass	-	6	17	-
white hawkweed	2	2	-	-
Sweetroot	2	2	-	3

pathfinder	2	8	-	9
queencup beadlily	-	2	3	3
Ross sedge	-	2	-	-
western fescue	-	1	2	-
round-leaved violet	-	-	-	3
western meadowrue	-	-	-	4
Columbia brome	-	-	-	2
strawberry spp.	1	-	-	-
starry solomonplume	3	5	7	5

[4]The following are four associations identified for the grand fir series in the moist forest zone (Williams et al. 1995): grand fir/Douglas maple/queencup beadlily (ABGR/ACGLD/CLUN), grand fir/ninebark (ABGR/PHMA), grand fir/dwarf huckleberry (ABGR/VACA), and grand fir/big huckleberry/queencup beadlily (ABGR/CLUN).

Species	Moist forest-Western Hemlock Series[5]					
	TSHE/ARNU3	TSHE/CLUN	TSHE/GYDR	TSHE/MEFE	TSHE/RUPE	TSHE/XETE
Tree overstory:						
western larch	14	15	-	40	-	-
western hemlock	17	19	28	36	36	46
western redcedar	11	25	37	-	29	16
Douglas-fir	12	16	-	-	-	-
grand fir	25	15	13	-	-	-
subalpine fir	-	-	-	11	6	5
western white pine	10	5	-	-	-	-
Englemann spruce	-	-	-	18	-	6
lodgepole pine	-	-	-	-	30	60
Tree understory:						
western redcedar	6	10	6	-	5	8
western hemlock	7	4	4	6	5	10
grand fir	3	5	2	-	-	-
subalpine fir	-	-	-	5	-	2
ponderosa pine	-	-	-	-	-	-
Shrubs and subshrubs:						
rusty menziesia	-	-	-	8	2	3
beargrass	-	-	-	14	-	9
sidebells wintergreen	-	2	-	3	3	3
Cascades azalea	-	-	-	10	-	-
Oregon grape	3	-	-	-	-	-
mountain ash	-	-	-	2	-	-
pachystima	-	5	2	4	3	5
baldhip rose	3	3	-	-	-	-
five-leaved bramble	-	-	-	-	9	-
thimbleberry	4	-	-	-	-	-
twinflower	11	8	7	-	-	9
Douglas maple	3	-	-	-	-	-
oceanspray	-	-	-	-	-	-
dwarf huckleberry	-	-	-	-	-	-
Russet buffaloberry	-	-	-	-	-	-
Utah honeysuckle	-	2	2	6	3	3
w. prince's pine	3	4	-	-	-	5
big huckleberry	4	3	3	12	7	8
low huckleberry	-	-	-	-	-	-

Scouler's willow	-	-	-	-	-	-
Herbs:						
pathfinder	-	-	3	-	-	-
queencup beadlily	5	3	6	9	7	6
wild sarsaparilla	18	-	-	-	-	-
round-leaved violet	2	3	3	-	4	3
starry solomonplume	5	3	5	-	-	-
Sweetroot	-	-	-	-	2	-
western rattlesnake plantain	-	2	2	-	2	2
lady-fern	-	-	2	-	-	-
oak fern	-	-	15	-	12	-
coolwort foamflower	-	-	7	7	8	5
Hooker fairybells	-	-	3	-	-	-
sweetscented bedstraw	-	-	2	-	-	-
claspleaf twisted-stalk	-	-	-	-	2	-
trillium	-	-	-	-	2	-

[5]The following are four associations identified for the western hemlock series in the moist forest zone (Williams et al. 1995): western hemlock/wild sarsaparilla (TSHE/ARNU3), western hemlock/queencup beadlily (TSHE/CLUN), western hemlock/oak-fern (TSHE/GYDR), western hemlock/rusty menziesia (TSHE/MEFE), western hemlock/five-leaved bramble(TSHE/RUPE), and western hemlock/beargrass (TSHE/XETE).

Species	Moist Forest-Western Redcedar Series[6]			
	TPHL/OPHO	TPHL/ARNU3	TPHL/CLUN	TPHL/VAME
Tree overstory:				
western larch	-	8	12	15
Douglas-fir	-	18	21	19
grand fir	13	13	-	8
Engelmann spruce	-	14	-	-
paper birch	-	6	-	-
western redcedar	35	24	34	11
western hemlock	23	-	-	-
lodgepole pine	-	-	-	19
Tree understory:				
western redcedar	4	4	6	4
grand fir	-	5	4	4
western hemlock	2	-	-	-
Douglas-fir	-	-	-	4
Shrubs and subshrubs:				
twinflower	-	6	12	16
Douglas maple	3	4	4	-
baldhip rose	-	4	5	4
Oregon grape	-	3	4	3
thimbleberry	-	5	-	-
bunchberry dogwood	-	6	-	-
pachystima	-	-	10	7
w. prince's pine	-	-	5	5
Utah honeysuckle	-	-	2	4
big huckleberry	-	-	-	14
bearberry	-	-	-	4
prickly currant	2	-	-	-
devil's club	9	-	-	-
shiny-leaf spirea	-	-	-	5
Herbs:				
wild sarsaparilla	-	12	-	-
queencup beadlily	4	4	4	4
starry solomonplume	9	5	4	4
sweetscented bedstraw	2	3	-	-
sweetroot	-	3	-	-

lady-fern	29	-	-	-
oak-fern	23	-	-	-
wild ginger	7	-	-	-
coolwort foamflower	7	-	-	-
baneberry	4	-	-	-
circaea	2	-	-	-
clapleaf twisted-stalk	3	-	-	-
Hooker fairybells	3	-	-	-
pathfinder	2	-	-	-
round-leaved violet	-	-	2	4
w. rattlesnake pantain	-	-	2	-

[6]The following are four associations identified for the western redcedar series in the moist forest zone (Williams et al. 1995): western redcedar/devil's club (THPL/OPHO), western redcedar/wild sarsaparilla (THPL/ARNU3), western redcedar/queencup beadlily (THPL/CLUN), and western redcedar/big huckleberry (THPL/VAME [Community Type]).

Species	Cold Forest – Subalpine Fir Series[7]											
	ABLA2/ COCA	ABLA2/ RHAL-XETE	ABLA2/ RHAL	ABLA2/ TRCA3	ABLA2/ XETE	ABLA2/ CLUN	ABLA2/ VACA	ABLA2/ LIBOL	ABLA2/ CARU	PIEN/ EQUIS	ABLA2/ VAME	ABLA2/ VASC *
Tree overstory:												
western larch	8	-	11	21	-	13	18	21	10	-	19	-
Douglas-fir	23	-	-	7	6	10	23	19	36	-	18	-
subalpine fir	13	35	26	23	35	24	-	16	6	13	15	31
grand fir	-	-	-	14	-	-	-	-	-	-	-	-
Englemann spruce	26	13	-	15	11	14	-	26	-	44	-	-
lodgepole pine	-	-	10	16	6	11	20	-	-	-	22	26
Tree understory:												
Douglas-fir	4	-	-	-	-	-	6	7	10	-	-	-
subalpine fir	7	10	14	3	20	11	6	9	2	5	11	14
Englemann spruce	5	3	-	1	3	3	3	4	-	2	-	-
Shrubs and subshrubs:												
sidebells wintergreen	3	3	3	2	-	3	-	2	-	-	3	-
shiny-leaf spirea	-	-	-	2	-	-	5	-	4	-	6	-
serviceberry	-	-	-	-	-	-	2	-	-	-	-	-
common snowberry	5	-	-	-	-	-	-	4	-	-	-	-
Oregon grape	-	-	-	-	-	-	2	-	-	-	-	-
bunchberry dogwood	14	-	-	-	-	-	-	-	-	8	-	-
red-osier dogwood	5	-	-	-	-	-	-	-	-	5	-	-
pachystima	-	4	5	2	-	3	5	-	3	-	6	6
baldhip rose	4	-	-	-	-	-	-	-	-	-	-	-
bearberry	-	-	-	-	-	-	9	-	-	-	-	-
beargrass	-	15	-	-	31	-	-	-	-	-	-	-
mountain ash	-	3	-	-	4	-	-	-	-	-	-	2
twinflower	13	-	-	-	-	8	19	10	-	4	-	-
prickly currant	3	-	-	4	-	1	-	3	-	4	-	-
dwarf huckleberry	-	-	-	-	-	-	6	-	-	-	-	-
russet buffaloberry	-	-	-	-	-	-	-	-	-	-	25	-
Utah honeysuckle	4	4	4	3	3	4	3	-	-	-	3	-
w. prince's pine	3	-	2	-	-	3	4	2	-	-	3	2
big huckleberry	-	18	15	19	24	-	-	-	-	-	18	-
low huckleberry	-	-	12	-	10	10	-	-	-	3	10	10
grouse huckleberry	-	-	14	-	-	-	-	-	-	-	-	25

Cascades azalea	-	36	22	-	3	-	-	-	-	-	-	-
rusty menziesia	-	17	33	-	-	-	-	-	-	-	-	-
Sitka alder	-	-	-	-	-	-	-	-	-	9	-	-
five-leaved bramble	-	-	-	-	-	-	-	-	-	3	-	-
thimbleberry	3	-	-	-	-	-	-	-	-	-	-	-
Herbs:												
bluejoint reedgrass	-	-	-	-	-	-	-	-	-	5	-	-
horsetail	-	-	-	-	-	-	-	-	-	36	-	-
oak-fern	-	-	-	-	-	-	-	-	-	19	-	-
claspleaf twisted-stalk	-	-	-	-	-	-	-	-	-	4	-	-
lady-fern	-	-	-	-	-	-	-	-	-	3	-	-
arrowleaf groundsel	-	-	-	-	-	-	-	-	-	2	-	-
pinegrass	4	-	-	-	-	-	27	-	56	-	25	-
strawberry spp.	-	-	-	-	-	-	5	-	3	-	-	-
heartleaf arnica	-	-	-	-	-	-	-	-	9	-	-	-
starry solomonplume	3	-	-	-	-	4	-	-	-	-	-	-
queencup beadlily	3	-	-	7	-	6	-	-	-	-	-	-
sweetroot	-	-	-	-	-	2	-	-	3	2	-	-
smooth woodrush	-	-	-	-	3	-	-	-	-	-	-	-
round-leaved violet	-	-	-	4	-	3	-	-	-	-	3	-
white hawkweed	-	-	-	-	2	-	2	-	2	-	2	-
northwestern sedge	-	-	-	-	-	-	3	-	-	-	-	-
raceme pussytoes	-	-	-	-	-	-	-	-	4	-	-	-
western meadowrue	-	-	-	4	-	2	-	2	3	-	-	-
showy aster	-	-	-	-	-	-	-		3	-	-	-
Columbia brome	-	-	-	-	-	3	-	-	-	-	-	-
western rattlesnake plantain	2	-	-	-	-	2	-	1	-	-	-	-
sweetscented bedstraw	-	-	-	-	-	-	-	2	-	-	-	-
coolwort foamflower	-	3	-	-	-	-	-	-	-	5	-	-
false bugbane	-	-	-	15	-	-	-	-	-	2	-	-
Sitka valerian	-	-	-	-	-	-	-	-	-	-	-	3
lupine spp.	-	-	-	-	-	-	-	-	-	-	-	3
groundsel spp.	-	-	-	-	-	-	-	-	-	-	-	2
pinesap	-	-	-	-	-	-	-	-	-	-	-	2

[7]The following are 12 associations identified for the subalpine fir series in the cold forest zone (Williams et al. 1995): subalpine fir/bunchberry dogwood (ABLA2/COCA), subalpine fir/Cascade azalea-beargrass (ABLA2/RHAL-XETE), subalpine fir/Cascade azalea (ABLA2/RHAL), subalpine fir/false bugbane (ABLA2/TRCA3), subalpine fir/beargrass (ABLA2/XETE), subalpine

fir/queencup beadlily (ABLA2/CLUN), subalpine fir/dwarf huckleberry (ABLA2/VACA), subalpine fir/twinflower (ABLA2/LIBOL), subalpine fir/pinegrass (ABLA2/CARU), subalpine fir/grouse huckleberry (ABLA2/VACA), Engelmann spruce/horsetail spp. (PIEN/EQUIS), and subalpine fir/big huckleberry (ABLA2/VAMA [Community Type]).

Appendix 6. Canopy Cover[1] (%) of Species in Plant Associations for Fluvial Surfaces within the Colville, Okanogan, and Wenatchee National Forests (Kovalchik and Clausnitzer 2004).

Species	ALIN/ALLUVIAL BAR	POTR/COST	POTR/SYAL	PIEN/COST	PIEN/SYAL
Tree overstory:					
subalpine fir	3	-	-	6	trace
western larch	-	-	-	4	10
Englemann spruce	trace	-	-	42	35
paper birch	-	7	19	-	-
lodgepole pine	-	2	4	-	4
ponderosa pine	-	20	6	4	18
quaking aspen	-	55	51	1	14
black cottonwood	-	6	13	10	15
Douglas-fir		12	3	22	29
Tree understory:					
subalpine fir	2	-	-	3	2
paper birch	-	5	4	-	-
Englemann spruce	2	1	5	6	6
quaking aspen	-	16	15	-	-
black cottonwood	1	8	1	-	-
Douglas-fir	-	6	4	4	1
Shrubs:					
vine maple	-	50	-	-	-
Douglas maple	-	9	30	3	4
mountain alder	61	16	11	6	5
Sitka alder	3			3	3
Saskatoon serviceberry	2	3	2	4	2
red-osier dogwood	trace	51	7	47	3
bearberry honeysuckle	1	-	-	1	1
Utah honeysuckle	-	-	-	2	trace
Lewis' mock orange	-	10	4	-	-
bittercherry	-	-	40	-	-
common chokecherry	-	29	6	-	-
alder buckthorn	-	60	-	-	-
Hudsonbay currant	trace	-	-	-	-
prickly currant	1	8	5	3	1
baldhip rose	-	7	2	5	3
Nootka rose	-	8	26	-	-
woods rose	-	2	5	-	-
red raspberry	20	-	-	1	1
western thimbleberry	trace	2	4	2	4
dwarf red blackberry	-	4	3	5	-
Bebb's willow	7	12	-	-	-
Drummond's willow	4	-	-	-	-
Mackenzie's willow	2	-	-	-	-
Scouler's willow	2	8	7	8	2
russet buffaloberry	-	-	-	2	1
Douglas spiraea	3	-	-	-	-
shiny-leaf spiraea	-	-	-	5	6
common snowberry	-	30	53	10	12

	ALIN/ALLU VIAL BAR	POTR/ COST	POTR/ SYAL	PIEN/ COST	PIEN/ SYAL
Low shrubs and subshrubs:					
Oregon hollygrape	-	-	-	1	1
western prince's pine	-	-	-	trace	1
bunchberry dogwood	3	-	-	5	trace
Labrador tea	-	-	-	-	-
twinflower	7	2	4	6	8
myrtle pachystima	3	22	2	7	16
five-leaved bramble	-	-	-	trace	-
Perennial forbs:					
baneberry	-	-	-	1	trace
heartleaf arnica	-	-	-	1	1
showy aster	-	-	-	1	1
enchanter's hightshade	-	-	-	1	-
queencup beadlily	-	-	-	1	trace
roughfruit fairy-bells	-	-	-	trace	10
woods strawberry	-	-	-	1	trace
western yarrow	trace	-	-	-	-
Columbia monkshood	trace	1	1	-	-
common pearly-everlasting	trace	-	-	-	-
sharptooth angelica	1	4	2	-	-
fewflower aster	7	-	-	-	-
Watson's willow-weed	1	-	-	-	-
wild sarsaparilla	-	-	9	-	-
northern bedstraw	-	-	trace	-	-
small bedstraw	trace	-	-	-	-
sweetscented bedstraw	1	2	1	1	1
western rattlesnake plantain	-	-	-	trace	1
miterwort species	-	-	-	2	1
northern bluebells	-	-	25	-	-
mountain sweet-root	-	trace	1	1	2
purple sweet-root	-	1	2	1	1
pink wintergreen	-	-		1	4
largeleaf avens	1	1	1	-	-
common cow-parsnip	trace	-	-	-	-
March cinquefoil	1	-	-	-	-
sidebells wintergreen	2	-	-	-	-
Arrowleaf groundsel	1	-	-	-	-
alkali-marsh butterweed	-	-	trace	-	-
western solomonplume	-	-	-	2	1
starry solomonplume	1	2	3	2	1
claspleaf twisted-stalk	-	-	-	1	1
common dandelion	-	trace	1	-	-
western meadowrue	-	3	7	2	2
coolwort foamflower	2	-	-	1	trace
false bugbane	-	-	-	4	-
American speedwell	trace	-	-	-	-
Canadian violet	2	7	2	1	1
pioneer violet	3	-	-	1	trace

	ALIN/ALLU VIAL BAR	POTR/ COST	POTR/ SYAL	PIEN/ COST	PIEN/ SYAL
Grasses or grasslike:					
redtop	15	1	trace	-	-
spike bentgrass	-	5	-	-	-
winter bentgrass	-	2	-	-	-
Columbia brome	-	-	-	1	1
bluejoint reedgrass	49	4	-	-	trace
woolly sedge	-	2	-	-	-
pinegrass	-	-	-	-	2
soft-leaved sedge	trace	-	-	1	-
thick-headed sedge	-	trace	trace	-	-
bladder sedge	1	2	-	-	-
wood reed-grass	-	-	-	2	-
blue wildrye	-	1	2	1	1
tall mannagrass	5	trace	trace	-	-
fowl mannagrass	-	3	5	-	-
Kentucky bluegrass	-	1	3	-	-
Ferns and fern allies:					
lady fern	trace	-	-	-	-
common horsetail	3	1	1	1	1
wood horsetail	trace	-	-	-	-
common scouring-rush	-	-	-	trace	trace
oak fern	trace	-	-	trace	-

[1]Mean canopy cover within plots where the species occurred during sampling.
[2]The following are five associations identified for the western redcedar series in the moist forest zone: mountain alder/alluvial bar association (ALIN/ALLUVIAL BAR), quaking aspen/red-osier dogwood (POTR/COST), quaking aspen/common snowberry (POTR/SYAL), Engelmann spruce/red-osier dogwood association (PIEN/COST), and Engelmann spruce/common snowberry association (PIEN/SYAL). Refer to Figure 2.2 that indicates the location of these plant associations on the fluvial surface.
[3]Trace = trace cover, <1% canopy cover.

Appendix 7. Comments and Service Responses Associated with the Draft Habitat Management Plan for Little Pend Oreille National Wildlife Refuge.

The following table provides the names and/or affiliations for following written comments received on the draft HMP for LPONWR during its public review period (March 1 to April 1, 2005). Note that identification (ID) numbers were assigned to commentators in order to relate specific comment(s) with a response. In cases where more than one comment had similar subject matter, they were grouped under a single response.

ID Number	Last Name	First Name	Affiliation
1	Anderson	Joel	
2	Baskin	Family	
3	Batty	Robert	
4	Belden	Ned & Gaby	
5	Biosca	Cecilia	
6	Blanchard	Herb	
7	Cada	Eugene	
8	Campbell	Edward	
9	Catherwood	Leslie	The Wilderness Society
10	Dawson	Jeff	
11	Dawson	John & Melva	
12	Delgado	Tony	Stevens County Commissioner
13	Derosier	Mike & Linda	
14	Devin	Teresa	
15	Dubois	Jean	
16	Durnell	Tim	
17	Fields	Robert	National Wildlife Refuge Association
18	Francis	Kirk	
19	Frobe	Russell	
20	Frobe	Marian	
21	Garringer	Theresa	
22	Gilmore	Tom	
23	Gotham	Bryan & Deb	
24	Groth	James	
25	Heflick	David	Northwest Ecosystem Alliance
26	Henneman	Chad & Jamie	
	Hockley	Chuck & Nancy	
27	Hill	Leisa	
28	Hill	Jeff	
29	Inman	Babby	
30	Kegel	Amy	
31	Kelson	Richard	
32	Kessler	Bruce	
33	King	David	

34	Knight	George & Marlene	
35	Kreft	David	Natural Resources Conservation Service
36	Kroiss	Andy & Bobbi	
37	Larsen	Brothers	
38	Lawson	Elim & Lois	
39	Leonard	Jean	
40	Mann	Leslie	
41	Matson	Noah	Defenders of Wildlife
42	McCambridge	Nancy	
43	McCart	Wesley	Stevens County Farm Bureau
44	McGregor	Bob	
45	McTimmonds	Sarah	
46	McTimmonds	Leroy	
47	Moore	Sandra	
48	Moore	Rick	
49	Morehouse	Hal	
50	Morton	Bob	State Senator
51	Nelson	Steve	
52	Ott	Merrill	Stevens County Commissioner
53	Robinson	Dave	Concerned Friends of Ferry County
54	Roellich	Gregg	
55	Ryland	Maggie	
56	Samuels	Roger	
57	Schott	Stephen	
58	Schott	Lynn	
59	Schroeder	Rick	U.S. Geological Survey
60	Shaw	Linda	
61	Tokach	Margaret	Stevens County Conservation District
62	Tryon	Don	
63	Villers	Gerald	
64	Vosen	Christine	
65	Ward	Julie	
66	Ward	Otto	Arden Old Timers Association
67			Friends of LPO Board of Directors

Forest Thinning

Comment: *"The draft HMP utilizes commercial and noncommercial thinning of the forested areas on the LPONWR as a widespread tool for habitat management. However, federal and state mandated logging buffer standards are not addressed or followed in the Draft HMP. These buffer standards are critical in the protection of sensitive wetland and riparian habitats. The LPONWR should take the responsibility to adhere to these buffer standards and address them in the HMP."* (36)

"The Draft HMP includes commercial and noncommercial thinning of forested areas in and around sensitive riparian areas without regard to federal and state buffer setback standards. These standards were developed for the protection of habitat and water quality and should be strictly adhered to in the Draft HMP." (61)

"Incorporate riparian buffer offsets for commercial/noncommercial thinning of forest areas." (61)

Response: We apply the same standards commonly used by other natural resource management agencies including, but not limited to, Washington State Forest Practices Rules; Title 222WAC (WAC 222); and the federally developed Inland Native Fish Strategy (INFISH). These are among the applicable laws that must be considered whenever a commercial timber sale is developed. The information contained in WAC 222 was developed primarily to address issues regarding forest industry and not specifically wildlife habitat management, habitat restoration, and biological integrity which are important components of refuge management. Along with safeguarding natural resources such as soil and water, we are charged with managing and improving wildlife habitat for specific refuge purposes. Therefore, we will consult a variety of sources before deciding upon a course of action. The refuge policy, as noted in the CCP, is to maintain a 300-foot setback from riparian areas, or a buffer to the extent of the 100-year floodplain. This does not imply that we will not enter these areas for management purposes. For example, it may be necessary to selectively remove hazard trees close to campsites for safety reasons which are proximal to riparian areas. In addition, trees of certain species may be harvested as part of a riparian restoration project that will result in reproducing a natural plant community as defined in the HMP.

Regarding sensitive wetland and riparian habitats, we suggest a broader focus than logging buffers and consider the overarching purpose of habitat management on a LPONWR. Note specifically on page four of the HMP that references are made to the HMP policy which provides guidance for habitat management and directs us to use the best available science, and ecological principles. In addition, the Biological Integrity, Diversity, and Environmental Health Policy states, "… the highest measure of biological integrity, diversity, and environmental health is viewed as those intact and self-sustaining habitats and wildlife populations that existed under historic conditions". As a result of the application of this guidance, the HMP draws from a variety of source material to identify and solve very specific management issues. For example, in Section 2.3.2 of the HMP addressing alluvial riparian habitat, five miles of Bear Creek and two miles of the LPO River are identified as being in unsatisfactory condition. In Section 4.6 Alluvial Riparian, the objective is to restore a "riparian zone of mature deciduous trees >160 feet wide and >1/8 mile in length." for this seven miles of riparian. In the strategies portion of this section, we state that existing, and potential, woodland riparian areas will be protected from negative impacts such as logging. However, it may necessary to remove some conifers to facilitate the establishment and growth of native deciduous species to promote restoration of a functional riparian community.

Comment: *In summary, the Draft HMP is inconsistent in habitat management procedures and does not allow for all conservation practices to be utilized throughout the LPONWR. The Draft HMP's heavy reliance on prescribed burning and commercial/noncommercial thinning is overly destructive, narrowly focused, and considered a high risk/liability in sensitive habitat areas by other federal agencies.* (36)

Response: As described in the CCP (Record of Decision signed and Environmental Impact Statement completed, May, 2000) and HMP, we are utilizing a variety of conservation practices to achieve habitat objectives for LPONWR. Based upon available scientific literature, prescribed fire and commonly practiced forest thinning techniques are recognized as tools to manage and restore forest habitats that were overstocked with unnaturally large amounts of hazardous fuels as a result of fire suppression, timber harvesting, and livestock grazing. Their use in natural resource management is accepted and widespread by federal and state agencies as well as private industry. Risk and liability is inherent in nearly every activity or management action however, they are minimized by adhering to agency policy and guidelines to accomplish goals and objectives as safely and efficiently as possible. Safeguards and procedures to minimize risk are built into our planning documents and habitat and prescribed burn prescriptions.

Comment: *The CCP Plan and associated EIS do a good job of identifying the problem of overstocked forest stands caused by improper past logging and fire suppression. However, discussion regarding the impacts of logging on the residual forest stand, the impacts on soils related to logging road and skid road development and use, and the role logging plays in the invasive weed problem so prevalent on the Refuge is lacking. Maybe I am just overlooking it, but I do not see a discussion of logging related soil compaction. In my experience, this is a significant problem almost everywhere in the interior west. You cannot run around over the landscape with equipment weighing twenty tons and more and not have impacts. The HMP should address this weakness in the CCP and EIS. It is now clear commercial thinning is a substantial program on the Refuge.* (62)

Response: Because soil compaction is an unavoidable consequence associated with forest management, it is addressed in our habitat prescriptions and Special Use Permits by specifying types and sizes of equipment that may be used, timing of logging operations, use of existing roads, and reserving the option of suspending logging activities when soil conditions are most susceptible to compaction. Nevertheless, some level of soil compaction is an unavoidable result of active forest habitat management. We view this as an acceptable trade-off to reduce the risk of damage and loss as a result of wildland fire and to produce specific outcomes for the purpose of habitat management. I t should be noted that the local U.S. Forest Service District Hydrologist completed a compaction survey on one of our sale units in 2003 and found the soil compaction to be well within the normal range of expected impacts from timber harvest and no effects to on-site vegetation or surface runoff was expected to occur. Furthermore, it was inconclusive as to whether the compaction was a direct result of timber harvest or from past land uses related to agricultural practices and cattle grazing.

Comment: *I have spent some time looking at thinning projects on the Refuge and the quality of logging looks pretty good. Residual stand impacts are less than on other ownership lands. Commercial thinning can be efficacious, but it is not the same as reducing stocking levels*

through natural means. Commercial thinning should not be selected for sending profitable material to local mills or because it provides local logging jobs. I assume future audits will be undertaken on most federal lands to assess the efficacy of thinning programs. On National Wildlife Refuges, the audits need to show that commercial thinning was the proper strategy for habitat improvement. (62)

Response: As described within the CCP and HMP, forest management activities are only implemented on LPONWR in order to achieve wildlife and habitat objectives. Commercial thinning is being used to improve habitat by reducing unnaturally high stocking of young trees that have resulted in accumulation of hazardous fuels. The CCP indicates that management of forest habitats on LPONWR depends upon the successful return of fire as a natural ecosystem process. However, we cannot simply revert to applying fire without some pre-conditioning of forest communities in preparation of its use. Nearly a century of fire suppression along with the accumulation of forest fuels has necessitated reducing these fuels by mechanical methods prior to burning to reduce risk. Commercial thinning is a safe and effective way to reduce hazardous fuels in preparation for re-introduction of fire.

Commercial harvest is also effective to manage for early and late seral forest types that are lacking on LPONWR. The existing old growth stands benefit by removal of competing trees that are unnaturally present because of fire suppression and other historic land management practices such as livestock grazing and timber harvest for other than wildlife management purposes. Reducing competition for resources will encourage the remaining trees to persist and develop for longer periods of time; a critical consideration when managing trees for attributes that develop over centuries. Harvesting smaller diameter trees also benefits the residual stand by effectively increasing the average diameter and spacing of remaining trees, which are characteristic of old growth forest. It also affords us the opportunity to manage for decadence by selecting for trees that have desirable wildlife characteristics such as hollow boles and broken or damaged tops. Early seral stages of forest communities are also benefited by thinning, especially in conjunction with prescribed burning, which resets the stand and readies the soil for a new crop of seedlings.

Fire Management

Comments: *"With the Healthy Forest Act created by Congress and the President, burning is not acceptable. The clean air act has no room for air pollution. Under the Federal Clean Air Act, Washington State has a law RCW 70.94.011 to preserve, protect and enhance air quality. It is further the intent of this chapter to protect the public welfare, to preserve visibility, to protect scenic, aesthetic, historic, and cultural values, and to prevent air pollution problems that interfere with life, property, or to natural attractions. It also address's the State, Federal Government, public and private organizations to use all known available methods (such as grazing to reduce vegetation) to reduce, prevent and control air pollution. Spokane County is an example, with their ban on grass burning by farmers producing grass seed. The 2004 Fall burning on the LPO raised numerous complaints within our area. Cattle grazing reduces fire risk by reducing moderate and fine fuels."* (11, 22)

"If fires are contained on the LPO, the smoke is not. I am concerned over the air pollution that this management practice will cause…." (27)

Response: The Healthy Forest Restoration Act of 2003 states that its purpose is, among other things, the reduction of wildfire risk to communities, municipal water supplies, and other at-risk Federal land through the implementation of hazardous fuel reduction projects. The use of prescribed fire is considered a tool to reduce hazardous fuels under this Act.

Washington State has had a Smoke Management Plan in effect since 1969. In its current revision (1998), it meets the requirements of the Washington Clean Air Act (RCW 70.94), Forest Protection Laws (RCW 76.04) and the US Clean Air Act (42 USC 7401).
The Washington Smoke Management Plan acknowledges the role of fire in forest ecosystems and reflects legislation finding it to be in the public interest to use fire under controlled conditions to maintain healthy forests and eliminate sources of fuel.[1] The prescribed fire program for LPONWR complies fully with the state plan. These state and federal laws set standards for air quality. Through the implementation of Smoke Management Plan, the State of Washington has improved its air quality over the years.

Comment: *"…Fire is definitely more disruptive to wildlife than cows and calves in a meadow. The cattle will naturally follow the grass availability: Severe reduction in grazing to replace with burning is not a logical step, but very drastic.*

The possible exposure to fire getting out of control is another matter of serious concern. The cost of fire containment is expensive and dangerous. The exposure to litigation, or angry citizens in this regard is far greater than grazing cattle. In years of drought fire is not again not a logical answer. It is very wasteful. From a business standpoint a very poor business decision. In a time of reduced funds to important needs in society, to burn is expensive, instead of generating income, risky, and a poor health decision.
In regard to environment a very backward step. The Fish and Wildlife Service is suggesting we begin an outdated method of fire suppression." (21)

"…Unlike grazing, fire does kill many of nature's helpers: insect, rodents, snakes, etc. They are just as valuable to our environment as the redtailed hawk or the pileated head woodpecker." (27)

"…I believe it would be far better for the land, the animals and our environment to utilize grazing as a means of control and maintenance. My concern is intensified by the recent years of drought this area has suffered. No matter how well planned and careful a prescribed burn might be, there can be no real control of "Mother Nature." The danger this practice threatens is too great a risk!" (29)

Response: Fire is recognized as a natural ecosystem process that shaped forest communities and it plays an important role in maintaining a balanced ecology on LPONWR and its surrounding landscape. Although grazing on the LPONWR dates back at least 70 years, forests here have been under the influence of fire for a much longer period of time. The conclusion that fire is disruptive to wildlife is inconsistent with the best available science regarding natural ecological processes that shaped the refuge landscape. We monitor the effects of prescribed

[1] Washington state Department of Natural Resources Smoke Management Plan, 1998, p 2.

burning during and immediately following the burn. We have not noted wildlife mortality associated with our prescribed fire activities. Because we burn only a small percentage of the refuge annually, it likely has no negative effects on wildlife species at the population level.

The objective of restoring fire's role in the forest is to achieve the long-term goal of a healthy, naturally functioning system. Even with grazing, prescribed burning is required to establish natural ecosystem processes that are required to restore and sustain healthy forest communities. Prescribed burning is implemented under a tightly controlled set of parameters that are set forth in federal policy. If the risk of escape is not acceptable, we do not ignite a prescribed burn. As a method of reducing fire suppression costs and wildland fire damage, we are re-introducing fire as a natural ecosystem process through a combination of hazardous fuel reductions and subsequent prescribed burning that reduces the risk of catastrophic wild land fire.

Comment: *"…the Draft HMP relies heavily on prescribed burning to manage these 40,000 acres without listing the negative effects that burning has on habitat, wildlife, water quality, air quality and the impacts on adjacent landowners…"*

"As a LPONWR permit holder, we have personally witnessed the negative effects of prescribed burning conducted on the LPONWR. These negative impacts range from excessive burning of wildlife habitat to LPONWR employees leaving burned areas unsupervised while the ground debris was still smoking. In some occurrences, the smoke continued for over a week and had the potential to reignite." (36)

Response: Prescribed burning has been utilized on LPONWR in accordance with the CCP and approved burn plan. This plan contains specific prescriptions that have been developed using scientific literature and professional experience to ensure that prescribed burning is used safely on LPONWR. The acreage burned over the past three years has averaged slightly less than 1000 acres per year (less than 2.5% of the total refuge acreage). The refuge fire staff has an excellent safety record with regards to managing prescribed fire activities conducted on LPONWR. Based upon prescribed burn prescriptions, weather, and site specific conditions, units treated with prescribed fire are frequently monitored to make sure they do not re-ignite.

Comment: *"Your program of proscriptive grazing on five widely scattered old fields will not adequately address fuel-loading on an area containing 40,000+ acres. Many other areas need to have their grassy vegetation managed in order to prevent severe fire damage."* (37)

Response : Through the use of forest management practices including thinning and introduction of low intensity frequent prescribed burns, the risk of catastrophic wild land fire will be greatly reduced. The old fields will be managed with a combination of prescribed fire, mowing, and rotational grazing. These strategies will be used to produce grassland conditions that will provide habitat for foraging and nesting birds and foraging habitat for white-tailed deer. These strategies will be evaluated and then used appropriately to achieve the old field objective identified in the HMP.

Comment: *"The Draft HMP relies heavily on prescribed burning to reduce tree competition and fuel loads throughout the LPONWR. Due to habitat risk management factors and the liability of*

uncontrolled fires spreading to adjacent landowners during low precipitation years, the District recommends the Draft HMP be modified to limit prescribed burning and only be utilized after less destructive practices are employed. Furthermore, widespread prescribed burning on the LPONWR has negative effects on air quality throughout the air shed and impacts a large number of adjacent landowners/residents. Air quality studies in the Little Pend Oreille River's air shed and the development of community fire plans should be performed prior to making the LPONWR's HMP heavily dependant on prescribed burning…" (61)

"…Prescribed burning seem to be relied on heavily, yet no considerations have been given to the health and protection of local communities with respect to smoke and the threat of fires leaving the refuge…" (43)

Response: Using prescribed burning on 1000 acres per year is consistent with the CCP and does not constitute heavy reliance or widespread use of one practice on the 40,000+ acre LPONWR . The scientific literature indicates that the dry forest communities evolved with frequent low intensity fires that shaped the ecosystem processes that maintain healthy native plant communities. The previous responses indicate that the LPONWR is in compliance with the Washington State Smoke Management Plan in effect since 1969 which meets the requirements of the Washington Clean Air Act (RCW 70.94), Forest Protection Laws (RCW 76.04) and the US Clean Air Act (42 USC 7401).
The forest stands treated on LPONWR were in an unnaturally dense condition because of fire suppression and grazing, which predisposed them to a variety of risk factors ranging from insects and diseases to intense, stand-replacing wildland fire. It is largely due to the liability of uncontrolled wild land fire spreading from the refuge to adjacent private property that we have treated thousands of acres along the LPONWR border with thinning and prescribed fire. A direct result of those treatments is reduced risk of the aforementioned catastrophic wild land fire, which we will continue to address through management strategies presented in the HMP.

Oppose Livestock Grazing

Comments: *"The mandate of National Wildlife Refuge lands is to be managed solely for the conservation of wildlife and plants. Grazing of domestic animals is incompatible with this mandate.*

Cattle don't belong on the refuge." (55)

"Please discontinue the use of the LPO for permanent grazing allotments, as determined in the Comprehensive Conservation Plan of 2000. The Refuge should be managed for wildlife, and cattle grazing is not compatible with this. " (42)

"I would like to express my support for the elimination of cattle grazing on the Little Pend Oreille Wildlife refuge. Having been born in Colville 57 years ago, I have enjoyed outdoor activities around Colville for many years. I have fished and hunted on the refuge and various local areas for as long as I can remember. It has always bothered me to see the stream damage done by cattle when they were allowed to graze. I have read various studies that support the

idea that cattle grazing on streams causes erosion and silting in the steams. The silt then impeded spawning of the native fish.

I feel the Refuge should be managed for the fish and wildlife, not private enterprise." (63)

"I would like to emphasis my belief that the Refuge should not be used as a grazing resource as that is not the purpose of the Refuge.

As the former coordinator of Emergency Services for Stevens County I conducted SAR (search and rescue) training operations on the Refuge and would like to see this privilege extended to future SAR personnel. I now use the Refuge as a quiet place to enjoy my hobby of photography." (6)

"National Wildlife Refuges should be managed for the best interests of Conservation. Grazing cattle in not compatible with this goal. Nor for the benefit of a few selfish individuals intent of profiteering from the system for self gain from public lands." (8)

"As a visitor to the refuge, particularly during hunting season – get those cows off!! I hate the cow pies, the flies, the trampled grouse habitat, the smell, the noise, the dust, the weeds! This is a refuge for wildlife. Cattle have little or no business there." (32)

"In my experience, grazing permits always sound better on paper than they are. In the real world, electric fences short out. I've never met a rancher that didn't have to round up strays. Cattle always get away from where they are supposed to be. Turnout, roundup and stocking rates rarely match permit requirements. Ranchers always have excuses. Irresponsibility is institutionalized. Politicians side with the cattle industry. In recent years, some ranchers have adopted a hostile attitude just to force government or environmentalist to buy them out.

This is the right time to terminate grazing on the refuge." (62)

"The February 2005 Draft habitat Management Plan (DHMP), allows the use of livestock grazing as a "management tool" for achieving land-management objectives on the Little Pend Oreille National Wildlife Refuge (the Refuge).

Northwest Ecosystem Alliance (NWEA) wishes to express the following concerns about this aspect of the DHMP:

1. *It is widely accepted that grazing is harmful to numerous ecosystem dynamics and beneficial to none. Indeed, the DHMP itself is replete with citations attesting to the adverse impacts of grazing, both in general and on the Refuge. In stark contrast, the DHMP provides virtually no substantiation for the notion that grazing can have a net positive effect on ecosystem dynamics and is, therefore an appropriate management tool on a National Wildlife Refuge.*

2. *<u>Natural</u> tools with proven ecological benefits such as fire – both natural and prescribed – are readily available tools to achieve land managements objectives in*

all situations described in the DHMP for which grazing is proposed, such as maintenance of old fields on the Refuge.

3. *Therefore, the decision to allow for the use of grazing as a management tool on the Refuge is inconsistent with wildlife-refuge management objectives and policy guidance, the DHMP itself, and best available science.*

"The adverse effects of grazing are repeatedly cited in the EA, including a citation regarding invasive species in the "old fields", where grazing may be employed as a management tool:

> *'Vegetation within these fields range from thick stands of redtop, timothy, or orchard grass to dense infestations of invasive plants including cheatgrass, thistle, St. John's wort, and spotted knapweed (Nielson and Lohman 1999). Most of these meadows have been included in grazing allotments.' (25)*

Response: The compatibility determination for livestock grazing within the 2000 CCP for LPONWR (Volume 2-Appendix F-33) stated "… [annual] grazing will continue until 2005 and therefore will not be compatible until that year. The 2000 CCP indicated that grazing may be used as a management tool to achieve specific habitat objectives. The details of how the tool would be used will be developed and discussed in the step-down Habitat Management Plan scheduled for completion by 2005." Consequently, annual livestock grazing was incompatible from the 2005 grazing season thereafter in accordance with the CCP. In contrast, the use of prescriptive grazing in conjunction with other management tools (prescribed fire, mowing, and selective thinning) as presented in the HMP is compatible and represents a potential means to achieve the habitat objective for old fields based upon available science. Because the FWS needs to retain all potentially effective management tools, grazing will be evaluated to determine if it can contribute to achievement of the HMP objective on approximately 168 acres (<0.5% of the refuge) of selected old fields where its use likely will not impact non-target resources. These selected old fields are likely the only locations on the refuge where grazing currently would contribute to refuge habitat and wildlife objectives and be considered compatible. Vegetation response associated with grazing as well as other management actions in these old fields will be monitored to assess whether the HMP objective is achieved. Through the adaptive management process, the most efficient and effective management tool(s) will be selected to achieve the old field's objective.

Comment: *"It is unreasonable to expect a permittee to start grazing so late (July 15) and to do so much work (construct and remove fence every season around fields) for so few head of cattle. The suggested cattle-watering procedure is way too expensive to be implemented."* (37)

Response: The rotational prescribed grazing presented within the HMP was designed to achieve the old field habitat objective to meet the life history requirements of migratory birds and white-tailed deer. The July 15th start for grazing in old fields was selected to minimize/prevent adverse affects to nesting migratory birds. In accordance with the HMP policy, management strategies are designed to meet habitat objectives to fulfill refuge purposes and biological integrity, diversity, and environmental health. Other aspects of the grazing prescription (e.g., permittee construction of fencing) were identified in order to protect alluvial riparian, in-stream, and forest habitats that have been impacted by previous grazing practices on LPONWR. We are providing

the public with the opportunity to graze LPONWR in accordance with the grazing prescription and stipulations identified in the HMP. If the proposed grazing program is found not to be economically viable, the LPONWR staff will implement other habitat management techniques identified in HMP to achieve the old fields habitat objective.

Comment: *No science referenced in the EA supports use of grazing as a management tool except for a brief reference to a flawed short-term study: 'In 1998, a study was conducted by the University of Idaho examining the effects of livestock grazing on the structure and composition of riparian vegetation within selected pastures on LPONWR (Nielson and Lohman 1999). The study objective was to assess the short-term response (1-2 years) of the structure and composition of streamside vegetation to livestock exclusion. This study involved comparing plant communities in grazed and ungrazed pastures at the beginning and end of the grazing season. Overall, these investigators found little differences in riparian vegetation associated with ungrazed and grazed pastures. A lack of difference was not expected because apparent changes in structure and composition of riparian vegetation following removal of grazing for periods less than 4 years have yet to be reported by scientific studies. They stated that it may require several more years for clear, easily interpreted patterns to develop. The quantitative data collected will provide valuable baseline information useful for comparing changes in riparian vegetation resulting form various future management regimes."* (25)

Response: The Nielson and Lohman study does not support the use of livestock grazing as a management tool to achieve habitat objectives for alluvial riparian on LPONWR. The experimental design, data analyses, and data interpretation are scientifically defensible and appropriate for the study objective which was "…to document the early effects (1-2 years) of livestock exclusion on the structure and composition of streamside vegetation." The authors generally found no differences between pastures where grazing was continued and those where grazing had been removed from areas that had been subjected to season long grazing for decades. The authors indicated that plant species composition and structure requires additional time (a total of five years without grazing) is needed for recovery on LPONWR. In addition, the authors noted impacts of grazing (e.g., spread of invasive species) that were consistent with other published studies concerning the detrimental effects of grazing in riparian areas.

Comment: *In summary, the DHMP offers no substantiation whatsoever that livestock grazing is compatible with either wildlife-refuge management compatibility criteria or consistent with historic natural dynamics on the Refuge.*

Even if native herbivores had historically played a substantial role on the refuge these native herbivores were no longer present to continue this role, there would are other management tools readily available to mimic this dynamic, such as prescribed fire and mowing. Indeed, the DHMP states as much in this weak case for the use of grazing:

> *Rotational prescribed grazing may be the best tool for managing these fields. Ample water is available nearby, and there are no other habitat types sensitive to grazing such as aspen or wetland plants. Drawbacks to using this tool for vegetation management include the close proximity of riparian areas with the potential for damage from straying*

livestock, and for livestock to attract brown-headed cowbirds. Prescribed fire and mowing may also be useful management tools in these areas.

NWEA requests that the LPONWR seriously reconsider the appropriateness of allowing continued livestock grazing on the refuge under the guise of a 'management tool.' In the event that, following this reconsideration, the Refuge determines that allowing continued grazing for any reason is indeed compatible with refuge-management guidelines, mimics a historic natural ecosystem dynamic on the refuge, and is determined to be the most effective management tool for that purpose, we ask that the Refuge make a case for all of the above in a supplemental public document and make that document available for public review and comment. Doing so is particularly important in light of the Refuge's 1996 grazing review, in which numerous negative impacts of grazing were documented and no positive impacts were documented." (25)

Response: Historically, livestock grazing allotments encompassed the majority of the LPONWR's 40,000 + acres. Actually, due to terrain and distribution of forage, about 20,000 acres of refuge was actively grazed annually, with livestock grazing concentrated on old homestead meadows and along low gradient riparian areas. The Compatibility Determination written as part of the Refuge's Comprehensive Conservation Plan in 2000 found the then current annual livestock grazing program to not be a compatible use. However, the compatibility determination found prescribed grazing, as part of the management alternative selected for the CCP, to be compatible: "Restoration of native forest and riparian ecosystems on the Little Pend Oreille NWR may be best achieved without cattle, however, in altered environments, like old fields where the A soil horizon is gone, livestock grazing may be an effective tool to manage nonnative vegetation. This enables the Refuge to retain grazing as a tool for vegetation management under specific controlled conditions." (CCP Appendix C page 38)

This HMP refines the decisions made in the CCP and recommends management strategies to meet objectives set in the CCP. Based on the compatibility determination in the CCP, no prescribed grazing was recommended for any riparian areas or forested upland habitats, thus reducing the portions of the refuge where prescribed grazing may be implement to less than 1% for the Refuge's land base; concentrating it in those parts of the refuge commonly referred to as the "old fields".

There are approximately 584 acres of old fields remaining on the refuge. They range in size from <1 acre to 60 acres, averaging 11 acres each and occur both adjacent to riparian corridors and on upland sites. The field management objective in the CCP stated "Maintain approximately 500 acres of fields as openings to provide a diversity of habitat structure, grass and forage for wildlife, for enhanced viewing opportunities and to maintain certain cultural resources." A review of these areas determined that 66.6 acres should be allowed to revert to either conifer or hardwood forest. About 136 acres were already in a desirable agricultural crop (alfalfa) or should be tilled and planted to a mix of perennial native and desirable non-native grasses and forbs.

Prescribed fire was determined to be the best management tool for maintaining about 213 acres of the old fields spread across 28 sites. Prescribed fire was chosen because many of these fields are small and widely scattered. Several have potential for fire to expand and rejuvenate existing

aspen clones which mowing and grazing cannot do. Other factors such as lack of available water for livestock, and presence of wetlands, riparian strips or streams indicated prescribed fire was the best management option.

There remained six discrete old field units (totaling 168 acres) ranging in size from about 22 to 35 acres. These sites lent themselves to management using prescribed grazing due to their size, topography, availability of water and lack of other habitat types including aspen that would be damaged by livestock use.

All three of the currently available tools for managing these old field habitat types (prescribed fire, mowing and rotational prescribed grazing) have advantages and disadvantages. The prescription for grazing in the HMP, which includes timing restrictions, a rotation limiting grazing to once very three years, requirements for temporary fencing, off-stream watering, and vegetation structure objectives, is designed to minimize the impacts associated with livestock grazing while emphasizing its advantage as a low cost alternative to prescribed fire or heavy equipment operation.

Based on monitoring, adaptive management will be used to identify the appropriate future application of one or more of these strategies considering the site specific effects on each site's progression toward achieving the objectives outlined in the HMP.

Obviously, reducing the historic annually grazing program from 635 AUMs on an effective 20,000 acres to 22-32 AUMs on about 56 acres annually can hardly be considered an effort to "disguise" rotational prescriptive livestock grazing as any thing but a "management tool."

Comment: *"Section 8-2 of the CCP states, 'No grazing objectives are adopted under the CCP. The annual livestock grazing will continue at its present intensity through the 2004 grazing season, after which it will be discontinued. Subsequent grazing will be use only as a wildlife habitat management tool to achieve a specific habitat objective. Stipulations required by the Compatibility Determination specifies: Review habitat management options and use grazing when and if it is the most efficient method for managing vegetation.' In those areas where grazing is proposed in the HMP, exactly what is the 'specific habitat objective?' And at what point will you determine whether grazing is, 'the most efficient method of managing vegetation'".* (62)

Response: First, please note the Service has extended permitted annual grazing through the 2005 grazing season. The draft HMP states the objective for old fields as: 'Annually maintain approximately 500 acres of old fields with >90% herbaceous cover, providing early- spring forage and fawning cover for white-tailed deer as well as structure for foraging and nesting landbirds, comprised of 25-75% desirable native (e.g., blue bunch wheatgrass) and cultivated grasses (e.g. orchard grass, timothy); remaining herbaceous cover composed of desirable forbs (e.g., clover, small burnet, alfalfa). Maintain < 30 % canopy cover of trees, saplings, or seedlings (page 82).

Obviously, this objective applies to all the old fields, regardless of whether they are currently planted to alfalfa or are one of the three fields slated for tillage and planting to a mix of perennial native and desirable non-native grasses and forbs. Also included in this list are the fields currently vegetated with some mix of native but mostly non-native grasses that are slated for management through rotational prescribed grazing. The prescription for rotational prescribed grazing includes the specific guidelines that livestock will be removed when herbaceous stubble height averages 6-8 inches. This is a standard stubble height that retains sufficient residual vegetation to serve as a ground cover while maintaining plant health. Since these old fields are essentially pastures, this standard seemed reasonable. Please also realize these pasture are only grazed once every three years in order to maintain the health and vigor of the grasses. Two out of three years these grasses and other plants will be allowed to grow unimpeded.

Adaptive management is described in U.S. Fish and Wildlife Service Manual 620 FW 1 as "The rigorous application of management, research and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels." We will use adaptive management to determine if the objectives for each site are being met, and make changes via annual work plans. The strategies described in the HMP, whether rotational prescribed grazing, prescribed fire or some other technique, are the initial management strategies. Future evaluation may prove one technique to be superior to another.

<u>Comment:</u> *"Grazing on a refuge is inappropriate and against the intent of the Refuge Improvement Act, except when it can be demonstrated essential to meet refuge purposes. Although the HMP will curtail unsustainable annual grazing practices, the HMP fails to eliminate all grazing activity on the Refuge. Despite the Service's own recognition of the ill effects of grazing, the HMP specifically employs prescribed grazing as a habitat management tool. The HMP recognizes the disadvantages of using this tool:*

> *'Drawbacks to using this tool for vegetation management include the close proximity of riparian areas with the potential damage from straying livestock, and for livestock to attract brown-headed cowbirds' (page 87).*

Allowing even controlled, prescribed grazing poses numerous adverse environmental impacts to sensitive habitat areas, including compacting soils, sedimentation, etc. The value of observing habitat responses to 15 years of rest from grazing more than outweighs the potential management benefits. There are ample grazing lands outside the Refuge and grazing has not been sufficiently demonstrated to be a necessary management tool essential to the Refuge's purposes. Therefore grazing should be prohibited on the Refuge.

The HMP should direct that there be no livestock grazing on the Refuge for any reason for the duration of the 15 year plan. If the Service sees a need to use livestock as a management tool at the end of the 15 year planning cycle, then it can propose revisions to plan at that time.

The annual cattle grazing program on the Little Pend Oreille Refuge in not only incompatible with the wildlife conservation mission of the Refuge, but with the mission of the Refuge Service as a whole, and as such, should be terminated in perpetuity. We hope that the Refuge will continue to uphold its roll as a leader in sound ecological management and eliminate all grazing on refuge land. (9)

Response: While it's true that rotational prescribed grazing has certain disadvantages that we mention in the HMP, prescribed fire and mowing also have disadvantages. For example, prescribed fire requires specific conditions for implementation that may not annually occur, and mowing is limited to areas with relatively level terrain. Eliminating rotational prescribed grazing as a habitat management tool during the life of the CCP would discard a strategy that may prove to be necessary to economically and efficiently meet old fields objective.

The old fields are highly disturbed sites containing vegetation planted by homesteaders to support domestic livestock grazing. The CCP recognized the value of keeping these areas in grassland field for several reasons including habitat for grassland birds and for wildlife viewing opportunities. Maintaining the desirable structure and vegetation characteristics of these sites would not be possible if they were not actively managed during the 15 year life of the plan.

Only a limited number of specific old fields were identified to be managed initially with rotational prescribed grazing. Sites were selected based on such parameters such as availability of water sources to fill watering tanks, adequate size to contain a small herd of livestock for several days, and lack of sensitive habitats such as aspen or wetlands that could be impacted by domestic livestock. Used in this way, rotational prescribe grazing is compatible with the purpose of the Refuge.

Comment: *"Given LPONWR's long and negative history with cattle grazing it's disappointing that the refuge is recommending using "prescribed" grazing as a management tool to maintain some of the old fields. This activity has a large chance of abuse – both purposeful and accidental – and should not be employed to maintain old fields. The refuge and others have done extensive research into the negative impacts of grazing in habitats of LPONWR. It is time to restore the refuge from these past abuses."* (41)

"After reading all the negative impacts, I can't see that grazing could lend any positives. Perhaps in very small, surgically applied areas, grazing would be effective, if highly managed. I assume that will run costs up very high. I sincerely doubt that cattle grazers are willing to work such small area with such short windows of application. Moving cattle is expensive. Additionally, will the USFWS incur the cost of fencing for these projects? If so, it seems like a lot of cost for little gain. Other methods, such as fire, chemical, mechanical, or hand-work could yield equal results with less impact." (32)

Response: We agree that using livestock as a management tool is not without hazards. The prescription for rotational prescribed grazing is quite restrictive to prevent impacts to refuge resources. The costs of temporary fencing and the off-site watering system will be borne by the permittee or contractor. The grazing permittee's fees maybe offset by the costs to meet refuge special use permit restrictions required to protect refuge resources and implement a compatible

grazing program. If there are not interested grazing permittees, or if the use of prescribed livestock grazing does efficiently and economically meet refuge objective for old fields, one of the other vegetation management tools such as prescribed fire may be utilized.

Comment: *"Livestock grazing is the leading cause of the invasion of weeds throughout the West. Horses and cattle are a problem on the Refuge. Pg. 134 of the HMP includes a discussion of Hound's tongue and the problem of seeds being carried by the coats of cattle. This is one good example, but there are many. Most of the private pastures in NE Washington seem to have healthy populations of weeds. Bringing cattle from those lands onto the Refuge means deliberately introducing weed seeds onto the grazing areas every few years. That is a bad policy and I urge you to terminate grazing, or require livestock feeding on weed free feed for an appropriate time prior to coming on the Refuge, along with inspection and leaning of coats.*

Almost everywhere on public lands, managers are busy creating the conditions that facilitate the germination of spread of invasive weeds. They then expect taxpayers to pony up the dollars to address a problem caused by special interest management. Please do not do that." (62)

Response: Invasive plant species represent a continuing problem on LPONWR. Livestock certainly are one of the ways weed seeds are introduced onto and dispersed throughout LPONWR, as are visitor's vehicles and even the wind. Eliminating all but very limited, controlled livestock grazing in old fields vegetated by exotic and native grasses should help reduce not only new seeds being brought onto the Refuge but the dispersal of seeds within the area. We will evaluate methods of limiting spread of invasive plants, including those suggested in the comment, and will include steps to address the spread of invasive plants by permitted livestock by whatever means are practical. In addition, an Integrated Pest Management Plan will be developed that will identify strategies to control the spread as well as the introduction of invasive on the refuge.

Support Continued Annual Livestock Grazing

Comments: *"We would like to express our support in favor of cattle grazing and cattle presence on the Little Pend Oreille Wildlife Refuge. We feel that it is a useful management tool and definite boost to our local economy.* (2)

"I support cattle grazing on the LPO. The article I have enclosed shows an open minded approach to range land management. Cattle are beneficial to plants and grasses. Which in turn benefit's wildlife." Author included article titles " Finding Common Ground" The Albuquerque Tribune: Business January18, 2002. (28)

"We live within a short distance of the game range, and enjoy the wildlife that move in and out of the area.

My concerns about the management and plan to be implemented in the near future may not fit with the best historic uses of the land. I believe livestock can and have been use here and elsewhere to enhance wildlife habitat. I think it is a mistake in not utilizing historic data and input from the producers who have been working this area for generations.

In a rush to fulfill "feel good"' management plans at the LPO, you may regret the impact on the game range and surrounding land by not working with livestock producers to gain the best overall use and benefit of the LPO." (49)

"The draft plan references damage attributed to grazing, but does not say how that occurred (Lack of USFW&S oversight? Lack of permittee cooperation?) or what alternatives were explored to correct the problem. There is an abundance of literature in professional journals and agency reports that cites examples of proper grazing use improving wildlife habitat in forested and riparian zones. Examples of rapid recovery of riparian zones under proper grazing use are found throughout the western U.S. Livestock exclusion is a valid alternative, but is not the only alternative by any means. I would encourage the plan authors to do more literature review and present a balance approach to the grazing issue. I think the credibility of the final plan would benefit from this extra review, no matter what the preferred alternative is." (35)

"Low risk conservation practices, such as prescribed grazing, is widely recognized as a habitat management tool and should be utilized on the LPONWR and not limited or excluded." (36)

"I also feel it was very biased towards livestock grazing on the L.P.O. Research that has been done to date proves that grazing is very beneficial not only for wildlife and migratory birds, but for fire suppression and plant regeneration.

The L.P.O. has its own unique ecosystem, of which a lot of this can be attributed to grazing since the mid 1880's. To remove grazing would cause a disruption to some of these plant and animal species that have evolved around cattle grazing.

I feel there needs to be a change in how the grazing is done, but eliminating or reducing it to the point it can not be economically feasible for the permit holders is not using best available science to date. Let's not forget that the past is over and we can't go back, but what we can do is work toward the future, not recreate by create.

I strongly support Livestock grazing on the Little Pend Oreille Wildlife Refuge to achieve the goals of the future." (10)

"By using sound and latest science, we must listen and try new concepts. Both parties must work together, be willing for change, have goals, and have monitoring systems in place to meet our goals.

It is known that grazing is compatible on other U.S. Fish and Wildlife Refuges. This is done as a cooperative effort between ranchers and refuge managers as a vegetative management tool.

Examples are:

Gray's Lake National Wildlife Refuge in Idaho established for migratory birds

The Ridgefield Refuge in Washington is seeking livestock to graze their refuge

The Malheur national Wildlife Refuge in Oregon uses grazing and haying to manage vegetation and the list goes on

It is agreed that each refuge is unique. The LPO's habitats include mountainous forest, dry and moist forest areas, wetlands, and stream riparian habitats. This is typical of grazing land within our area. The U.S. Forest Service and private lands have proven that grazing and wildlife are compatible and enhance each other. Our ranch five and one-half miles from Colville, according to the biologist for the Washington Fish and Wildlife, has the highest population for white tail deer per acre in Eastern Washington. This could be said for pileated woodpecker as well. We graze this land extensively. We the ranchers involved with the grazing on the LPO have years of experience with grazing and wildlife management to better enhance stewardship of the soils, plant communities, water quality and all types of wildlife." (11)

"We want to express our great disappointment in your decision to eliminate our grazing lease of the past twenty-five years.

That decision was not based on scientific fact and you continue to justify your poor technical resource.

We can only hope that political influences can operate with a clear and fair agenda." (7)

"In regards to the plan, our comments center mostly on the issue of livestock grazing. We are in support of continued grazing because of its many benefits to wildlife, especially in terms of migratory birds. As history noted in your study can attest, the land that is now encompassed by the refuge has been grazed for nearly the last 100 years. This ongoing practice has helped to keep grasses vibrant and stimulate growth while suppressing ground level forest fuels and keeping grass stubble short for the benefit of bird habitat. Livestock at the LPO NWR are doing an important job by helping to maintain habitat for a number of species and at far less cost that a labor crew or machine could accomplish." (26)

"The Little Pend Oreille Game Range has a long history of grazing dating back to the early pioneer days. A proven fact that grazing does benefit wildlife because the LPO has endured excellent hunting over many years before even managed as a refuge. Another reason for this belief is that Stevens County is known State and nationwide as the best Whitetail deer hunting in the state. …

We have all been informed of the past destructive practices over the years to the environment from manufacturing, forestry, mining, agriculture and just about every venture that man has been involved with, and overgrazing has been one of them, but today we have the technology to graze cattle in a stewardship manner that I beneficial to the ecology of any specific type of flora and fauna that we need to protect and enhance." (12)

"Science has proven that wildlife flourish and benefit from livestock grazing. Let grazing continue on the Little Pend Oreille Wildlife Refuge to enhance the environment, and help to sustain a health economy derived from small business." (14)

"Grazing should continue on the Little Pend Oreille Wildlife refuge to benefit both wildlife and the economics of the area as it has in the past. It is known that grazing is compatible on other U.S. Fish and Wildlife Refuges. This is done as a cooperative effort between ranchers and refuge managers as a vegetative management tool." (22)

"Grazing seems to be used as a secondary tool, or last resort. Many National Wildlife Refuges use extensive grazing as a tool for habitat management, yet this plan does not do this. The plan does not present an unbiased view of information on the subject to come to the conclusion of very limited grazing." (43)

Response: The HMP for LPONWR steps down and adds specificity to the CCP habitat objectives and strategies to achieve them. Because management strategies (including grazing) were previously described and evaluated in the Environmental Impact Statement (EIS) for the CCP, there is no requirement to evaluate alternative types of grazing within the HMP. We recognize that other grazing strategies are available that will reduce the impacts to riparian and maybe appropriate for private lands as well as state and other federal agencies that have a multiple use mandate. However, the NWRS is primary use network of lands specifically for fish and wildlife and these alternative grazing strategies (e.g., corridor, riparian) will not achieve the habitat objectives identified within the HMP, particularly for alluvial riparian and forest objectives. Based upon available scientific information from studies conducted on and off LPONWR, the specific habitat attributes presented within habitat objectives (except for old fields) have been negatively affected by the current grazing strategies. Moreover, many of these studies indicate that grazing in alluvial riparian and forest habitats detracts from, rather than contributes to, achieving habitat objectives.

There are a number of refuges throughout the NWRS that utilize livestock grazing as a management tool to achieve wildlife and habitat objectives. Based upon site-specific conditions and habitat objectives, grazing has, and likely will continue to be used, as a management strategy to achieve resource objectives. Ridgefield, Grays Lake, and Malheur NWRs are excellent examples of refuges where prescribed grazing is used as a management strategy to achieve specific wildlife and habitat objectives. Grazing is used at Ridgefield within improved pastures that support 1000s of foraging wintering Canada geese. Cattle's grazing supports the purpose of the refuge (management for Canada geese and waterfowl) by providing short palatable nutritious grass preferred as forage by wintering geese. At Malheur and Grays Lake NWRs (purpose is management for nesting migratory birds), grazing is used to manage wet meadow grasses to provide a mosaic of structure for foraging and nesting areas for sandhill cranes and waterfowl.

Comment: *"The Draft HMP limits prescribed grazing to only 168 acres of the over 40,000 acres available under the LPONWR's responsibility. This conservation management tool is widely accepted (by both federal and state agencies) as a positive technique in improving wildlife habitat in forest and riparian zones. Surprisingly, the Draft HMP made extra ordinary efforts to present only negative references to the value of prescribed grazing. This biased representation of a widely accepted habitat management technique is contrary to other federal agency's conservation practices."* (61)

Response: Unlike some state and other federal land agencies that are multiple use, the NWRS is a primary use network of lands where wildlife is the first priority. In accordance with the Compatibility policy, management strategies such as prescribed grazing only are to be used if they contribute to the achievement of refuge purpose(s). Because livestock grazing is not an appropriate tool to achieve forest and riparian objectives, prescribed rotational grazing only is presented for the old fields habitat objective in the HMP. In addition, the available scientific information from studies on and off LPONWR found that livestock grazing negatively affected habitat attributes associated with forest and alluvial riparian habitat objectives.

Comment: *"I have ridden through portions of the Pend Oreille Wildlife Refuge near Colville, Washington and was very surprised and disappointed to learn of the proposed decision to discontinue grazing on the refuge. To eliminate this prescribed tool in public land management for this particular area, I believe is not good stewardship nor management. In portions of the refuge that I rode through in checking on the permittee's cattle, I was impressed with the positive stewardship the grazing permitted:*

- *The diminishing fuel build-up*
- *The enhancement of beautiful forest meadows*
- *The prevention of increased weed areas*
- *The presence of the cattlemen monitoring their herds and thereby reducing the vandalism and abuse of our natural areas*

Continuing the grazing activities in this pristine and open-space area will also protect the properties beyond the perimeters of the refuge, diminish the urban encroachment, and keep our adjacent ranching landowners contributing to our local economy.
I respectfully request your good efforts in continuing the livestock grazing on the Pend Oreille Wildlife Refuge. " (50)

Response: Based upon available scientific information from studies conducted on and off LPONWR, livestock grazing causes many impacts to native plant communities present on the refuge. As discussed in Appendix 1 of the HMP, livestock grazing is a contributing factor to unnaturally overstocked stands in forested habitats as well as the introduction and/or spread of invasive plant species. Because livestock grazing may contributed to providing quality habitat in old fields on LPONWR, the HMP identified prescribed, rototational grazing as a management strategy to evaluate for this habitat type.

There is no readily apparent relationship between continued livestock grazing as a means to diminish urban encroachment on LPONWR. The refuge is located 13 miles from the nearest town. In addition, there is no evidence to suggest that the presence of grazing permittees has reduced vandalism on LPONWR.

Because both current permittees are not landowners adjacent to LPONWR, their continued grazing likely will have no bearing on the viability of the neighbor's ranching operation adjacent to the Refuge.

Alternative Grazing Plans

Comments: *"In 1997, we participated in the development of an independent LPONWR grazing alternative plan sponsored by the local Natural Resources Conservation Service (NRCS) and the Stevens County Conservation District. This plan included numerous references to peer-reviewed grazing management practices, but the LPONWR elected not to implement this plan. As a result, the recommended fences were not constructed and grazing management alternatives outlined in the proposed plan could not be fully implemented."* (36)

"The Natural Resources Conservation Service (NRCS), the Stevens County Conservation District, and all LPONWR livestock permit holders submitted a Grazing Alternative Long-Range Plan to the LPONWR in September 1997. This plan outlined prescribed grazing techniques, goals, and objectives to enhance the wildlife habitat on the LPONWR and contained a large list of peer-reviewed references as supporting documentation. Unfortunately, the LPONWR Staff did not incorporate the prescribed grazing techniques identified in the Plan and conversely elected to eliminate the annual grazing program on the LPONWR.

Increase the number of acres available for prescribed grazing to support an annual grazing plan.

Initiate a pilot prescribed grazing program utilizing the 1997 Grazing Alternative Plan as a basis. " (A copy of the referenced plan was attached) (61)

Response: We acknowledge the effort the agencies and permittees put in that plan. We reviewed it carefully while preparing the CCP in 1997. We also reviewed it again while writing this HMP. While the grazing alternative identified some valid changes in grazing management, ultimately its priority was retaining an economically viable annual grazing program at the current stocking rate. As presented, the grazing plan failed to support the requirements for wildlife habitat management and restoration outlined in the CCP. However, the use of late summer/fall rotational prescribed grazing on selected old fields described in the HMP is similar to the fall grazing recommended in the Grazing Plan. In summary, this plan presented a grazing program that conflicted with objectives from the CCP as stepped down to HMP habitat objectives except for the prescribed rotational grazing strategy in old fields.

Comment: *"They (existing permittees) would propose to increase the number of cattle grazed to attain an effective and economic tool to meet refuge goals. (300 AUM's within five years) (800 AUM's was a high at one time).*

Address the fencing, rethink the present fences and remove and replace fences to eliminate areas that are forcing livestock to be a problem. Install fences to keep livestock out of critical areas, not force them to be in sensitive areas. This could eliminate many miles of present fences." (11)

Response: As summarized in Appendix 1, grazing results in impacts to alluvial riparian and forested areas. Based upon the HMP objectives for forest and alluvial riparian habitats (stepped down from the CCP), grazing will not achieve habitat objectives. Based upon LPONWR-specific studies that assessed the effects of grazing, it was determined that grazing was not an

appropriate management strategy to achieve alluvial riparian and forest habitat objectives identified in the HMP. Specifically, the habitat attributes for the alluvial riparian and forest habitat objectives were negatively affected by short duration and season-long grazing systems. Increasing the allotted grazing use by 70% and installing more fences that would impede wildlife movement as well as impact public access would not support CCP and HMP objectives.

Grazing and Instream Habitat

Comments: *"We absolutely disagree with the grazing portion of this HMP blaming livestock grazing for the deterioration of the riparian areas and the widening of the streams on the LPONWR is completely false. As your records should show, these impacts were caused by beavers constructing dams and then management removing these animals and their structures therefore causing the back-up water to erode the riparian bank and widen the stream beds."* (37)

Response: Scientific studies within instream and alluvial riparian habitats on LPONWR, found that livestock grazing was the primary cause of habitat degradation (see Appendix 1). Alluvial riparian habitat has been shaped by variable flooding that naturally occurs on an annual basis. Long-term annual grazing in alluvial riparian habitats on LPONWR had compromised the capacity of these habitats to withstand large flood events such as the ones that occurred during 1997. Extensive erosion and stream bank loss can, and do, occur within alluvial riparian habitat systems that have been compromised by grazing.

Some limited beaver trapping did occur on LPONWR until 1996. Three small dams plugging road and lake over-flow culverts were removed within the last two years. However, the eroding stream banks and degraded channels recorded during the riparian condition and fish habitat surveys, damage which is still apparent today, did not result from beaver management. It's readily apparent that they are the result of long-term impacts that certainly included livestock grazing.

Comment: *"I support livestock grazing on the LPO. Our family has enjoyed the LPO for years even before it was declared a wildlife refuge. Several areas have been declared off limits to cattle. One that comes to mind is the flats below headquarters. The river banks are in sad shape in this area. Large sections of bank have caved in the river. Yes cattle do compact stream banks. In this case they may help prevent a lot of erosion that is occurring.*

Please reconsider your decision to ban cattle on the LPO they are a valuable tool in rangeland management." (27)

Response: Based upon studies previously conducted on LPONWR, we concur that the stream banks as well as associated instream and alluvial riparian habitats are in degraded condition. These habitat impacts were found in areas that had been subjected to long-term, season-long grazing. With regard to stream banks, these studies on LPONWR indicated that grazing has caused bank shearing and erosion. Other studies conducted throughout the West concur with the finding that grazing causes instability of the stream banks. Instream studies on LPONWR indicate that channels are wide and shallow rather the natural deep and narrow configuration.

The altered channel morphology is directly attributable to erosion directly or indirectly attributable to livestock grazing where streams are easily accessible to cows.

As described in the HMP, restoration of degraded alluvial riparian, stream bank, and instream habitats involves long-term re-establishment of sedges, shrubs and trees whose roots will be adequate to effectively hold the soil that prevents and/or minimizes further stream bank erosion. We recognize that erosion is a natural ecosystem process associated with infrequent, large flood events in alluvial areas; however, degraded stream banks were subjected to unnatural erosion from normal flooding events.

Comment*: "The Colville River Watershed was identified as an impaired water body and is on the Washington State 303(d) list for fecal coliform. The Little Pend Oreille River is a major tributary of the Colville River and runs through the LPONWR. Due to the high number of wildlife on the LPONWR and plans for increased wildlife habitat, the Draft HMP should include a section describing management techniques the LPONWR will utilize to reduce fecal coliform water quality contamination.*

Develop a water quality enhancement program to address fecal coliform contamination from wildlife." (61)

Response: We acknowledged the 303(d) listing for the Little Pend Oreille (LPO) River in the CCP. The LPONWR staff has been involved in the Washington Department of Ecology efforts to address water quality in the Colville River watershed. We are currently developing a water quality monitoring plan for LPONWR. In the interim, we are monitoring water quality, including fecal coliform, from the LPO River where it enters and leaves LPONWR as well as at confluences with major tributaries.

The cessation of the current annual grazing and implementation of rotational prescribed grazing likely will greatly reduce or eliminate the fecal coliform inputs into LPONWR lakes and streams by domestic livestock. Historically, livestock have had unlimited access to lakes and creeks within grazing allotments. The HMP eliminates livestock grazing in all those areas (especially alluvial riparian habitats) encompassing streams and lakes. Old fields identified for rotational prescribed grazing in the HMP do not contain water bodies accessible to livestock. The HMP prescriptions require that livestock be watered within the enclosed grazing unit rather than allowing access to streams.

Active and passive restoration of riparian vegetation also will improve water quality. In turn, these management actions will provide better habitat for big game (white-tailed deer and elk) populations using LPONWR. Because restoring and maintaining healthy habitats (especially alluvial riparian) will act as natural buffers, no additional management practices are likely necessary to protect water quality from fecal coliform associated with wildlife on LPONWR.

Comment: *"Address water quality, the 2004 refuge water testing shows the quality of water entering the refuge is about the same as where it leaves the refuge. Testing for fecal coliform in grazing areas was low and acceptable. Establish off stream watering sites for wildlife and livestock. Give the livestock and large animal wildlife incentives not to frequent the streams."* (11)

Response: Limited water quality data collected on LPONWR do indicate higher fecal coliform associated with grazed areas. During July 2004, water samples were collected at six sites that included the locations where LPO River enters and exits LPONWR as well as four points within refuge. At the site where the LPO River enters LPONWR, the fecal coliform level in the river exceeded the water quality standard. About 5 stream miles downstream, after flowing through an area with no livestock grazing, the fecal coliform level was below this standard. Water collected at the confluence of Bear Creek and North Fork Bear Creek also showed both creeks well below the standard. In contrast, a sample taken at the confluence of Bear Creek and the LPO River after flowing through the more intensely grazed, lower elevation portions of the Refuge, had a fecal coliform concentration exceeding the standard. The standard continued to be exceeded at the point where the river exited LPONWR. Although another set of samples taken during August 2004 did not exceed the standard, there was a trend of higher concentrations of fecal coliform found for sampling sites associated with grazed areas.

As described above, off-stream watering is required in the proposed rotational prescribed grazing prescriptions. Providing off-stream watering facilities is neither practical nor effective for free roaming wildlife.

NEPA Process

Comment: "*First, I believe there has been a total lack of public outreach for comment and public participation on this draft HMP. The following are points to this effect:*

- *To my knowledge nothing was ever printed in any local of county papers that a draft plan was out for comments. Ms. Langelier made it plain in a telephone conversation I had with her on April 1, 2005 that although she sent something to the paper, she had no knowledge of anything being printed. I became aware of a draft plan at a local TMDL meeting by a local cattleman on the evening of March 30, 2005. The only reason this man knew about the plan was because he grazes cattle at the LPO until this year.*
- *The LPO website lists HMP. There is no mention anywhere on the homepage or elsewhere that states planning is going on. Only if you know what HMP stands for and down load the cover letter does this information come to light and planning activity is realized.*
- *The HMP is referred to as a refinement of the Comprehensive Conservation Plan (CCP). A 184 page document containing page after page of new information is hardly a refinement. Where on the site is the CCP so a comparison could take place?*
- *The HMP was placed at three area libraries. Again, how was one to know that the plan was at the libraries?"* (43)

Response: Because no additional NEPA documentation was required for this HMP, no additional public review and comment were triggered under NEPA. However, the Service invited public review (30-day period ending April 1, 2005) of the HMP through the following public outreach efforts: sent postcard notices to 301 parties who were on the original mailing list for the CCP and provided comments regarding its habitat and wildlife management strategies; sent HMP copies to 3 local libraries (Kettle Falls, Colville, and Chewelah), congressional aids for Senators Murray and Cantwell and Congresswoman McMorris, and current grazing permittees; and provided a website (http://littlependoreille.fws.gov/HMP.htm).

Comment: "*Second, has NEPA been followed appropriately? Although this HMP has a small EIS, I believe that with all the species and habitat designation addressed, NEPA has been violated. Further, I was a signer of a petition for redress of grievance to Stevens County on the activities of the U.S. Fish and Wildlife on LPONWR. Stevens County followed up by sending USFWS a letter requesting joint agency status as is their right under NEPA. USFWS turned them down stating there was no planning going on. A 184 page Habitat Management Plan is planning. Besides violating NEPA, this is another violation of PEO #13352.*" (43)

Response: The refuge manager is required to conduct the appropriate level of NEPA compliance and public involvement during the development of the HMP. Because this HMP merely provides more specificity for management strategies that were previously described and evaluated in the EIS developed for the CCP, no further NEPA documentation is required, as noted in the Environmental Action Statement appended to the HMP. The HMP was released to the public for comment in order to gage public opinion and ensure that the best available science was used with regard to the management prescriptions to achieve habitat objectives stepped down from the CCP.

Comment: *"Third, I believe this HMP is in violation of the Federal Data Quality Act (DQA). The DQA calls for the presentation of data to ensure quality, utility, objectivity, and integrity. Most notable are:*

- *By stating this HMP is a refinement of the CCP, but not supplying a copy of the CCP on the website, the HMP lacks utility, objectivity, and integrity."* (43)

Response: The DQA requires federal agencies to use the best available scientific information for making management decisions. Because the CCP was cited within the HMP and it was and still is publicly available, there was no violation of the DQA.

Comment: *"As the HMP is a step down plan of the CCP, it would seem that the CCP should be as current and relevant as possible to ensure adequacy of the HMP. The HMP is the result of an Environmental Action (EA), which does not require further NEPA actions than were accomplished during 2000. However, recent activities seem to suggest that results postulated almost five years ago are likely no longer valid."* (52)

Response: In accordance with the Comprehensive Conservation Planning Process Policy (602 FW3), CCP revision should occur every 15 years or sooner, if necessary. Revision of a CCP is necessary under the following conditions: significant new information becomes available, ecological conditions change, major refuge expansion occurs, or when the need to do so is

identified through plan review that should occur at least annually. Modification to a CCP and associated management activities is warranted when annual review or monitoring and evaluation identify changes are necessary to achieve objectives related to unit purpose(s), vision, and goals. Since the CCP with its EIS and Record of Decision were approved during 2000, none of the aforementioned conditions necessitating revision of the CCP have been identified. Therefore, the CCP is considered current and valid for development of the HMP.

Comment*: "The livestock production economics section of the CCP establish the basis of development of the HMP. However, in 2001 and later, a series of Bovine Spongiform Encephalitis (BSE) outbreaks in Canada, and one case in Washington state, have closed the Canadian border to shipments of cattle. Subsequently, local and national livestock economics have taken a sharp upturn and profitability is much greater per AUM. The loss of grazing on the Little Pend Oreille NWR of some 6000 acres will have a much larger negative effect on the associated livestock growers and also the subsequent loss of revenues which would have been locally generated. This should be reassessed."* (52)

"Several ranchers will be displaced because of the actions of the decision. The CCP's economic impact statement is insufficiently analyzed. The ranchers were misled to believe that prescribed grazing would protect their permitted grazing. Major reductions of grazing acreage has been announced. To reduce from 1100 AUMs to less than 50 AUMs does little to restore confidence in what the management at LPO has said over the past few years." (52)
"The cattle industry is viable to the economy of Stevens County, and as the second poorest county in the state we cannot afford to lose any part of this industry" (12)

"The economy of the local area needs grazing on the Little Pend Oreille Wildlife Refuge. The present cow numbers (2004) at today's prices, and using a seven time turnover of the dollar in the area, represents just under one half million dollars to the Colville community." (14)

"The grazing economy of our area needs the pasture on the LPO Refuge. The present cow number (2004 year) at today's prices, and using a seven time turnover of the dollar in the area, presents just under one half million dollars to the Colville Community. The proposed 300 cows under the same formula represents one and one quarter million dollars to the local economy of Stevens County." (11)

Response: In accordance with the CCP policy (602 FW3), an analysis of the economic impacts associated with management actions was conducted for all alternatives presented in the CCP for LPONWR. As currently implemented on the refuge, grazing approximately 300 AUMs (not 1100 AUMs that occurred before 1994 when the Service re-established management of the refuge) in low elevation areas equates to a forage supply of 1.2 jobs and $38,000 in the range-fed cattle industry as states in the CCP for LPONWR (page 4-38). Although annual fluctuations in market conditions may affected the value of forage on LPONWR, a re-assessment of the grazing economics for the HMP is not warranted because it was adequately addressed through the NEPA documentation (EIS) associated with development of the 15-year CCP.

In addition, the compatibility determination for livestock grazing within the 2000 CCP for LPONWR (Volume 2-Appendix F-33) stated "… [annual] grazing will continue until 2005 and

therefore will not be compatible until that year. Grazing may be used as a management tool to achieve specific habitat objectives. The details of how the tool would be used will be developed and discussed in the step-down Habitat Management Plan scheduled for completion by 2005." Therefore, the use of prescriptive grazing in conjunction with other management tools (prescribed fire, mowing, and selective thinning) as presented in the HMP represents the most effective means to achieve the habitat objective for old fields based upon available science. Vegetation response associated with management actions in old fields will be monitored to assess whether the HMP objective is achieved.

Comment: *"In the latter portions of the Habitat Management Plan, Appendix 1, discussing the effects of grazing on LPONWR, little documentation exists specifically displaying the direct damages caused by grazing animals. Much time is spent in identifying other studies, explaining the decision to restrict grazing. However, the long narrative lacks specific information quantifying the damages asserted."*

Response: As described in Appendix 1 of the HMP, the impacts of grazing on alluvial riparian, instream, and aspen habitats are documented from assessments conducted (1996 and 1997) and reported on LPONWR by US Fish and Wildlife personnel (not LPONWR staff members) or US Forest Service employees. The impacts from grazing documented from these refuge assessments (Kelly Ringel 1998, 1999; Pyle 2000, Bartos 2001 [see Section 5.0 References in HMP) are consistent with detrimental effects resulting from livestock grazing reported in published scientific studies conducted primarily from the western United States that are described within Appendix 1. In addition, natural resource management experts from the Service as well as other state and federal agencies identified impacts to vegetation communities and physical features (stream bank erosion) attributed to livestock grazing during refuge workshops and a Wildlife and Habitat Management Review conducted during 1996.

Comment: *"Perhaps a better approach, considering the elevated levels of concern voiced by the grazers who had traditionally held permits on the LPO, would be to conduct a pilot program of managed grazing on the allotments, which would either validate the HMP, or would result in a new paradigm for management on the LPO which could result in a cooperative and collaborative relationship with the grazers and the environmental community, leading to a richer and more productive refuge."* (52)

"In closing, I ask please give us a pilot program that we can work with and be monitored by a diverse committee that will make regular reports as to their findings" (12)

Response: As described in the guidelines for developing the HMP for LPONWR (Section 1.1), adaptive management will be utilized to evaluate and modify management strategies to achieve habitat objectives. For the habitat objective for old fields (Section 4.2 of the HMP), approximately 500 acres annually will be maintained to provide forage and fawning cover for white-tailed deer as well as foraging and nesting cover for landbirds. By conducting habitat monitoring to assess whether the habitat objective for old fields is achieved through the use of prescribed fire, mowing, selective thinning, and rotational grazing, the LPONWR staff will be implementing adaptive management as described in the HMP which essentially represents the same opportunities to evaluate management as a pilot program.

Comment: *"The Wilderness Society is aware that the Refuge is under pressure to overturn this mandate [six priority uses enhanced consideration over the other general public uses] and allow the continued use of refuge land for annual cattle grazing. We have grave concerns that the decision finalized in the CCP [eliminate grazing] will be overturned and that the Service will again accommodate an abusive grazing program. Beyond the many adverse impacts grazing inflicts on a landscape, it would be inappropriate for the Refuge to continue to incur costs to manage and monitor cattle grazing on the Refuge, particularly during time of budget cutbacks and the Refuge System's tremendous maintenance backlog. The HMP must uphold the strong provisions adopted within the CCP."* (9)

Response: The compatibility determination for livestock grazing within the 2000 CCP for LPONWR (Volume 2-Appendix F-33) stated "…[annual] grazing will continue until 2005 and therefore will not be compatible until that year. Grazing may be used as a management tool to achieve specific habitat objectives. The details of how the tool would be used will be developed and discussed in the step down Habitat Management Plan scheduled for completion by 2005." Consequently, annual livestock grazing was incompatible from the 2005 grazing season thereafter in accordance with the CCP. In contrast, the use of prescriptive grazing in conjunction with other management tools (prescribed fire, mowing, and selective thinning) as presented in the HMP is compatible and represents a potential means to achieve the habitat objective for old fields based upon available science. Vegetation response associated with grazing as well as other management actions in old fields will be monitored to assess whether the HMP objective is achieved.

Comment: *"This letter is to address the issue of continued grazing of livestock on the Little Pend Oreille Wildlife Refuge in Stevens and Pend Oreille Counties of Washington State. The livestock community and ranchers grazing the LPO feel we were misled into thinking grazing would continue on the refuge. The USFW people from Portland's Regional Office came and assured there would be no end of grazing. The comprehensive plan disallowed permitted grazing, but would allow prescribed grazing. If the community had not been misled, there would have been many more comments for grazing on the LPO in the CCP public process. The comprehensive plan may have been adopted with prejudice."* (11)

Response: In a letter (December 28, 1993) from the Cada Cattle Company to Sanford Wilbur (Refuge Supervisor-Oregon/Washington/Idaho), a concern was expressed regarding the status of livestock grazing after the US Fish and Wildlife Service assumed management responsibilities of LPONWR from the Washington Department of Wildlife. A response was sent to the Cada Cattle Company in a letter dated January 10, 1994. In this response letter, Mr. Wilbur stated "As I said at the October meeting in Colville, our first year back at Little Pend Oreille will be for learning…Only after she and I feel we have a full understanding of what is going on at the Refuge will we consider any significant changes in administration. This doesn't mean that we might not 'tweak' a few things, like past Federal and State managers have done, but there will be no termination of current uses or addition of new uses without careful study and an opportunity for public input." Between 1994 and 1998, an average of 750 AUMs (range = 287 to 801) were used on LPONWR by the grazing permittees. As stated previously, the compatibility determination for the refuge CCP stated the annual livestock grazing would continue until 2005

and only prescriptive grazing to achieve wildlife and habitat management objectives described in a Habitat Management Plan would be permitted thereafter.

Biological Integrity, Diversity, and Environmental Health

Comment: "LPONWR, through its CCP and HMP, is one of the few refuges to date to comprehensively and effectively determine historic ecological conditions on the refuge and apply them to management. As stated in the HMP:

> *Because much of the forest landscape on LPONWR evolved under a frequent fire regime and was not subject to substantial grazing by native herbivores, a natural fire regime and forest management practices that will facilitate the recovery of natural ecological processes of native forest communities will be implemented to achieve refuge purposes, maintain and where appropriate restore biological integrity, diversity, and environmental health as well as manage for FWS mandated trust resources.*

Defenders supports this goal which is achieved through the HMP which emphasizes restoration of the forested and riparian habitat on the refuge.

We believe that all old fields should be restored to their forested, pre-settlement conditions. While early management of the refuge focused on game species that benefited from open fields, this early management cannot be interpreted as a purpose of the refuge, which is implied by the HMP." (41)

"We reject this rationale (game species are an important component of "other wildlife" specified in the executive order). Since the Executive Order and subsequent authorities used to create and expand the refuge did not specify groups of species beyond migratory birds, the FWS should employ the process outlined in the Integrity Policy to determine management goals for species and habitats." (41)

Response: The Refuge Improvement Act defines refuge purpose as: "purposes of the refuge and purposes of each refuge mean the purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit." Memorandum 11 from the Migratory Bird Conservation Commission meeting (September 24, 1940), which recommended the purchase of 1,041 acres for LPONWR under the Migratory Bird Conservation Act of 1929 (MBCA), states that establishment history for its 40,000 acres under Executive Order 8104 as "…for the protection of the Pend Oreille white-tailed deer, Rocky Mountain mule deer, ruffed, blue, and Franklin's grouse, minks, muskrats, bears, beavers, and waterfowl. Although the refuge was established under the MBCA, establishing memorandum identified other wildlife that was to be the focus of refuge management. The HMP identifies evaluating the use of fire and grazing on a 3-year rotation to provide nutritious forage for white-tailed deer (a State priority species) in old farm fields (1% of total refuge acreage) during the spring and as habitat for ground nesting migratory birds.

Comment: *"We particularly object to the tilling of non-native plants in these areas and the use of prescribed grazing. The Integrity Policy is quite clear that the FWS does "not allow refuges uses or management practices that result in the maintenance of non-native plant communities unless we determine there is not feasible alternative to accomplish refuge purpose(s)". We argue that indeed there are alternatives to planting non-native grasses in these open fields, including restoring the fields to forested areas, or at minimum planting native grasses."* (41)

Response: The HMP identifies implementation of a natural fire regime and forest management practices that will facilitate the recovery of natural ecological processes for 98% of the total refuge acreage. The 27.3 acres of alfalfa (less than 0.1% of the total refuge area), which is maintained through a cooperative farm agreement, is a cost effective method required to meet the spring energy demands on limited old field acreage needed to maintain populations of white-tailed deer (purpose species) that winter on the refuge. In addition, through fire, grazing, and agricultural practices on old fields, the refuge is able to distribute the wintering deer population to minimize potential risks from Chronic Wasting Disease that has been found in Canada and neighboring states.

The DHMP states that the LPONWR is directed to:

> *'Consider a range of habitat management strategies to meet specific wildlife or habitat management goals and objectives. To select appropriate strategies, consider the natural/historic frequency and timing of processes such as flooding, fires, and grazing by **native** herbivores. Where it is not appropriate or feasible to restore ecosystem function, refuge management strategies will mimic natural processes to the extent possible.'*

Note that management strategies that may be used are restricted to native herbivores, sideboards between which livestock grazing does not fit." (25)

Response: In accordance with the Biological Integrity, Diversity, and Environmental Health policy (601 FW3), management practices that mimic or consider natural ecosystem process (e.g., fire) are to be used to achieve habitat objectives, where feasible and practicable, in order to fulfill refuge purposes as well as maintain/restore biological integrity, diversity, and environmental health. Within Section 3.7E of this policy, a refuge manager can implement active manipulation of habitats to meet refuge purposes. To achieve the habitat objective within old fields on LPONWR (forage and fawning cover for white-tailed deer as well as foraging and nesting cover for landbirds), a range of management strategies (prescribed fire, mowing, prescribed rotational grazing, and selective thinning) are proposed within the HMP based upon the best available science. Through habitat monitoring over time, the LPONWR staff will identify the most economically feasible and practical management strategies and prescriptions necessary to achieve the habitat objective for old fields. The use of prescribed grazing to achieve the HMP objective for old fields is consistent with the compatibility determination within the CCP for grazing.

The DHMP states the following regarding compatibility of activities:

> *'With the exception of refuge management activities which are not economic in nature, all other used are subservient to the NWRS' primary wildlife management responsibility and they must be determined compatible before being authorized. For additional*

> *information regarding existing compatibility determinations for LPONWR, refer to the refuge CCP (US Fish and Wildlife Service 2000). Also, refer to Appendix 1 of this plan for further discussion about the history, use and evaluation of impacts associated with livestock grazing along with impacts associated with fire suppression and timber harvest on the LPONWR and the surrounding landscape.'*

Further, in the excerpt below, the DHMP states that even natural grazing was never a significant activity on the Refuge:

> *'Because much of the forest landscape on LPONWR evolved under a frequent fire regime and was not subject to substantial grazing by native herbivores (Appendix 1), a natural fire regime and forest management practices that will facilitate the recovery of natural ecological processes of native forest communities will be implemented to achieve refuge purposes, maintain and where appropriate restore biological integrity, diversity, and environmental health was well as manage for FWS mandated trust resources.'*

Therefore, the notion that livestock grazing could possibly mimic and recover a historic natural process on the Refuge is seriously suspect. (25)

Response: In Section 2.3.3, page 37 of the draft HMP is a description of the old fields that occur on the Refuge. These fields are totally artificial openings, created by homesteaders during the early 1900's by clearing native forest and planting a variety of non-native crops and forage plants. Rotational livestock grazing to achieve the habitat objective for old fields is not recognized as a natural ecosystem process that shaped native, historic plant communities within the LPONWR landscape. In accordance with the CCP compatibility determination, livestock grazing will be used as a management tool to achieve the habitat objective for old fields, where its use is not proposed in the context of mimicking a natural ecosystem process. In accordance with the Biological Integrity, Diversity, and Environmental Health policy (section 3.7E), a refuge manager can implement active manipulation of habitats to meet refuge purposes. However, for those sites that will remain in the artificial state as old fields due to CCP objectives, livestock grazing can be an effective tool for meeting habitat management objectives. As stated above, habitat monitoring will be used to identify the most economically feasible and practical management strategies and prescriptions necessary to achieve the habitat objective for artificially created old fields.

GIS

Comment: *"In the maps, I like the backdrop of the ortho images, but your shading symbols totally obscure the image. I suggest using the transparency option on the color symbols to allow the ortho to "bleed through." This effect is generally liked by most people. You may have to change some of your colors in this process, though. Finding the balance is the difficult part."* (32)

Response: Because the transparency effect is visually appealing, its use was considered. The ortho images are used as a backdrop only to give the reader additional information of the surrounding environment, but the vegetation data is the primary focus of these maps. Various

transparency options and color ramps were trialed for the HMP. If the transparency was such that the image could be seen, then it became too difficult to discern color values. If transparency was set lower such that the image could not be seen, there is no point in using transparency at all. Therefore, no transparency was used in order to maximize the color variances of symbols.

Comment: *"Refer to Figure A3.8. Why is the ortho in the NW portion light grey and in the SE portion bold? (I see why…the image outside is light.) I think these should show the same when they are outside the unit of interest. I suggest light in both areas so the eyes are drawn more to the center of the map."* (32)

Response: This option was considered and the authors found it more desirable to mask outside the refuge boundary only.

Comment: *"Some of the symbols with a map are missing. Please refer again to Figure A3.8. There are raster cells within the management unit that are not symbolized. Does this mean you have no information? It needs to be accounted for in the legend."* (32)

Response: The figures in Appendix 3 with cover types include areas that are identified because they were not classified as cold, dry, or moist forest (e.g., agriculture, shrub, urban). Within Section 2.1.2 under each management unit, we revised the text to indicate that cover types illustrated in even numbered figures for Appendix 3 pertained to dry, moist, and cold forest types.

Comment: *"I would think that your cover and habitat types came from vector data. I'm not certain here. Somewhere in the map section, knowing the source of these data as well as resolution and accuracy would help to inform the reader. If the data originally were vector, why is it drawn in raster? If it is raster, where did it come from? What is the cell size?"* (32)

Response: The original data is raster. Please refer to "Appendix 4. Geographic Information System Data Used for Little Pend Oreille National Wildlife Refuge" for details about the data, such as source and resolution.

Comment: *"I like the cool north arrow on the maps. The scale bars are nice, I would also like to see the representative fraction for scale as well (i.e. 1:24,000). It's easy to add and some people interpret that information more readily. Having a neat line around the legend would help set it apart. A legal disclaimer for use of the maps should be included somewhere. I recommend that for all published maps."* (32)

Response: Although some readers might find it helpful to have a representative fraction scale on the maps, FWS cartographic standards only require that scale is represented in both US and SI metric formats. A legal disclaimer has been added to "Appendix 4. Geographic Information System Data Used for Little Pend Oreille National Wildlife Refuge".

Comment: *After reading the draft Habitat Management Plan, I'm impressed at the information and detail gathered in such a short order. I'm not impressed in the detail of vegetation information. Looks pretty rough to me. I believe that if you are going to do specific*

management actions –acre by acre- you need specific vegetation on-the-ground data. What I see from your maps is only generalized refuge-wide data. I would assume before anymore grazing, that you would go out and collect good vegetation sample that will guide your goals." (32)

Response: We agree that site specific data will facilitate the implementation of habitat management strategies identified in the HMP. For management of old fields on LPONWR, site-specific monitoring data (e.g., species occurrence) has been and will continue to be collected, particularly for those sites being treated with prescribed fire and rotational grazing, in order assess achievement of habitat objectives described in the HMP. Previous to the implementation of all forest management actions, site-specific vegetation information is collected to determine the appropriate management strategies and prescriptions.

Support Continued Public Uses

Comments: "*We … are very much in favor of the Hunting, Fishing, Horseback riding and Livestock grazing rights on the Little Pend Oreille Game Range.*

Please include our letter of concern in favor of leaving the Little Pend Oreille Game Range open for the above citizen rights if this issue of property closure can be reconsidered." (23)

"We, Arden Old Timers Rodeo Association, are very much in favor of keeping the LPWR open to public access for hunting, fishing, horseback riding and continued grazing. Your consideration in this matter is much appreciated. Thank You" (66)

"I am very much for public use of the L.P.G.R.! Hunting, fishing, horse back riding and grazing. DO NOT SHUT US OUT!" (31)

"Please keep the Little Pend Oreille Wildlife Refuge open to public access of all kinds including grazing, hunting, fishing and horseback riding." (34)

Response: In accordance with Service policy, the HMP does not address the current public-use (recreational) activities like hunting, fishing and horseback riding that were found compatible in the CCP. Therefore, finalization of the HMP will not affect the current hunting, fishing and horseback riding as identified in the CCP for LPONWR.

Wildlife Species Not Receiving Protection

Comment: *"The Draft HMP and the Comprehensive Conservation Plan (CCP) both include in their purpose and goals as protecting all migratory birds. However, the LPONWR Staff only feels obligated to list migratory birds of their choice. Both of these documents include lengthy paragraphs of discrimination against the migratory brown headed cowbird. Their discrimination is not in compliance with the establishing Executive Order, since they must protect all migratory birds.*

During discussions with the LPONWR Staff, their response to this discrimination is the migratory brown headed cowbird was not in existence prior to pre-European times. However,

the LPONWR Staff has not provided evidence that 100% of the other migratory birds on their list were pre-European. Throughout the Draft HMP, pre-European standards are not consistently utilized for the different habitats throughout the LPONWR. It is unfair to narrowly focus the migratory bird list and discriminate against a bird that has utilized LPONWR habitat for nearly two centuries." (36)

Response: We assume the commenter is referring to Table 3.1 Resources of Concern (Conservation Targets) for the Little Pend Oreille National Wildlife Refuge of the Draft HMP. The bird section of the table is an abridged list derived from almost 200 species of birds that occur on LPONWR. Within Section 3.0 of the HMP, we selected species of migratory birds as conservation targets because they are recognized as focal species. As a focal species, their habitat requirements represent the larger assemblage of native migratory birds which inhabit the LPONWR and surrounding area. The migratory birds selected as focal species were adopted from Partners-in-Flight (Altman 2000). These are species that are of special concern due to factors like rarity or being representative of particular habitats of interest.

Although brown-headed cowbirds (*Molothrus ater*) did exist prior to European settlement of North America, they did not naturally occur in northeastern Washington. This species originally occupied the Great Plains where it was closely associated with native bison. When settlers introduced domestic livestock to new areas beyond the historic range of the bison, the cowbird expanded its range to ultimately occupy almost the entire North American continent. In addition, brown-headed cowbirds are nest parasitizers laying their eggs in other birds' nests, which is detrimental to the host birds' reproductive efforts. The range extension of cowbirds into new areas greatly impacted bird species that have not evolved defenses to parasitism. The LPONWR HMP specifically addresses the relationship between livestock occupancy on the refuge and associated presence of cowbirds which impacts other migratory birds.

Comment: *"Not all species are afforded the full protection of the Refuge. Most notable is the Columbia Frog. This species requires grazed areas for habitat. The Cow Bird is another that requires the presence of cattle. Although these species are to be protected by the plan, they are not adequately provided for."* (43)

Response: Columbia spotted frogs (*Rana luteiventris*) inhabit marshes, permanent ponds, lake edges and slow streams, usually where there is abundant aquatic vegetation. Scientific literature regarding the life history of this species identifies grazing as being detrimental to the species.

Refer to cowbird discussion in earlier response.

Custom and Culture

Comments: *"Last, there seems to be underlying bias by the managers of the LPONWR. Grazing and the associated practice have been the custom and culture of the area for decades yet these seem to be ignored. No economic considerations of the local population have been considered."* (43)

"By maintaining the History and Culture of the Community. The Hughson Family was grazing the land where the LPO is now. In the 1870's the Hughson's furnished meat to Fort Colville. (11)

Response: We are sensitive to the fact that changing the livestock grazing regime on LPONWR can cause hardship for its permittees. However, as previously mentioned, the management of the NWRS is directed by a series of legislative mandates and policies (See HMP Section 1.1) that were considered during the development of CCP for LPONWR. The CCP determined that annual grazing would only be compatible (allowable) for another 5 years (2000-2004). At the conclusion of the 2004 grazing season, the annual, season-long grazing that had been implemented would not be allowed on LPONWR. Under the CCP's preferred alternative, only prescribed grazing to meet wildlife and habitat objectives identified in a step-down HMP would be permitted on LPONWR after 2004. In the HMP, prescribed, rotational grazing was identified as a management strategy to achieve the old fields habitat objective. Please remember that this issue, as well as a discussion of the economic values of livestock grazing on the Refuge, was discussed during development of the CCP adopted in 2000. At that time, the permittees were given five grazing seasons, now extended to six, to adjust their operations as a result of this change. The draft HMP is only an extension of that document that develops specific habitat management goals, objectives, strategies, and prescriptions based on decisions made in the CCP.

Use Best Science

Comment: *"Using up to date science and stewardship, be willing to change the way the Refuge has been grazed for the past 100 plus years and be willing to step forward and use grazing as a tool for the 'good of the environment'.*

By using sound and latest science, we must listen and try new concepts. Both parties must work together, be willing for change, have goals, and have monitoring systems in place to meet our goals.

With today's (2004) relevant scientific information available, we have a number of people who have science backgrounds, with grazing and wildlife, that are willing to help us work to achieve both our goals. A partial list of professionals follows: (author included a list of 6 individuals).

We wish to see grazing remain on the Little Pend Oreille Wildlife Refuge using today's best available science, unprejudiced views, and total cooperation of both parties to seek the highest attainable goals for the Refuge. We want what would be best for our local economy, small business (the ranchers), and the environment." (11)

Response: Based upon an assessment of the available science (Appendix 1) regarding effects of season-long grazing to alluvial riparian, instream, and forest (aspen) habitats, it was determined that grazing will only be used in old fields on a rotational basis to meet the LPONWR HMP objective for this habitat. In similarity with other management strategies presented in the HMP, prescribed, rototational grazing only will be used to meet habitat objectives that are stepped down from the LPONWR CCP. Because the HMP policy for the Service requires on-going assessment of progress toward achieving objectives, monitoring will be conducted to evaluate

habitat response associated with management actions. The best available science will continue to be used on LPONWR to determine the appropriate management strategies to achieve HMP habitat objectives.

Miscellaneous

Comment: "*We at the NRCS do acknowledge that our Range Management Specialist, Bob Gillaspy, was present during the field review. However, the wording in the draft habitat management plan infers that members of the review team were all in agreement and that every member came to the same conclusion. We are not aware of any report that was signed or endorsed by all members of the review team. We cannot accept this representation and ask that the wording be changed. Though the reviewers may have noted some problems, there is no mention made of alternatives that were considered or if opinions varied-Which they did!*" (35)

Response: The HMP was modified to indicate that the conclusions identified in the report were the interpretation of FWS review personnel. The report recommendations prepared by the FWS considered management required to fulfill refuge purposes as well as other NWRS mandates and policies together with the input of all resource experts present during the review. The review team that was unable to identify any positive benefit for habitat or wildlife associated with the grazing program is specifically identified in the review report as Service personnel conducting the review. We modified the HMP to clarify FWS authorship of the review report.

Comment: "*The NRCS postion is that grazing can, in some instances, be used as a tool to maintain or enhance certain vegetative conditions that can benefit some wildlife species. Any grazing must be managed to achieve a described management objective and be closely monitored to ensure success.*" (35)

Response: We concur with the NRCS position regarding the use of grazing as a management tool to enhance vegetation conditions to benefit some wildlife. In Region 1 of FWS, 30 of 112 NWRs utilize grazing to achieve refuge-specific habitat and wildlife objectives. These objectives range from removal of naturalized annual vegetation to promote the growth of native, perennial grasses for the benefit of endangered species such as kangaroo rats, blunt-nosed leopard lizards, and San Joaquin kit foxes to management for short-grass habitat that supports foraging Canada geese and sandhill cranes. Other objectives achieved through grazing include removal of exotic vegetation from vernal pools to support endangered plants and invertebrates and removal of invasive plants by grazing sheep and goats.

Comment: "*Our family has grazed cattle on the Little Pend Oreille National Wildlife Refuge (LPONWR) land continuously since 1943 and the termination of our grazing permit on the Refuge has caused an undue financial and operational hardship. After reviewing the Draft Habitat Management Plan (HMP), I am submitting the following written response.*

Section 2.3.3 Old Fields: This section addresses the historical background of the fields and meadows within the LPONWR. However, the Draft HMP fails to account for and address the unique situation surrounding the meadow and corrals in the Flodell Creek area located on the LPONWR. In 1967, the Washington State Game Commission, the Washington State Department

of Natural Resources (DNR), and the United States Department of Interior (DOI) signed a Memorandum of Understanding (MOU) agreeing to an easement for the purpose of constructing a holding corral on the LPONWR. These corrals were to be used jointly by the permittees of DNR and Washington State Department of Game. In 1968, the corrals were constructed on the LPONWR utilizing DNR funding under program X-390-550-000. I have attached copies of supporting documentation concerning the MOU and construction of the corrals.

In January 2005, I contacted the local DNR Office and confirmed the MOU is still in effect and termination of the easement was not currently being negotiated. However, this important MOU is not addressed anywhere in the LPONWR Final Comprehensive Conservation Plan of August 2004 or the Draft HMP currently being reviewed for public comment.

When I contacted Jerry Cline (LPONWR Biologist) in February 2005, he stated our family would not be given a 2005 LPONWR grazing permit and would not be allowed to utilize the corrals. Furthermore, he stated the LPONWR had plans to fence the border between the DNR and the LPONWR during the summer of 2005. This action would be in direct violation of the Memorandum of Understanding without formal negotiation between DNR and the United States Department of Interior.

As a DNR permit holder, the location of these corrals has a significant operational impact in the conduct of our annual grazing program especially in the retrieval of our livestock at the end of the grazing season. These corrals are located on a 5 acre meadow in the northeast boundary corner of the LPONWR which is directly adjacent to DNR land where we lease over 10,000 acres. The importance of the corral's location is the meadow's lower topography in relation to the higher DNR land which aides in the natural migration of livestock to the lower meadow when colder temperatures set in during livestock retrieval in late September to early October.

Our family has utilized these corrals continuously since 1967 and we have never been notified by the LPONWR of any negative impacts to the habitat in this small meadow. Conversely, if we are not granted a LPONWR on/off grazing permit it will have a detrimental impact on our grazing operation on DNR lands.

Appendix 1. History of livestock grazing on LPONWR: This section addresses the number of permitees, AUMs, and locations of pastures. However, our LPONWR permit, AUMs, and pasture on Flodell Creek are never addressed or included.

Table A1.2: This table incorrectly lists grazing history for grazing unit 7e as "Not grazed". However, our family has continuously grazed this unit since 1943 in conjunction with our DNR permits." (15)

Response: For the last several years, Phillip Dubois has been issued a 30 AUM on-off permit due to his use of the five acre meadow and corral on the LPONWR. We have not considered this permit in the same light as the other annual livestock grazing permits due to the unusual nature of his use. His cattle only used the meadow and corral for short periods of time at turnout and gathering with the majority of their time spent on his adjacent DNR permit. For that reason, we considered the 5,828 acre grazing unit 7e as "not grazed".

We were not aware of the MOU Mr. Dubois described until March 2005 when we were provided a copy. The MOU stipulates that any of the three parties may cancel the agreement in writing with 30 days notice, and the Washington DNR then has 90 days to remove the corral if they so wish. We plan to submit this written notice to be effective at the conclusion of the 2005 grazing season. We have informed DNR about Mr. Dubois' situation and they are looking for an alternative corral site. With the one year grazing extension provided to all permittees including Mr. Dubois, there should be sufficient time for a satisfactory arrangement to be found that will accommodate Mr. Dubois' needs for the 2006 grazing season.

Comment: "*I have noticed a few other problems you might want to incorporate into the Final HMP. I notice tire tracks on horse trails. They appear to be mountain bike tracks. On steep slopes, mountain bikes or motorcycle tracks in a trail have a serious potential for erosion. Horses create individual divots that tend to slow water and promote infiltration, but continuous tire tracks channel water directly downhill with velocity. Increased education and enforcement are needed.*" (62)

"I also see tire tracks on cross-country travel routes, caused by refuge staff or trespass vehicles. It would be helpful if staff stayed on legitimate travel routes. The public has a follow-the-leader attitude about off road use." (62)

Response: We agree that tire tracks on horse trails can be a problem. It is a law enforcement and education issue if the tracks are from motorcycles which are prohibited from these trails. Mountain bikes are welcome on designated trails and their use has so far been encouraged. The problems caused by this type of use will be properly addressed in the Public use Management Plan which, like the HMP, is a step down plan referred to in the CCP.

Regarding the cross-country travel routes, we believe you are referring to unauthorized vehicle use. This is also a law enforcement and education issue that we are confronted with on a regular basis. We address it by signing, visitor contact through printed materials and personal contact, and citations when necessary. Keep in mind public access roads (closed to public vehicles during the winter months) and management access roads (not open to the general public) are used by the LPONWR staff to conduct wildlife and habitat management activities .

Comments: "*The CCP discusses the removal of fences from the Refuge as a 15-year project. A good, well- maintained boundary fence and removal of interior fences should be a high priority. I have removed several dead animals from livestock fences, including deer that got their hind legs wrapped in wire strands and starved until coyotes put them out of their misery. This kind of hostile wildlife environment does not belong on a National Wildlife Refuge. The final HMP should accelerate the schedule.*" (62)

Response: We agree that the interior fences on the refuge are a hazard to wildlife, particularly in light of their poor condition. Although the CCP discusses a project for removing extraneous fences, it was not included as a specific objective in the CCP. As a result, it was not carried through as an objective in the HMP. However, we will continue to remove fences (as time and

funds allow) with priority placed on those in white-tailed deer winter range. In addition, new boundary fences are built to a standard designed to minimize their hazard to wildlife. The strategies associated with rotational prescribed grazing in old fields require the use of temporary fences.