FIRE MANAGEMENT PLAN/ENVIRONMENTAL ASSESSMENT

LRNRA Whispering Pines Fire, 2006

U.S. Department of the Interior
National Park Service

Fire Management Plan
Environmental Assessment
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Lake Roosevelt National Recreation Area

Abstract

Pursuant to National Park Service (NPS) fire management policies and guidelines, all units of the NPS with vegetation that can sustain fire must have a fire management plan. The Fire Management Plan (FMP) and Environmental Assessment (EA) provides the policy guidance managers need to make fire management decisions based on current and anticipated conditions.

Vegetation at Lake Roosevelt National Recreation Area (LRNRA) includes at least three fire-prone ecosystems, these being steppe (semi-arid grassland), shrub/steppe, and ponderosa pine (*Pinus ponderosa*) forest. Fire plays a critical role in the health and maintenance of each of these ecosystems. The long history of suppressing fires in the region has also had effects on the park's vegetative communities. The last FMP for the park was completed in 2009 (National Park Service, 2009c). This new FMP will serve as a planning document for the park for the next 5 to 15 year period. It includes a number of updates meeting current Department of Interior and NPS policies. It also includes all park lands in the two Fire Management Units which will facilitate park-wide management and response actions to wildland fire events.

The FMP includes two alternatives which received a detailed review in this environmental assessment:
Alternative 1 – (No Action) – Continuance of a multi-year native vegetation restoration approach to include the 32 treatment areas defined in the 2009 FMP, as well as the Defensible Space units that were created between 2009 and 2013. Continued full suppression of all wildfires, use of mechanical treatment and prescribed fire to achieve forest restoration objectives and provide for public safety.

Alternative 2 – (Enhanced Protection of Neighboring Lands and Park Resources Alternative) – A multi-year native vegetation restoration approach and Wildland Urban Interface (WUI) fuels reduction emphasis to include 54 additional treatment units. Continued full suppression of all wildfires, use of mechanical treatment and prescribed fire to achieve native plant restoration and forest health objectives, provide for public safety, enhance defensible space adjacent to park infra-structure and private property, and approve the removal of 1000 hour fuels (fuels with a diameter of 3 to 9 inches) for salvage and firewood on a case by case basis.

Alternative 2 is the NPS preferred alternative. The majority of predicted adverse impacts under this Alternative would occur as a result of expanding fuels management to 54 additional treatment units. Long-term adverse impacts would be negligible for air quality, water resources, soils, plants, wildlife, sensitive species and their habitat, cultural resources, visitor use and experience, safety, and neighboring lands; especially in comparison to the impacts that could be seen if large-scale, wildfires were to originate on and expand from NPS lands.

This environmental assessment provides guidance for the further management of fire within LRNRA. Due to the programmatic level of environmental compliance completed, further site specific analysis may be required before implementation of the activities proposed in the FMP EA. Also, due to the nature of how Lake Roosevelt is managed, many issues will

require continued coordination and consultation with the managing partners (Bureau of Reclamation, Bureau of Indian Affairs, Confederated Tribes of the Colville Reservation, and the Spokane Tribe of Indians) and other interested partners and parties.

Individuals or organizations wishing to provide written comments during the review period can access the Planning, Environment, and Public Comment system (PEPC) at http://www.nps.gov/laro/parkmgmt/planning.htm or in writing to: Superintendent, Lake Roosevelt National Recreation Area, 1008 Crest Drive, Coulee Dam WA 99116.

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1.0 PURPOSE AND NEED FOR ACTION

A. Need for Federal Action and EA Revision

This document was prepared in accordance with the National Environmental Policy Act (NEPA) and NPS *Management Policies* (NPS, 2006a) to analyze the 2009 FMP and propose the enclosed revisions. Implementation of the Federal Wildland and Prescribed Fire Management Policy Guidelines (National Wildfire Coordinating Group, 2006), with the associated changes of terminology and implementation procedures, makes it necessary that fire management plans reflect current direction. Further, the NPS proposes to add project areas for hazard fuel reduction and to revise the operating guidelines for project implementation including the use of mechanical methods and prescribed fire to accomplish management objectives. Some of these mechanical methods are being proposed for other than over snow or frozen ground operations as was specified in the Finding of No Significant Impact (FONSI) of the previous EA. Different impact analysis and greater level of survey may be required. In addition, LRNRA published their General Management Plan (NPS, 2000) in January of 2000. Updating the FMP to incorporate new wildland fire terminology and policies as expressed in NPS *Management Policies* (NPS, 2006a), verified through Director's Order 18, 2009 (DO-18) and implemented in NPS Reference Manual 18 (RM-18) while tiering off goals and objectives of the 2000 GMP will continue.

A FMP is also required under DO-18, which states: "All parks with vegetation that can sustain fire must have a Fire Management Plan" (NPS, 2009a) A FMP is a detailed description of strategies and actions intended to provide direction for the effective management of wildland and prescribed fire on a particular area of land. It is developed in accordance with the federal policies outlined in *Guidance for Implementation of Federal Fire Policy* (National Wildfire Coordinating Group, 2009). This EA is the supporting document of the FMP and is used to steer fire plan direction through public input and meet the requirements of NEPA.

National Park Service policy recognizes that fire is an important ecological and evolutionary force in many terrestrial ecosystems. The policy further states that fire will be managed to fulfill the need of protecting, perpetuating, or recreating natural environments or historic scenes. Fire management strategies for individual parks must be designed based on park management objectives. The resource management objectives of the park may determine whether a prescribed fire component is needed. Vegetation at LRNRA includes at least three fire prone ecosystems, these being steppe (semi-arid grassland), shrub/steppe, and ponderosa pine forests. Fire historically played a critical role in the health and maintenance of these ecosystems.

Since the influx of Euro-Americans to the LRNRA region in the 1820's varying levels of fire suppression occurred, beginning with the suppression of fires around building developments. Another form of unintended suppression increased as more livestock was brought into the area. Livestock grazing would reduce the amount and continuity of the fine grassy fuels, essentially making areas less fire prone (Ortman et al. 1998). Fire policies began to be formalized in the early 1900's as a reflection of catastrophic fires that resulted in part from an era of settlers clearing land with fire and poor logging practices (Agee, 1993). At the establishment of the recreation area, efforts were probably begun to actively suppress fires. This capability improved

in the 1960's, when suppression became more effective allowing fewer fires to become large. Today LRNRA fully suppresses all wildland fires on the recreation area. This is not expected to change with the approval of this plan although an increased prescribed fire element may be added to the management scheme.

The suppression of fire at LRNRA has eliminated a high frequency low intensity fire cycle of 6 to 19 years typical of ponderosa pine forests (Huff et al., 1995). The benefits of these historic fires included reduction of duff material, recycling of nutrients, reduction of accumulating fuels, pruning of trees which reduced ladder fuels into the canopy, thinning of regenerating pines, sanitizing of trees with dwarf mistletoe (*Arceuthobium spp.*), and the encroachment of young conifers into grasslands. These benefits have not been available with the suppression of fires. Past wildfire suppression actions have led to many forest stands that are overly dense causing a shortage of resources needed for vigorous growth. This limiting of resources affects not only the size and volume of the tree, but also reduces the tree's ability to fend off attacks by various endemic insects and diseases. In turn, dying trees eventually lead to heavier fuel loads on the forest floor. The exclusion of fire in the steppe, shrub-steppe, and ponderosa pine ecosystems in the future will continue the stress on vegetation as systems become more and more out-of-sync from the norm. Importantly, the continuing buildup of forest fuels will increase the frequency and severity of wildfires threatening LRNRA visitors and adjacent property owners.

The NPS needs this plan to guide management decisions in response to wildland fire incidents occurring within LRNRA and adjacent to the area's boundary. Presently, and in the future, all wildland fires will be suppressed. The size and configuration of LRNRA's land base eliminates the option of using wildfire to obtain other resource objectives that may be possible in a park with a large aggregate acreage. In contrast, the preferred alternative proposes to add a prescribed fire and mechanical fuel treatment component that would enhance the NPS ability to manage and improve the park's ecosystem components and processes while providing for firefighter and public safety.

The FMP must also address the WUI issue. Private lands, many of which contain homes and other structures, border much of LRNRA. These private properties could be affected by NPS policy regarding the management of its forest fuels. The use of prescribed fire, along with mechanical means to reduce forest fuel loads, will reduce the risk for wildland fires moving onto adjacent private property.

Fire management planning, utilizing the NEPA planning process, has evolved since the original FMP and FONSI were approved on March 9, 2001. An update of the 2001 FMP was developed under parameters developed as a result of a new NEPA planning process completed with a FONSI signed January 14, 2009. The 2009 FMP environmental assessment would be superseded by this proposed FMP/EA to include additional project areas and effects to resources on these additional acres. Prior to implementation, each individual unit will be assessed for; archaeological/cultural significance and impacts (Section 106), silvicultural needs, and, threatened and endangered/sensitive species. Once each unit has been assessed, a suitable treatment option will be applied.

Lake Roosevelt National Recreation Area Background

In 1946 the Secretary of the Interior, by his approval of an agreement between the Bureau of Reclamation, the Bureau of Indian Affairs, and the NPS, designated the NPS as the manager for Coulee Dam National Recreation Area. The area included Franklin D. Roosevelt Lake, the Reservoir formed behind Grand Coulee Dam, and the "freeboard" lands that were purchased at and above the1310' elevation. Through over 50 years of changes, including a name change to Lake Roosevelt National Recreation Area in 1997, the NPS now manages approximately 47,438 acres of the 81,389 acres of total water surface, associated shoreline, and 12,936 acres of the 19,196 acres of total freeboard land. In 1990, two adjacent Native American Tribes were included in the Lake Roosevelt Cooperative Management Agreement. The Confederated Tribes of the Colville Reservation (CCT) and the Spokane Tribe of Indians (STI) manage the remaining water surface and freeboard land (NPS, 2003a).

The purpose and significance of LRNRA, as articulated in the park's 2000 GMP, is as follows:

1. Provide opportunities for diverse, safe, quality, outdoor recreational experiences for the public.
2. Preserve, conserve, and protect the integrity of natural, cultural, and scenic resources.
3. Provide opportunities to enhance public appreciation and understanding about the area's important resources.

Significance

Lake Roosevelt National Recreation Area offers a wide variety of recreation opportunities in a diverse natural setting on a 154-mile-long lake bordered by 312 miles of publicly owned shoreline. It contains large sections of the upper Columbia River and Spokane River, and a record of continuous human occupation dating back more than 9,000 years. It is contained within two distinct geologic provinces – the Okanogan Highlands and the Columbia Plateau - both of which were been sculpted by ice age period glaciers and catastrophic floods.

B. Objectives

The wildland fire management program of a park, carefully guided by resource management objectives, should protect cultural resources and perpetuate the natural resources and their associated processes and systems. The preservation of natural and cultural resources within LRNRA is the fundamental requirement for its continued use and enjoyment by park visitors as a unit of the National Park System.

General resource management goals are outlined in the Park's 2000 GMP, which states that a purpose of the area is to "Preserve, conserve, and protect the integrity of natural, cultural, and scenic resources". (NPS, 2000).

The wildland fire management plan for LRNRA (NPS, 2014) includes the following goals:

1. Provide for firefighter and public safety. This is the first consideration and highest priority when implementing elements of the fire management plan.

2. Develop a systematic approach to dealing with wildfires as well as the planning and implementation of prescribed fire projects.
3. Promote interagency planning wherever possible.
4. Include rehabilitation techniques and standards that comply with resource management plan objectives and mitigate safety threats.
5. Develop and maintain staff expertise in all aspects of fire management.
6. Prevent, where possible, all wildfires from burning onto adjacent lands.
7. Provide for the continuation of the natural role of fire in the ecosystem through the use of prescribed fires consistent with the protection of life, cultural/natural resources, including air quality, property, and adjacent land values.
8. Mechanically treat fuels, including thinning of trees, in preparation for the use of management-ignited fires or treatment of areas where management ignited fires are not deemed appropriate.
9. Develop a prescribed fire-monitoring plan.
10. Foster informed public participation in fire management activities to enable the park to respond appropriately to the needs of adjacent landowners.
11. Effectively integrate the fire management program into all park activities and operations.

C. Issues and Impact Topics

Each parcel is identified as a potential project unit. Each project unit will be evaluated prior to area specific implementation for cultural, archaeological, biological, and land use impacts, and consultation will take place with the affected tribes, state, and/or federal agencies.

This EA identifies areas where the use of prescribed fire and mechanical treatment, is used to achieve resource and protection management objectives. The EA will identify the potential impacts that may be associated with the use of prescribed fire, including what steps may be needed to prepare an area for prescribed burning (e.g., mechanical treatment to reduce fuel loads, etc.). Although the 2009 environmental assessment and FONSI is being supplemented to include additional treatment areas, treatment types, etc., issues identified in the initial 2009 scoping still persist. Issues raised in the meetings generally related to the conditions under which prescribed fire might be used, the decision making process, how potential impacts to adjoining private lands would be taken into account, smoke management, and advance notification of adjoining landowners.

These issues include:

1. Safety of visitors, firefighters, and adjacent property owners.
2. Hazardous fuel accumulations.
3. Protection of natural resources, including air, water, soil, plants and animals.
4. Mitigating spread of invasive weeds from prescribed burning.
5. Prescribed fire effects on federal and state listed sensitive species.
6. Escape of fires, especially prescribed fires, on to adjacent private land.
7. Effects to adjacent landowners including smoke from prescribed burns and noise from thinning activities.
8. Protection of cultural resources.

9. Effects on recreation use.

These issues led to the following Impact Topics, which are analyzed in the Environmental Consequences section, Chapter 4.

1. Air Quality
2. Water Resources
3. Soils
4. Plants
5. Wildlife
6. Sensitive Species
7. Cultural Resources
8. Visitor Use and Experience
9. Safety
10. Adjacent Landowners

2.0 ALTERNATIVES

This section describes the alternatives considered, including the proposed action and the *No Action* alternative. It summarizes some of the environmental consequences and defines the differences between the alternatives, especially in how their environmental consequences differ. There are two alternatives being analyzed in this environmental assessment: ***No Action*** Alternative (Alternative 1) and the ***Enhanced Protection of Neighboring Lands and Park Resources*** Alternative (Alternative 2).

A. Elements Common to All Alternatives

FIRE MANAGEMENT ACTIONS COMMON TO BOTH ALTERNATIVES

1. Under all alternatives, full suppression actions will be taken on all human and natural caused wildfires, with the exception of prescribed fires. Full suppression actions would provide for public, park staff and firefighter safety, protect public and private resources, and utilize techniques that are least damaging to LRNRA's natural and cultural resources.

2. The safety of firefighters, park staff and the public is the number one priority in the fire management program.

3. Wildfire use for resource benefits, the use of wildfires to benefit resources, would not be allowed under any of the alternatives. "Human caused wildfires" does not include prescribed fire, unless the prescribed fire goes beyond the unit boundaries and is declared a wildfire.

4. Mechanical treatments, including thinning of trees, may be used to reduce fuel loading, and thinning or taking of diseased or infested forest stands.

5. Prescribed fire, including pile burning, will be used for hazard fuel reduction, maintenance and/or re-creation of historic landscapes and ecosystem management including:

    a. **Hazard fuel reduction:** Reduce hazardous fuel accumulations in LRNRA to protect the forest, natural/cultural/historic resources, public and private developments and property. Hazard fuels are those fuels that have unnaturally accumulated within LRNRA boundaries as well as natural fuels that threaten developed facilities.

    b. **Ecosystem management**: Fuels in prescribed fire projects designed to meet resource management objectives will be reduced either mechanically or by using prescribed fire. Ecosystem management projects, which enhance natural processes and native flora and fauna while using prescribed fire, will be actively pursued. Simulate the natural benefits (the historical range of variability) of fire on the ponderosa pine forests and grasslands.

    c. **Cultural landscapes**: Prescribed fire will be used to recreate and maintain historic landscapes where appropriate.

    d. **Prescribed Fire Plan**: All prescribed fire projects will have a Superintendent approved Prescribed Fire Plan and will only be implemented under the constraints of that plan. Personnel positions listed in the Prescribed Fire Plan must be on site before initiation of the prescribed burn.

    Once restoration goals are met, maintenance burning will be performed on a schedule ranging from 5 to 15 years based on monitoring of the fuel bed load using the National Fire Monitoring Handbook (NPS, 2003b) or other methods of data collection when areas do not contain permanent fire monitoring plots.

    It is possible that prescribed fire would not be utilized in some years due to staffing and funding shortfalls or lack of favorable weather. Prescribed fire would be applied only when all the requirements described under RM-18 for prescribed fire plans are met. A prescribed fire plan includes measurable criteria that define conditions under which fire may be ignited. Prescription criteria includes: fuel moistures, weather parameters and spot forecasts, holding force requirements, firing techniques, and timing (NPS, 2009b)

6. NPS managers would have approval to remove wildfire killed vegetation within the perimeter of the wildfire when deemed necessary for protection purposes. They would also have approval to remove 1000 hour fuels prior to prescribe burns thru salvage logging, chipping and removal of tops & branches (including firewood removal). Firewood removal would be completed by NPS staff or through superintendent authorized permits to the public. Firewood could be offered as a donation to charities and other non-profit organizations. Hazardous trees felled for safety purposes could be considered firewood.

MANAGEMENT ZONES COMMON TO BOTH ALTERNATIVES

Management Zones: The following Management Zones were identified and mapped during the development of the LRNRA 2000 GMP.

1. ***Concentrated Recreation Zones:***
   Fuel reduction activities in Concentrated Recreation Zones will be actively managed for aesthetics. In order to maintain aesthetics within concentrated recreation areas, vegetation will be manually thinned and crown densities will be maintained to provide adequate shade for these areas. In addition, slash will be treated on site prior to the peak visitor use season (Memorial Day – Labor Day). To mitigate any potential impacts to visitor and public enjoyment, informational and interpretive messages would inform and educate visitors and the public about the historic role of fire in these ecosystems and the objectives of fuel reduction techniques.

2. ***Developed Recreation Zones:***
   Fuel reduction activities in Developed Recreation Zones, which include areas of the park with adjacent vacation cabins, will be actively managed for restoration of the naturalized area. In order to maintain these areas, vegetation will be manually thinned in conjunction with prescribed burns; basal area will reflect silvicultural prescriptions. Pre-reservoir access routes may be used to access these areas. In many cases, routes do not exist. No heavy equipment on slopes greater than 25 percent will be allowed. Skid trails will be water-barred and seeded after skidding operations if necessary.

   Slash will be left on site in preparation for prescribed burns throughout the area. However, the amount of slash left on site should not provide a nursery for insect outbreaks or lead to large areas of sterilized soils after burning so that invasive plant species can easily establish. Decisions on how to manage slash will be guided by recommendations from the U.S. Forest Service (USFS) Wenatchee Forest Pest Office. To mitigate any potential impacts to visitor and public enjoyment, informational and interpretive messages would inform and educate visitors and the public about the historic role of fire in these ecosystems and the objectives of fuel reduction techniques.

3. ***Historic and Interpretive Zones:***
   This management area would include locations where important historic or cultural resources would be preserved and interpreted for the public, recognizing that historic vegetation is an important component of this landscape. In order to maintain these areas, vegetation will be manually thinned in conjunction with prescribed burns, basal area will reflect cultural landscape designs. Pre-reservoir routes may be used to access these areas. In many cases, routes do not exist; no new roads will be cut in these areas.

   Slash will be treated prior to heavy visitor use season, or left on site in preparation for prescribed burns throughout the area. However, the amount of slash left on site should not provide a nursery for Invasive Pest Species (IPS). Decisions on how to manage slash will be guided by recommendations from the USFS Wenatchee Forest Pest Office. To mitigate any potential impacts to visitor and public enjoyment, informational and

interpretive messages would inform and educate visitors and the public about the historic role of fire in these ecosystems and the objectives of fuel reduction techniques.

4. ***Special Use Zones****:*
   Fuel Reduction Activities in the vicinity of Special Use Zones will be actively managed for restoration of the naturalized area to a healthy forest condition. In order to maintain these areas, vegetation will be manually thinned in conjunction with prescribed burns and basal area will reflect silvilcultural prescriptions once the treatment unit reaches a maintenance mode. Pre-reservoir routes may be used to access these areas. In many cases, routes do not exist, no heavy equipment on slopes greater than 25 percent will be allowed. Skid trails will be water-barred and seeded after skidding operations if necessary.

   Slash will be left on site in preparation for prescribed burns throughout the area. However, the amount of slash left on site should not provide a nursery for IPS. Decisions on how to manage slash will be guided by recommendations from the USFS Wenatchee Forest Pest Office. To mitigate any potential impacts to visitor and public enjoyment, informational and interpretive messages would inform and educate visitors and the public about the historic role of fire in these ecosystems and the objectives of fuel reduction techniques.

5. ***Dispersed Recreation Zone:***
   Fuel Reduction Activities in Dispersed Recreation Zone will be actively managed for restoration of the naturalized area. In order to maintain these areas, treatment of vegetation will consist primarily of prescribed burning, unless objectives cannot be met with prescribed fire alone, and access exists allowing mechanical fuel reduction. If fuel loadings are deemed to generate extreme fire behavior with associated unacceptable impacts, then mechanical fuels reduction methods may be utilized as a pre-burn treatment to mitigate fire behavior to acceptable levels.

   Slash will be left on site in preparation for prescribed burns throughout the area. However, the amount of slash left on site should not provide a nursery for IPS. Decisions on how to manage slash will be guided by recommendations from the USFS Wenatchee Forest Pest Office.

TREATMENT OPTIONS COMMON TO BOTH ALTERNATIVES

Forested parcels in the restoration phase will be treated with one or more of these treatment options:

1. Understory Thinning – Thinning of trees growing beneath the older, taller dominant and co-dominant trees (primarily trees of less than 8 inches in diameter at breast height (dbh)). These can be lopped and scattered in lighter stands or slash piled in denser areas for treatments associated with secondary entries into the treatment unit.

2. Crown (Overstory) Thinning – Thinning of dominant and co-dominant trees to decrease density to resemble stands within the historical range of variability of ponderosa pine and

mixed conifer forests thinned by fire. These projects should include salvage removal of the trees/logs which will greatly reduce the 1000 hour fuels and future fire intensities and also lower the contracted costs of removing the large wood components.

3. Prescribed Burning – Burning either for restoration includes the removal of slash piles, or for maintenance phase fuel reduction.

4. Chipping – Chipping of smaller materials primarily used to provide defensible space near structures or to treat slash in campgrounds without removing nutrients from the site.

5. Removal of Individual and/or Pockets of Hazard Trees – With numerous boat launch, camping, boat-in camping, and day use facilities scattered along the length of the recreation area, and with an ever increasing number of recreational and permanent homes scattered along the park's boundary, the removal of hazard trees is becoming an ever increasing management issue for the park. Root fungus, mountain pine beetle, visitor damaged, and a host of other mortality reasons including poor forest stand health and possibly climate change impacts are leading to numerous dead trees that threaten campers, visitors, park staff, park infrastructure, and neighboring homes and outbuildings. The dropped hazard trees represent large amounts of fuels if not removed. Hazard trees are primarily removed using chainsaws, handcrews, and in areas with roads, by front-end loader and truck. Much of the wood can be utilized as firewood in park campgrounds, maintenance shops, or delivered to local mills to be sawn into replacement boards for historic structures and other maintenance needs. Firewood collection permits may be issued by the superintendent to park neighbors and the public in the case of large amounts of wood occurring from hazard trees or major blowdowns along park boundaries. Park staff will typically buck the trees into firewood size pieces and not authorize the use of chainsaws except in very unusual circumstances. This removes significant amounts of heavy fuels that can threaten both park resources and neighboring developments during wildfire events.

Combinations of some or all of these treatments on each unit will be performed in the restoration phase during one or more entries into the treatment unit. Stands with a very high density (over 200 ft^2 of basal area/acre) may need prescribed burning between the understory thinning and crown thinning, and salvage removal of the large wood in addition to prescribed fire after crown thinning. Some units may not have a very high density but contain a heavy down fuel load or deep litter layer that will need prescribed fire between understory thinning and crown thinning phases.

In many of these forested units, the re-introduction of fire, without thinning prior to burning, will kill a larger number of overstory or mature trees. This will bring the stand characteristics further away from stands within historical range of those with a typical fire regime. In other stands, if the down fuel load is too high, the fire will have a tendency to partially sterilize the soil. As stated previously this will take key ecosystem components even further away from desired conditions.

Basal Area targets for forested areas will range from 40 square feet to 80 square feet of Basal Area dependent on the site index curves productivity estimates. As noted above, it is not expected that these basal targets will be reached in a single entry. Additional considerations for basal area targets in and near Concentrated and Developed Recreation zones may include leaving strips of denser forest as visual screens between NPS administrative buildings, neighboring developments, and roadways thereby contributing to the visitor experience.

Though a much lower park-wide priority except at a few sites, the shrub-steppe areas may be treated with the use of prescribed fire alone. If fuel loads are heavy, the prescription can be tailored to put an appropriate amount of heat in the unit for restoration purposes. Control lines may also need extra work in the restoration phase to help keep fire confined within project boundaries. Defensible space areas near structures that are either too small or hazardous to include the use of fire would be better served by using other brush disposal techniques such as cutting and removal by chipping or pile burning. The threat of fire increasing the threat of cheatgrass (*Bromus tectorum*) and other invasive weeds benefitting from fire and the small land base of the park make the treatment of this vegetation type a low priority.

The primary objective for using the above listed tools and completing these projects on the identified treatment units is to reduce the level of fuel accumulation thereby reducing the chances of a wildfire escaping control measures, threatening park resources, and spreading to adjacent private property. Secondary objectives include moving the forest toward a more historic condition and improving forest health and ecological processes.

Measures will be taken in project implementation to protect cultural resources, sensitive plants, animals, and wildlife habitat in general. Prior to undertaking any projects the NPS will complete an internal scoping process to comply with the requirements of NEPA. The NPS will follow the process as described in Sections 2.6 and 3.2 of Director's Order-12. (NPS, 2006b) A burn plan specifying parameters for each prescribed fire will be completed for each project in compliance with DO -18 and RM-18.

Lake Roosevelt National Recreation Area, in achieving fuel reduction by mechanical thinning and prescribed burning on any pre-identified units throughout the park, will be evaluating all units broken down by treatment type in this environmental assessment, in relation to the impacts and mitigation measures for those treatment types.

Many forest stands will require mechanical thinning prior to re-introduction of prescribed fire. Mechanical treatment would be a pre-treatment designed to reduce fuel loading and ladder fuel continuity in project areas containing high tree densities. Attempting to introduce prescribed fire into these stands would have potentially catastrophic results in the form of stand replacing crown fires. A different pre-treatment option is to reduce the total fuel loading on a site through chipping or through piling and burning. Lowering the total fuel load before the introduction of prescribed fire (understory or broadcast burning) will reduce the effects of burning on the ground surface and subsurface soil layers. Individual large snags will be retained where they don’t pose a safety hazard and occasional untreated patches within the project areas will be left for wildlife habitat purposes. However if a tree is identified as a hazard in the following zones:

Concentrated, Developed and Historic/Interpretive, it will be removed during fuel reduction activities if possible. (NPS, 2012).

In addition to the project areas identified, the NPS may treat additional, small areas on a case-by-case basis. These defensible space projects may be initiated after a request from an adjacent land owner desiring to lower forest fuels in order to reduce the chance of a wildfire spreading from LRNRA lands to his/her private land or vice-versa. Upon such request, the NPS will assess the situation and may agree to perform fuels reduction if not in conflict with current LRNRA management plans and/or policy. This may include mechanical thinning, hand piling and burning accumulated ground fuels, and brush removal for up to 200 feet from any private structure. These types of fuel reduction projects would be second priority to any projects listed, would be at the park's discretion, and are dependent on available funds and resources. These defensible space projects are a management tool to address special cases of heavy fuel loads, major forest mortality events, and areas where steep slopes and other site specific conditions create the potential for intense and rapidly moving wildfires coming off of NPS lands. This is not a fix-all solution for poor placement of homes immediately adjacent to U.S. Government lands (i.e. little to no setback) or as protective measures for residential buildings constructed with non-fire resistant roofing and siding materials. Fire management staff at LRNRA will actively pursue partnerships with Washington Department of Natural Resources (DNR), local fire districts and participating conservation districts to provide adjacent landowners technical assistance and directing landowners to information on the *Firewise,* 2014 website operated by the National Fire Protection Association (NFPA). *Firewise* provides fuels management prescriptions to landowners which can reduce the potential for wildfire damage. Information is continually updated on the *Firewise* website: http://firewise.org. (NFPA, 2014). Resource protection and administrative staff at LRNRA will proactively work with county commissioners and planners to promote county zoning measures that include setbacks facilitating defensible space measures and that have construction requirements for fire resistant roofing and siding in forested areas.

The FMP under all alternatives will have a multi-year span. After completion of projects the NPS will undertake an extensive review and make any necessary revisions. During this period, the NPS may make revisions to the plan if conditions and policies warrant changes to the plan e.g. changes in federal guiding policies such as changes made in 2009 to federal policy on response concerning wildfire. Now instead of requiring suppression, managers are allowed to use wildfire for resource benefits with firefighter & public safety continuing to be the foremost goal in fire management.

B. Description of Alternatives:

Table 1 displays fire management activities proposed for each alternative.

Table 1: Alternative Comparison Summary of Proposed Management Activities in Acres

	Fiscal Year															
Proposed Activities	2014		2015		2016		2017		2018		2019		2020		2021-2026+	
	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2
Broadcast Burn *	228	298	225	225	82	82	131	131	45	205	0	135	0	233	0+	277+
Maintenance Burn *	46	46	171	171	97	97	70	70	57	57	36	36	20	20	158+	158+
Handpile	170	170	25	93	50	106	62	111	50	184	50	198	50	85	300+	1831
Handpile Burn^{+}	90	90	210	210	99	167	187	336	187	329	87	295	75	351	450+	2214
Thin	170	170	125	218	50	106	50	99	50	184	50	198	50	287	300+	1831
Lop / Scatter	54	54	50	87	0	42	0	40	0	74	0	79	0	196	0	567
Machine Pile			100	100												
Machine Pile Burn					100											

Broadcast Burn / Maintenance Burn*: LRNRA plans to ignite less than 150 acres of Broadcast Burns, and less than 50 acres of maintenance burns per year. More acres are on the schedule to give park staff flexibility with weather patterns and unit specific fuels availability. *Example: Units not completed in 2014 will be added to 2015 etc.*
Handpile Burn $^{+}$: LRNRA could ignite all available handpiles per season or a reduced number per season based on staffing.

Alternative 1 – (No Action) – Continuance of a multi-year native vegetation restoration approach to include the 32 treatment areas defined in the 2009 FMP, as well as the Defensible Space units that were created between 2009 and 2013. Continued full suppression of all wildfires, use of mechanical treatment and prescribed fire to achieve forest restoration objectives and provide for public safety.

As described in the 2009 FMP EA FONSI Alternative 1:
"will involve full suppression actions on all human/natural-caused wildland fires; mechanical treatment of fuels will be performed; and prescribed fire will be used in certain circumstances. All wildland fires would be suppressed as quickly as possible, while ensuring public and firefighter safety, and protection of natural/cultural/historic resources, park developed areas and neighboring private lands."(NPS, 2009c)

Alternative 1 would continue the treatments outlined in the LRNRA FMPs 2001 and 2009. It proposes up to 1,413 acres of prescribed fire through 2020: 382 acres of broadcast burning (27%), 713 acres of handpile burning (50%) and 318 acres of maintenance burning (23%). Additionally Alternative 1 would add 158 acres of Maintenance burns in 2021 and beyond and 75 acres of pile burns per year in 2021 and beyond. (See Appendix 5)

Under previous LRNRA fire management plans (2001 and 2009), approximately 1,952.8 acres have received or are scheduled to receive one or more treatments for fuels management and forest health. This represents 15.1% of the total park lands of 12,936 acres. Alternative 1 will continue new, follow-up, or maintenance treatments on these acres out to the year 2025 as staffing and funding levels allow.

Alternative 2 – (Enhanced Protection of Neighboring Lands and Park Resources Alternative) – A multi-year native vegetation restoration approach and WUI fuels reduction emphasis to include 54 additional treatment units. Continued full suppression of all wildfires, use of mechanical treatment and prescribed fire to achieve native plant restoration objectives, provide for public safety, and enhance defensible space adjacent to park infra-structure and private property, and approve the removal of 1000 hour fuels for salvage and firewood on a case by case basis.

Under this alternative, full suppression action would be taken on all unwanted human/natural-caused wildland fires (wildfires and escaped prescribed fires); mechanical treatment of fuels would be performed; and prescribed fire would be used for fuel reduction and ecosystem restoration. All wildfires would be suppressed as quickly as possible, while ensuring public, park staff and firefighter safety and protection of natural/cultural/historic resources and developments.

Under this alternative, the NPS would prioritize fuels reduction projects adjacent to park infra-structure and within pre-determined WUI zones. The NPS will manage the park's vegetative

cover to maintain and/or restore natural and healthy conditions. To assist in achieving protection and restoration objectives, the FMP forms a framework through which 54 individual units are identified for possible treatment by mechanical means and/or use of prescribed fire. After protection/restoration/fuels reduction goals are met, sustaining fire regimes within historical range of variability will be maintained primarily through the use of prescribed fire.

Mechanical hazard fuel reduction would be utilized around NPS structures (including historic structures) and areas adjacent to private property with nearby buildings, to provide defensible space increasing the potential for survival during wildland fire. Debris associated with these projects would be lopped and scattered, piled and burned, or hauled off-site. These treatments may also be used around rare plant populations, or to protect bald eagle (*Haliaeetus leucocephalus*) nest trees.

In 2012, NPS staff identified and mapped 54 new high priority project units (included in Appendix 7) for hazardous fuel reduction purposes. These projects are proposed for implementation during the multi-year period following revision of the FMP under Alternative 2. Most of the project areas surround park developments and many border private properties. Prescribed burn units within these project areas vary in size from 6 acres to more than 170 acres and were laid out based on natural and human-created firebreaks where possible.

The total area included in the 54 treatment units proposed under this alternative is approximately 2,430 acres or an additional 18.8% of the total park lands of 12,936 acres. This is in addition to the 1,952.8 acres treated since 2001 under the 2001 and 2009 LRNRA FMP's. Selection of this alternative would result in a total of 4,382.8 acres being treated or 33.9% of park lands by the year 2025 if funding and staffing levels allow. The total acres that will be reported as treated during the period covered by this FMP will be much higher as multiple entries/treatments and maintenance activities may occur on the same acreage. The project areas are dispersed among the five management areas: Concentrated, Developed, Dispersed, Special Use, Historic/Interpretive Zones.

By the end of fiscal year 2020 Lake Roosevelt proposes to reduce fuel loading on an additional 2,379 acres. Of the 2,379 acres, 856 acres (36%) will be treated with understory burns, 1,213 acres (51%) with pile burning, and 309 acres (13%) with maintenance burns. Additionally this plan proposes to treat an additional 2,649 acres from 2021 into the future. Defensible space units totaling 50 acres per year from 2021 through the year 2026 are included in this total. Defensible space unit acres beyond 2026 are not included. Of the 2,649 acres treated beyond the year 2021;, at least 10% will be treated with understory burns, 6% will be treated with maintenance burns, and 84% will be treated with pile burns. Additionally, a portion of the area treated with pile burns may be treated with an understory burn or maintenance burn in the future.

Table 2 Summary Comparison of Alternatives

Comparative Element	**ALTERNATIVE 1: NO ACTION**	**ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES**
National Wildland Fire Policy	Meets current policy	Meets current policy

Comparative Element	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
Fire Management Units	Same	Same
Restore and maintain natural vegetation communities	Yes Emphasis of this alternative is to utilize fire management operations to restore and maintain natural vegetation communities by the reintroduction/utilization of fire across the park landscape in a safe manner. This alternative provides the least amount of opportunity for restoration and maintenance of natural landscapes by proposing a smaller operational program.	Yes Emphasis of this alternative is providing reduced potential for wildfire impacts in WUI areas by utilizing fire management operations to reduce unnatural fuel loadings by restoring and maintaining natural vegetation communities through the reintroduction/utilization of fire across the park landscape in a safe manner. This alternative provides the greatest opportunity and flexibility for restoring and maintaining natural landscapes by proposing a larger operational program.
Utilization of Prescribed Fire	Prescribed fire utilized throughout the park; proposes broadcast burning, hand pile and machine pile burning a total of 2,851 acres from 2014 to 2026	Prescribed fire utilized throughout the park; proposes broadcast burning, hand pile and machine pile burning a total of 6,233 acres from 2014 to 2026
Reduces hazardous fuel accumulations.	This alternative provides the least amount of opportunity for hazard fuel reduction activities due to less proposed operations targeting hazard fuel accumulations	This alternative provides the most opportunity for effective hazard fuel reduction opportunities due to the proposed addition of 54 hazard fuel reduction projects through 2026.
Protect human life and property both within and adjacent to the park.	Yes. All wildland fires – wildfire, would be suppressed throughout the park as soon as detected. This alternative has the least amount of hazard fuel reduction projects.	Yes. All wildland fires –wildfire, would be suppressed throughout the park when threatening life and property. Mechanical/Manual fuel reduction projects would be used to modify wildland fuel loadings reducing wildfire potential near developed areas and in areas with heavy fuel accumulations where deemed necessary throughout the park. Prescribed fire would be utilized to meet wildfire hazard reduction goals where appropriate, throughout the park. This alternative will treat the most acres, reducing fuel loadings, thereby reducing the intensities of any wildfires in treated areas.

Comparative Element	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
Opportunities to work across park boundaries with neighbors	Alternative 1 has the smaller amount of opportunities to share projects across park boundaries with neighbors, due to a smaller proposed program.	The addition of 54 proposed projects targeting hazard fuel reduction projects through 2026 increases opportunities for shared cross-boundary projects with neighbors

C. Alternatives Considered but Rejected.

Two additional alternatives were considered but rejected from further consideration. The first included the option of utilizing *use of wildfire* to meet resource objectives, along with suppression, mechanical treatment, and prescribed fire. *Use of wildfire* for resource objectives entails allowing wildfires, such as one started by lighting, to burn freely as long as it stays within predetermined areas and prescription levels. This is generally accomplished in large pristine areas to allow the natural, often beneficial, role of fire to achieve resource benefits in fire adapted ecosystems. Because of the physical nature of LRNRA (long and narrow land base), this option could not be initiated without unacceptable risk to adjacent landowners.

The second alternative would utilize full suppression actions on all human/natural-caused wildfires along with the use of prescribed fires, but would not include use of mechanical methods for fuel reduction. This idea was rejected from further analysis because there are some situations where the use of prescribed fire alone to meet fuel reduction objectives would not achieve resource objectives, or present unacceptable escape risk. Some second growth forest stands, having developed in the absence of fire, have such a high level of ladder fuels (small, suppressed trees) that mechanical thinning is required prior to the re-introduction of fire. Trying to introduce prescribed fire into these stands prior to thinning trees mechanically would have potentially catastrophic results in the form of stand replacing crown fires and poses unacceptable risks when implementing a prescribed fire project under these conditions. Other reasons for rejecting the alternative include the need to remove some trees mechanically to provide defensible space around structures and around sensitive areas such as bald eagle nests, or threatened or endangered plant populations.

D. Environmentally Preferred Alternative

Alternative 2 (Enhanced Protection of Neighboring Lands and Park Resources Alternative) is the **Environmentally Preferred Alternative** for the following reasons:

- It continues the current priority of returning park vegetation to a more natural state. This is done on a much larger scale park wide, proposing 6,233 acres of treatments versus 2,851 acres of proposed treatments for Alternative 1, while focusing on forest habitats in and around WUI areas.

- Alternative 2 increases the area of proposed projects which will, through mitigation efforts, potentially protect more bald eagle nests and enhance more fire dependent species of concern.
- Alternative 2 has a greater probability to reduce air quality impacts due to wildfires as this alternative proposes more prescribed burning which decreases park fuel loadings thereby reducing the amount of particulates generated in a wildfire occurring in treated areas. Wildfires in treated areas are less intense, therefore easier to control, thereby shortening the duration of a wildfire and lessening impacts, such as smoke by enhancing the ability of fire suppression forces to control. Alternative 2 proposes more projects which could be incorporated into other neighbor's projects which would move a larger area outside the park towards vegetation representing a more natural condition further protecting the park from wildfire outside of the park moving onto the park.

Overall, Alternative 2 best meets the purpose for the LRNRA to preserve, conserve, and protect the integrity of natural, cultural, and scenic resources.

Alternative 1 and 2 Treatment Units:
A list and maps of proposed fire management projects for Alternatives 1 and 2 is found in Appendix 7.

E. Mitigation Measures

The NPS will implement the following mitigation measures as part of the chosen alternative. These measures are designed to minimize impacts to natural and cultural resources. Additional mitigation actions for cultural resources were developed in consultation with the Tribal Historic Preservation Officer (THPO) for the CCT. Mitigation measures will be incorporated throughout all fire management operations. Mitigation measures are designed to lessen or eliminate impacts to specific impact topics and are therefore the same for all alternatives. Table 3 summarizes all of the mitigation measures proposed for the fire management program. It is important to note that mitigation measures can change as new information is received and more effective mitigation measures are developed.

Table3: Mitigation Measures

Mitigation for	Critical Milestones	Responsible Party
Air Quality	Coordination for Prescribed fires will be conducted with the Washington State DNR smoke management office in Olympia. All state and federal regulations for smoke management will be followed.	Fire Staff
Water Quality	Where necessary, install silt fences at strategic points to prevent soil erosion downslope of areas where major soil disturbance occurs and cannot be avoided or in small dry channels within the treatment unit that are experiencing a headcut from reservoir operation or previous disturbances. Mechanical fuel reduction treatments will not be planned in riparian habitats. State/county regulations for cutting near riparian zones will be followed.	Resource & Fire Staff
Soils	Mechanical equipment such as tractors will not be used during wet	Resource &

Mitigation for	Critical Milestones	Responsible Party
	periods which may enhance soil compaction in the area of operations. Operating equipment on frozen or snow covered ground will be the preferred mitigation for both soils and cultural resource protection. Sound justifications must be noted before operation of equipment on dry soils is authorized. Low ground pressure machines will be used in any skidding operations. Skid trails will be designated before cutting operations begin. An integrated arch to lift one end of logs will be required. No heavy equipment will be allowed on slopes greater than 25 percent. Skid trails on slopes or dry gullies with active eroding headcuts in the treatment unit that are adjacent to a waterbody will have silt fences installed or be water-barred and seeded immediately after treatment to minimize soil erosion. Prescribed fire impacts would be minimized as control lines/fire breaks would utilize existing roads, trails, water bodies and other natural barriers where possible. Where possible, heavy accumulations of 1000 hour fuels will be removed through thinning treatments, salvage harvesting, or firewood removal prior to prescribed burn treatments. Piles will be burned during the winter season to minimize soil temperatures. Seeding of burn pile ash may occur when native seed is available and/or the piles burn especially hot to improve ground cover and reduce the threat of invasive weed infestations. The use of Cut-To-Length (CTL) Harvesting and Log Forwarding systems will be the favored method for the removal of overstory trees in mechanical thinning operations.	Fire Staff
Plants	Heavy fuel loads and dense overstories of large diameter trees will be mechanically treated and much of the bole wood (1000 hr. fuels) will be removed prior to prescribed burn treatments in one or more mechanical treatments. All burn prescriptions will include estimates of desired mortality and measures taken to prevent excessive loss of trees. In areas that require mechanical treatment and/or prescribed burns, invasive weeds will be surveyed to determine the species and frequency of weeds present before ground disturbing activities are conducted. If weeds are found to be present, measures will be implemented to help avoid spreading and increasing the abundance of the weeds present. In areas with dense or fire-benefitted invasive weeds, a range of Integrated Pest Management activities will occur, including pre and post herbicide treatments to reduce weed seed crops and seedlings. Native grass mixes may be planted on sterile soils left by intense wildfires, dense 1,000 hour fuel areas, and after pile burning to limit invasive weed production. Important large diameter conifers (in campgrounds and developed areas, along roadways, in scenic vistas, etc.) will have needle piles and duff raked away from the base of the tree prior to prescribed fire treatments to reduce mortality from the intense heat caused by burning dense, accumulated duff.	Resource Staff
Wildlife & Fish Species	Known raptor nest trees will be identified and protected during any mechanical treatment or prescribed burning. Snags will be left when determined not a safety hazard. Mechanical fuel reduction treatments will not be allowed within riparian habitats. Surveys for the nests of birds	Resource Staff

Mitigation for	Critical Milestones	Responsible Party
	protected under the Migratory Bird Treaty Act (MBTA) will occur on projects scheduled to occur between April 1 and July 15. Observations for bat maternity roosting colonies in cavities of large snags/trees will also be conducted during this time period. For projects scheduled in late winter (Jan. 15 to Mar. 30), nest surveys for great horned owls will also be conducted in concert with bald eagle surveys. Bald Eagle: LRNRA may mechanically treat fuels near nest and roost trees to reduce the threat to these trees from future fires. Treatment activities will not occur during the estimated nesting period of January 1 – July 31. Per recommendations of the Bald and Golden Eagle Protection Act operational activities in adjacent areas will be outside of the recommended 400 meters (or 800 meters line of site) to avoid disturbing nesting eagles (USFWS, 1986).	
Sensitive Plants	Areas scheduled for fuels treatments or prescribed burns will be surveyed for the presence of Nuttall's pussytoes. If found within the project area, the NPS will consider boundary locations, project modifications, or additional fireline construction within the project boundary to avoid areas of plant concentrations. Within each unit scheduled to be treated with prescribed fire that has this sensitive plant species, the NPS will establish plots and monitor fire effects on the existing plants. Based on the results of this initial monitoring, the NPS will re-evaluate the use of prescribed fire and mechanical fuels treatments and their effects on Nuttall's pussytoes and any other sensitive species found in a treatment unit.	Resource Staff or Fuels Modules
Sensitive Animals	Surveys of known nests and all trees in new treatment areas for nesting bald eagles will occur prior to starting any projects between January 1 and July 15. Measures may be taken to reduce ladder fuels around known nest trees reducing potential wildfire effects. During prescribed fire operations, actions will be taken to minimize the impact to old growth trees. Actions may include black lining around groves of large trees and snags along the reservoir; protection of individual known roost trees by mechanically reducing the fuel around the base of the tree; and exclusion of certain areas from the prescribed fire	Resource Staff
Cultural Resources	Measures will be incorporated to prevent adverse effects to cultural resources through avoidance. Conducting a cultural resource survey for each project and developing avoidance stipulations for cultural sites during the Section 106 process will accomplish this. These stipulations may include, but not be limited to, any of the following: • Foaming of wooden structures and artifacts; • Clearing of brush around structures and rock art panels; • Restrictions on the use of heavy equipment on cultural sites; • Restrictions on the use of hand lines or other ground disturbing activities on cultural sites; • Preservation of brush and trees that cover features on cultural sites. • Monitoring by a archeologist will be on-site during any ground disturbing activity. • Make cultural resource data available to Resource Advisors during a wildfire.	Resource Staff

Mitigation for	Critical Milestones	Responsible Party
	• Consult with the State Historic Preservation Office (SHPO) and THPO under Section 106 Mechanical equipment such as tractors will not be used during wet periods which may enhance soil compaction in the area of operations. Operating equipment on frozen or snow covered ground will be the preferred mitigation for both soils and cultural resource protection. Sound justifications must be noted before operation of equipment on dry soils is authorized. Low ground pressure machines will be used in any skidding operations. Skid trails will be designated before cutting operations begin. An integrated arch to lift one end of logs will be required. No heavy equipment will be allowed on slopes greater than 25 percent. Skid trails on slopes or dry gullies with active eroding headcuts in the treatment unit that are adjacent to a waterbody will have silt fences installed or be water-barred and seeded immediately after treatment to minimize soil erosion. Prescribed fire impacts would be minimized as control lines/fire breaks would utilize existing roads, trails, water bodies and other natural barriers where possible. Where possible, heavy accumulations of 1000 hour fuels will be removed through thinning treatments, salvage harvesting, or firewood removal prior to prescribed burn treatments. Piles will be burned during the winter season to minimize soil temperatures. Seeding of burn pile ash may occur when native seed is available and/or the piles burn especially hot. The use of CTL Harvesting and Log Forwarding systems will be the favored method for the removal of overstory trees in mechanical thinning operations. If it were determined after further analysis and consultation that the cultural resources of a particular unit could not be adequately protected through implementation of the above or similar measures, then proposed activities would be substantially modified or cancelled. In the event that archeological or historic materials are discovered during project activities, work in the immediate vicinity will be discontinued, the area secured, and the SHPO and THPO notified as appropriate.	

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3.0 AFFECTED ENVIRONMENT

This section of the environmental assessment describes the existing environment potentially affected by the alternatives. An analysis of how the proposed action might affect these resources is found in the Environmental Consequences Section.

A. General Description

Lake Roosevelt is a reservoir formed when the Grand Coulee Dam impounded the waters of the Columbia River. It is approximately 151 miles long along the main stem of the Columbia River and extends from the dam site at Grand Coulee to near the Canadian border. At full pool, the lake's surface elevation is 1,290 feet, the surface area is 81,389 acres, and the total shoreline is about 513 miles. From the dam to Kettle Falls, the reservoir ranges from one-half to one mile in width and then narrows considerably in its upper reaches and tributaries.

The NPS manages about 312 miles of shoreline, 47,438 acres of the total 81,389 acres of water surface, and 12,936 acres of land. Lake Roosevelt National Recreation Area extends from the dam to the end of the reservoir at Onion Creek (south of Northport), and encompasses approximately 132 miles of river length of the Columbia River. It also includes 29 miles of the Spokane River arm of the reservoir and about seven miles of the Kettle River arm. Much of the remainder of the reservoir is within the reservation boundaries of the STI and the CCT and is not a part of the LRNRA. The Bureau of Reclamation manages the dam, its immediate area, and a few other areas necessary to operate the reservoir.

The geology of the area is typified by:

1. The Okanogan Highlands, located north of the confluence of the Columbia and Spokane Rivers, are low rounded mountains considered to be a western extension of the Northern Rocky Mountains. This portion consists of the bottom flanks of the low rounded mountains with conifer woodlands covering much of the hills and riverine valleys with small agriculture and town developments., The very northern portion of LRNRA includes a geologic area called the Kootenay Arc which has been mined for the many valuable mineral resources (silver, lead, gold, etc.) found therein.

2. The Columbia Plateau, a large flood basalt plateau south of the Spokane River and the Columbia (below the confluence of the Columbia and Spokane Rivers). This forms the southern shoreline of LRNRA and is the northern escarpment of the Columbia Plateau. It contains the steep north-facing basalt breaks along the Columbia River. This plateau's northern escarpment forms the southern shoreline of LRNRA as the Columbia River makes an east-west run until hitting the Cascade Mountains. It forms the steep north-facing basalt breaks along the Columbia River which are forested with Douglas fir (*Pseudotsuga menziesii*), other conifers, and associated understory plants. It also encompasses vast acreages of dryland agriculture (wheat, barley, oats, etc.) and private farm homes and outbuildings on the plateau which in mid-to-late summer is extremely vulnerable to wildland fires originating from NPS lands.

In portions of both of these provinces there is evidence of changes that occurred during the last great Ice Age. Glaciers carved their way down many of the north-south running valleys coming down out of Canada. Floodwaters of Lake Missoula from the collapsed glacial ice dams on the Clark Fork River in Montana and Idaho washed across eastern Washington numerous times carving the valleys that still exist today. Lake Columbia inundated much of the lower reservoir area due to glacial ice dams near the present day Grand Coulee Dam. Along the shore of the reservoir, river valley terrace deposits consist of glacial moraines or outwash, lakebed sediments, and Missoula flood deposits that have been sculpted into terraces by alluvial processes.

There is a mixture of public, private, and tribal lands adjacent to LRNRA. The CCT Reservation borders the LRNRA on the north and west for about 93 miles. The STI's Reservation borders the area for about eight miles north of the Spokane River Arm/Columbia River confluence and the entire length of the north shore of the Spokane River Arm. The western boundary north of the Colville Indian Reservation borders the Colville National Forest. With the exception of the section of the Spokane Indian Reservation, the south and eastern edge of the LRNRA borders a mixture of state and private land. The private land is a combination of farms, ranches and residential properties.

B. Resources Affected:

Air Quality

Ambient air pollutant concentrations for LRNRA are within national and state air quality standards. This attainment status may be attributed to the relatively low population density near LRNRA. Air-quality related values, scenic vistas, and pollution sensitive resources have not been identified for LRNRA. The predominant wind direction in this air shed is from the south, southwest (NRCS, 1978). Although the air quality is generally very good in the recreation area, it is affected by pollution emissions within and outside the area. Sulfur dioxide, nitrogen oxides and suspended particulate matter are the pollutants of concern from a smelter plant and a pulp and paper mill north of the park in Canada. The area experiences occasional episodes of high-suspended particulate matter from windblown dust from agricultural operations on dry spring and summer days, and exposed lakebeds during low-water periods. At times, air quality is also affected by smoke from wildland or prescribed fires that may occur within the national recreation area, surrounding area, and region. According to the Washington State Department of Ecology (DOE) the major air quality concerns in the Upper Columbia Valley Airshed include wood smoke (winter), agricultural-burn smoke (fall) and fugitive dust (Gamble, 1998) (primarily late spring to fall).

LRNRA is designated a Class II Airshed. This designation was established by Congress to facilitate the implementation of air quality provisions of the Clean Air Act. This designation allows a moderate increase in certain air pollutants. The Clean Air Act requires that the NPS comply with all federal, state, and local air pollution control laws (Section 118). The state agencies that manage air quality related concerns are the DNR. Ferry, Stevens and Lincoln Counties do not have county level ordinances regarding air pollution, but defer these concerns to the DNR and DOE (N.E. Washington Health District, 1999).

Adjacent to LRNRA and managing part of Lake Roosevelt is the STI's Reservation, which is, designated a Class I Airshed. Class I designation mandates the most protective requirements for protection of air quality related values. The next area of concern is the Spokane Metropolitan Area that is between 25-85 air miles east, southeast of the park. Spokane is a federally designated non-attainment area for carbon monoxide. A non-attainment area is defined in the Washington State Smoke Management Plan, as a clearly delineated geographic area that has been designated by the Environmental Protection Agency and promulgated as exceeding a national ambient air quality standard or standards for one or more of the criteria pollutants. The criteria pollutants include carbon monoxide, fine particulate matter (PM^{10}), sulfur dioxide, ozone, and nitrogen dioxide. Fortunately, the prevailing winds would typically carry smoke to the north of this area. It is possible that a westerly airflow could carry smoke up the Spokane River Valley, which runs upstream to the City of Spokane. The next nearest Class I Airsheds include the Pasaytan Wilderness (Okanagon National Forest) 85 air miles west and the Cabinet Mountain Wilderness (Kootenai National Forest) 90 air miles east. As the predominant winds come from the SSW and the LRNRA treatment units are smaller in size creating small amounts of localized smoke, it is not expected that these areas will be impacted from an air quality standpoint.

Other areas of concern for air resources would include several towns and communities that are next to or near LRNRA. These towns include Coulee Dam, Grand Coulee, and Electric City all directly adjacent to the western end of the park; Inchelium which is adjacent to the middle portion of the park; Wellpinit which is located north of the Spokane Arm; Kettle Falls which is adjacent to and Colville which is 10 miles east of the north-central portion of the park; and Northport which is approximately 5 miles north of the northern most point of the park. Other communities immediately adjacent to LRNRA that are not incorporated include Keller Ferry, Seven Bays, Hunters, Marcus, and Evans. There are a number of other concentrated summer home areas (Hansen Harbor, Sterling Point, Lincoln Mill, Deer Meadows, Fort Spokane, Cayuse Cove, Moccasin Bay, etc.) that are immediately adjacent to LRNRA that may also be impacted by any degradation of local air quality as well as the rural populations of the area.

Water Resources

Water is the major resource that makes up LRNRA. The State of Washington has designated Lake Roosevelt a class AA water body (Washington Administrative Code, 1999). This is the highest level in the state requiring the highest-level water quality standards (Washington Administrative Code, 1999). The water quality in Lake Roosevelt is somewhat impaired by both point and non-point pollutants. Studies have revealed that generally the water quality in solution is good but sediment being carried can tend to be toxic, containing heavy metals and organic pollutants.

The Columbia River above Lake Roosevelt has had nearly 100 years of point source pollution from a Canadian based lead/zinc smelter (now the largest of its kind in the world). There were other smelters that operated in the upper Columbia River watershed up until the 1920's including one at Northport, WA. Many millions of tons of effluent and slag were discharged into the tributaries and river and since the 1940's have flowed downstream and become entrapped in Lake Roosevelt. In the 1960's a Canadian pulp mill opened upstream and began to discharge various congeners of dioxins and furans. These chemicals of concern have also appeared in the

water and sediment research conducted on Lake Roosevelt. Prior to the creation of the reservoir, nearby lead, zinc, and uranium mines, gold placer mining, and several shoreline based sawmills operated along the river and tributaries. Most of these are now out of production, though one plywood mill, one cedar wood mill, and a cogeneration plant utilizing large quantities of wood chips still operate near the river in the vicinity of the town of Kettle Falls with other mills still in operation along the tributaries., Much more stringent water quality protection measures have been put in place on both the Canadian and U.S. sides of the border since the mid-1990's. The Spokane River has been an area of concern as well. One former uranium mine (Midnite Mine) is undergoing EPA Superfund clean-up efforts on the north bank of the Spokane River Arm. The largest population centers in eastern Washington (Spokane) and the Panhandle of Idaho (Coeur d'Alene) are upstream of Lake Roosevelt in the Spokane River Watershed. Upstream of these population centers is the Silver Valley Mining District (Coeur d' Alene River Watershed) that has operated for over 100 years. The Upper Columbia/Lake Roosevelt, Midnite Mine, and Silver Valley areas are each officially recognized EPA CERCLA sites undergoing a host of research and restoration activities, including water quality protection.

The impacts of these sources of pollution are not well defined. The proposed fire management activities at LRNRA should not add to or exacerbate any existing water quality issues. Potential water quality impacts from fire management activities related to heavy metals, nutrients and sedimentation are believed to be minimal. Levels of pollutants such as lead or mercury being released by smoke and ash during and after prescribed burning or wildfire events have not been studied. It is believed that the potential for exposure is negligible except from sites with known high levels of contamination. Research to-date has only found 1 small site near the former mining town of Bossburg, Washington that might be a concern for lead pollutants from high concentrations in the soil. Fire activities in this area are not currently planned and would be delayed until further testing on the extent of the contamination is determined and a remediation plan could put in place.

Soils

Soils in the upper Columbia watershed reflect the geology and climate of the area. Soils found in the mountainous areas are primarily entisols, while aridosols dominate the Columbia Plateau. Detailed soil surveys from the Natural Resources Conservation Service are available online for Ferry (1979), Stevens (1980) and Lincoln (1981) counties. These surveys provide details on soil types and distribution as well as information on land use, erosion hazards, and engineering properties. Additional soil and surficial geological information is available for the Colville National Forest, and for some private, state, county and tribal lands within the Lake Roosevelt watershed (Riedel, 1997).

Lake Roosevelt's shorelines are comprised of bedrock (10 percent) and thick ice age deposits (90 percent) (Jones *et al*. 1961 in Riedel, 1997). Bedrock shorelines, found mainly on the south shore of the lower reach and in the Spokane Arm, are generally more stable than those composed of silt and sand. Terrace deposits are particularly extensive on parts of the north shore of the lower reach of the reservoir near the Sanpoil River, and in the middle reach near Ninemile Creek, Cedonia, and the mouths of the Kettle and Colville Rivers. These terraces have failed and slumped into the reservoir at hundreds of sites over the last 54 years (Jones, et al., 1961; Schuster

1979 in Riedel, 1997). The Bureau of Reclamation maps and conducts annual surveys of the known and new slump areas as part of its reservoir operations.

Slower, gradual rates of erosion also threaten campgrounds, trails and other facilities located on lower terraces near the full pool elevation. Wave erosion and freeze-thaw processes, as well as vegetation loss are common causes of this erosion.

In the Southern portion of LRNRA the soil is formed from a mixture of colluvium derived from basalt, granite and loess; glacial and fluvial deposits; and overlying loess and/or volcanic ash. In the Northern portion of LRNRA the soils are formed from primarily glacial and fluvial materials mixed with or covered by volcanic ash and/or loess layers. Major elements of these soils include glacial lakebed sediment, glacial outwash, glacial till, glacial flood, volcanic ash and loess deposits (See Appendix 3 for specific soil type per fire unit). There are only a few mapped areas of Prime Farmland (dependent on supplemental irrigation) within LRNRA. These are located near the Colville Flats developed area and on the Kettle River arm. They are both vegetated with native plant communities.

Plants

Plant communities are important to fire managers. The type of plant community determines the types of fuels that are present on a landscape that will burn in a fire. Fire must have three components in order to burn, known as the *Fire Triangle*. The three components are Heat, Oxygen and Fuels. A discussion of fuels follows in the *Plants* section of this EA.

Fuels

Existing Conditions:

Fuels treatment projects completed at LRNRA from 2005 through the year 2013 includes:

- Understory and Crown thinning: 1,318 acres
- Pile burning: 670 acres
- Understory burning: 393 acres

These treatments have occurred in the Evans, Marcus, Gifford, Whispering Pines, Hunters, Camp Na Bor Le, Fort Spokane, Kettle Falls, Sterling Valley, Ricky Point, Bradbury, Clark Lake, Haag Cove, North Gorge, Enterprise, Doyle, Detillion, and Porcupine areas. The work completed thus far has occurred in condition class II and III, fire regime I forested areas, within WUI.

NFFL Fuels

Associated National Forest Fire Laboratory (NFFL) and National Fire Danger Rating System (NFDRS) models are used for fire behavior predictions (Anderson, 1982; Deeming, et al., 1977) and preparedness planning respectively. NFFL fuel models are used for predicting fire behavior. The following NFFL Fuel Models (FM) represents the wide range of vegetation types within the boundaries of LRNRA. Common FM in LRNRA are FM 1, 2, 6, 8, 9, 10 and 11. A summary of fuel/fire characteristics follows (Table 4). A more complete discussion of LRNRA fuels is found in Appendix 6.

Table 4. Summary of Fuel/Fire Characteristics

NFFL Fuel Model	Rates of Spread	Residual Burn Time	Resistance to Control
1	Very high	Short	Low
2	Very high	Relatively short	Moderately low
6	High	Relatively short	Moderately low
8	Low	Moderate	Moderate
9	Moderate	Moderate	Moderate
10	Moderate	Moderate	Moderate
11	Moderate	Moderate	Moderate

Plant Zones

Located in a semi-arid transition zone, plant communities along the 151 mile-long reservoir gradually change from steppe and shrub-steppe plant communities to ponderosa pine and mixed conifer forests on the north end of the reservoir. As this is a transition zone between grassland and a forest environment, large block definitions can be difficult due to the effects of varying slope aspects and soil types. The three predominant plant communities include bunch-grass grasslands (steppe); shrub-steppe; and transition ponderosa pine forest. Other communities of note include wetland/riparian, lithosolic (rocky soil), rocky outcrops, and mixed-conifer forests.

Fire once played a critical role in the transition forests (ponderosa pine) of LRNRA, and also influenced the steppe and shrub steppes systems as well. Daubenmire states: "There is undoubtedly much truth to the common opinion that before the white man came, frequent fires caused by lighting or aborigines kept the pine stands in the grassy group open to the point of being savanna-like" (Daubenmire, 1981). Much of Lake Roosevelt is contained within this "grassy" ponderosa pine habitat group. Investigations in ponderosa pine forests throughout the Western United states and Southern British Columbia have revealed that prior to 1900 most stands experienced surface fires at intervals ranging from 1 to 30 years (Stokes and Dieterich, 1980; Martin, 1982).

Native plant species adapted many different strategies to survive fire in this ecosystem. Some, such as service berry or bluebunch wheatgrass (*Pseudoroegneria spicata*) resprout after a low severity fire. Others, such as antelope bitterbrush (*Purshia tridentata*), often need to be reestablished by rodent cached seeds following a fire. Other species are adapted to take advantage of reduced post-fire competition. Seeds may be stored in the soil for long periods and only germinate following a fire, or seeds, carried by wind to the burned area, find more favorable conditions for germination.

Fire has long been an important influence shaping the plant communities of the Inland Northwest. The frequency with which a given area burned was dependent on the frequency of ignition, the plant community types, topography and regional climate. Fire as a physical process has several ecological functions:

- Maintenance of plant vigor and productivity.
- Reduction of woody fuel accumulations.
- Maintenance or creation of early successional stages.
- Increase in plant community diversity.
- Increase in forage availability and nutritional quality.

Actual post-fire plant community succession is dependent upon four primary factors including:

- Pre-fire plant community species composition.
- Fire intensity and its effects on the existing plant community.
- Post-fire environmental conditions including precipitation.
- Availability of seeds, rhizomes or other propagules to revegetate burned areas.

In recent history a fifth factor has entered the picture: the proximity and aggressiveness of invasive species such as cheatgrass and other non-native annual grasses, mullein (*Verbascum spp.*), non-native thistles and knapweeds (*Centaurea spp.).* In some areas these species have benefitted, thrived, and rapidly expanded as a result of frequent fires.

Steppe/shrub, steppe zone

The lower lake valley and hillsides between Grand Coulee Dam and Keller Ferry are dominated by steppe (bunchgrass grassland)/shrub-steppe plant communities once common to the Columbia Plateau. Common species along this section include grasses such as bluebunch wheatgrass, needle-and-thread grass (*Stipa comata*), and Idaho fescue (*Festuca idahoensis*); forbs such as arrowleaf balsamroot (*Balsamorhiza sagittata)*, northern buckwheat (*Eriogonum spp.)*, brittle prickly pear (*Opuntia spp*), alumroot (*Heuchera spp.)*, and lupine *(Lupinus spp.)*; and shrubs such as big sagebrush (*Artemisia tridentata*), rabbitbrush, and antelope bitterbrush.

As with other vegetation communities at LRNRA, fire exclusion has altered the natural succession and composition of grassland communities. Steppe/shrub steppe plant associations at LRNRA range from areas dominated by bunchgrasses such as bluebunch wheatgrass and Idaho fescue which occur in pure stands of grass, or intermingled with bitterbrush and other shrub species to transition zones where grasses are interspersed with mature ponderosa pine forests. Most western grassland communities evolved in fire environments with frequent natural fire events ranging from every 3-5 years to longer intervals of up to 70 years (Weaver, 1951; Vogl, 1965). Short interval fire frequencies, 5-20 years, are most often reported for grassland habitats. Most graminoid species are well adapted to fire either through structural, physiological or reproductive strategies.

The perennial grasses native to LRNRA grow from central root mounds called tufts, or tussocks. These bunchgrasses are capable of vegetative reproduction from these tufts and will present new flower/seed stalks each spring. At the time of the year that natural fire occurred, summer growth, flowering and seeding of the grass is complete and the plant is in a physiological state of dormancy. As fire passes through a stand of bunchgrass, the dead upper portions of the plant are burned off leaving the tuft intact to produce new growth the following year. Early season burning can create high mortality rates among vegetation as the high moisture content of the plant causes high heat transfer to internal tissue. Fire can also create seedbeds for regeneration of new grass plants.

Bluebunch wheatgrass regenerates vegetatively and by seed following fire. Because of its relatively few, coarse leaves and large stems, little material accumulates at the base of the plant to serve as fuel. Prolonged high temperatures normally do not occur at the root crown, and most basal buds will survive (Antos, et al., 1983). Severe fires caused by increased accumulations of fuel or presence of a dense shrub component will kill bluebunch wheatgrass (Zlatnik, 1999). Idaho fescue is more sensitive to fire than bluebunch wheatgrass. Studies have indicated high mortality levels to Idaho fescue from summer burns with virtually no mortality in the fall when the plants were dormant, although fire reduced the basal area of the tufts. Idaho fescue can survive low to moderately severe fires (Eugene et al., 1966). Idaho fescue has a fine; denser culm which can lead to smoldering that can in turn damage or kill the plant. Wright and Klemmendson (1965) found that season of burn, not burning intensity, was the critical factor in mortality of needle-and-thread grass. Similar results were reported by the same researchers for Sandberg bluegrass (*Poa sandbergii*). (Wright and Klemmendson, 1965)

Common rabbitbrush (*Chrysothamnus nauseosus*) (CR) is an important seral shrub associated with LRNRA's shrub-steppe communities. Low to moderate severity fires allow for CR to resprout readily from buds on or near the stem base. At higher fire intensities, these buds may be killed (Wright, et al. 1979) and (Tirmenstein, 1999). Surviving plants and those near the burn margin can quickly re-colonize the site by production of wind borne seed. Biomass production remains low for one to three years and then increases rapidly. Burning temporarily eliminates sagebrush and other plants that compete for resources such as water or space. Release from competition stimulates rubber rabbitbrush (*Ericameria nauseosa*) to produce large numbers of viable achenes. Seedlings that emerge from these achenes are able to establish successfully because of their rapid root elongation (Mckell, 1956; Tirmenstein, 1999). Sites with a good under story of perennial grasses and forbs are less likely to be dominated by rabbitbrush after burning than those where the understory has been depleted. CR can dominate stands for a decade or more, but it is generally superseded by sagebrush (Tirmenstein, 1999). Low disturbance following fire can decrease spread of rabbitbrush as well, similar to like resting an area from grazing for a minimum of two growing seasons.

Ponderosa pine zone

Between Keller Ferry and the upper end of the Spokane River Arm at Little Falls Dam vegetative communities transition from shrub-steppe to ponderosa pine forest (some second growth). Common trees include substantial stands of ponderosa pine and Douglas fir, especially on the steep, north facing slopes. The grasses in the steppe/shrub steppe zone are also common in this zone. Forbes include arrowleaf balsamroot, northern buckwheat, and lupine; shrubs such as big sagebrush, rabbitbrush, and antelope bitterbrush. Red osier dogwood (*Cornus Stolonifera),* willows (*Salix spp.),* river birch (*Betula occidentalis*), and black cottonwood (*Populus trichocarpa*) are common in the riparian areas.

Areas along the middle and upper reservoir, between the Spokane River and Kettle Falls, are covered with a mix of dense ponderosa pine forests, and Douglas fir. The steppe environment within the boundary becomes less evident as in the previous sections. Grasses include those in the steppe/shrub steppe zone with the addition of pinegrass (*Calamagrostis rubescens*) in the ponderosa pine understory. Common forbs include hairy goldstar (*Crocidium multicaule*), phlox (*Phlox spp.*), and nodding onion (*Allium cernuum*); shrubs include chokecherry (*Prunus*

virginiana), serviceberry (*Amelanchier alnifolia*), Wood's rose (*Rosa Woodsii*), Douglas hawthorn (*Crataegus douglasii*), snowberry (*Symphoricarpos spp.*), and occasionally smooth sumac (*Rhus glabra*) and blue elderberry (*Sambucus cerulea*). Alder (*Alnus spp.*), willow, hazelnut (*Corylus cornuta*), and black cottonwood are common along the riparian areas. In the northern end, rocky mountain juniper (*Juniperus virginiana)* may be found right next to the shoreline and on rocky, river bars.

The physiological features of the pacific ponderosa pine characterize this tree as a fire-adapted species. Its characteristic high, open crown with large protected buds, high foliar moisture content and ability to self-prune lower branches help protect the crown of the tree, while its thick, exfoliating bark help to protect the boles of mature trees from fire (Saveland and Bunting, 1988). Fire has also been found to create favorable seedbeds for seedling establishment. This is often attributed to the post-fire soil condition, which is rich in available inorganic nitrogen that benefits ponderosa pine growth and establishment (Ryan and Covington, 1986). In a western Montana study, Pacific ponderosa pine produced 12 percent of the total number of sound seeds found on a burned clear-cut site over a 5-year period (Swezy and Agee, 1991).

Many pre-1900 forests were dominated by ponderosa pine as a major seral species in mixed-conifer forests of Douglas fir and grand fir (*Abies grandis*) forests. In the absence of fire these areas have moved toward their successional climax. With the cessation of frequent fires, the trend toward dense stocking and domination by shade-tolerant species favors other mortality agents such as mountain pine beetle (*Dendroctonus ponderosae*), dwarf mistletoe, and comandra blister rust (*Cronartium comandrae*) in dense ponderosa pine forests; western spruce budworm (*Choristoneura occidentalis*), tussock moth (*Orgyia pseudotsugata*), and root diseases in "firs"; Indian paint fungus (*Echinodontium tinctorium*) in grand fir; and dwarf mistletoe in Douglas fir (Arno 1988).

Community Ecology:

The ponderosa pine/shrubland community (*Pinus ponderosa*/*Symphorocarpos albus* community) of LRNRA is a true ponderosa pine forest, in which open stands were dominated by pacific ponderosa pine as the seral and climax tree species. True ponderosa pine communities in eastern Washington historically contained a sizable perennial herbaceous component, which along with pine needles encouraged frequent and widespread burning (Weaver, 1957; Agee, 1993). The frequent presence of fire-scars on older trees of ponderosa pine communities suggests that the majority of these historical fires were of low intensity, and served primarily to reduce levels of litter, duff and downed fuels, while stimulating production of forbs and grasses (Agee, 1993)

Historical mean fire return intervals for eastern Oregon and Washington ponderosa pine stands are typically 11 to 16 years (Weaver, 1959), however, shorter intervals (6 to 7 years) are recommended for the restoration of open stands of mature ponderosa pine (Biswell, 1960). Longer fire return intervals, which allow time for the build-up of dense, single-age thickets (dog-hair) increase the potential for higher severity firs and insect attacks, both of which increase mortality in mature ponderosa pine stands (Agee, 1993).

Some areas in the existing ponderosa pine/shrubland community at LRNRA contain an understory dominated by dog-hair with little or no understory component present (Duke and Kopper, 2001). The overstory is comprised of relatively low vigor, mature trees with a high level of mountain pine beetle infestation and dwarf mistletoe infection (Flanagan, 2000). The present condition of the stand is attributed to the policy of fire exclusion, which had resulted in overstocked stands with slow growth and poor vigor of trees, accompanied by sparse herbaceous component (Weaver, 1957; Biswell, 1972; Harrington, 1996). Silvicultural cutting and pile burning or removal of excess small trees is recommended to allow for successful application of prescribed fire and the return to a more open stand structure dominated by vigorous trees of seral species (Arno, 2000).

Ponderosa Pine Management Implications:

An increased mortality of ponderosa pine due to post-fire mountain pine beetle attack as well as from the reintroduction of fire to an area in which fire has been suppressed is inevitable and unpredictable (Agee, 1993). Despite the inherent risks of fire reintroduction, it is generally considered desirable to reintroduce low severity fire with measure rather than forgo the use of fire altogether. The benefits of prescribed fire include understory growth stimulation and addition of available nitrogen to the soil. (Flanagan et al., 2003).

On the Colville Indian Reservation in eastern Washington, low-intensity prescribed fire in a dense thicket of small diameter trees reduced the density of young trees (<10 feet tall) by 95%, while maintaining larger pole size trees (11 to 20 feet tall) by over 50% (Wooldridge and Weaver, 1965). These results are relevant to predicting post-fire mortality of seedling trees at LRNRA, where the North Cascades National Park (NOCA) Fire Effects Monitoring (FEM) recorded a mean density of 8481.7 seedling trees per acre (Appendix 3).

The current research on fire effects in northwestern ponderosa pine stands suggests that stand densities are too high to prevent high losses of overstory trees due to crowning, root biomass loss and post-fire insect attack at LRNRA. Over the long term, the use of selective thinning is expected to improve forest health by opening up the canopy and reducing competition for limited resources (i.e. water in areas with sandy alluvial soils), and thus lowering the susceptibility to mountain pine beetle attack (Gara, 2000). Recent field investigations (2012) by USFS representatives have found that Armillaria root disease (*Armillaria ostoyae*) may be common in many forested areas of the park and contributing to both direct mortality and to weaker trees susceptible to mountain pine beetle and other insect attacks. It may be a leading cause of mortality for the many hazard trees, many of which are larger dominant trees, that the park must remove each year in order to protect staff, visitors, and park resources in the developed zones., This root disease primarily affects pine and so management of a mixed species forest, especially near developed areas may become a consideration for park management.

The NPS manages plant species to control forest pests and diseases, eliminate invasive plants, reduce hazard fuels, and maintain historic landscapes. National Park Service staff annually carries out measures to control forest pests, with assistance from the USFS. Forest insect and disease infestations are a continuing problem in the ponderosa pine forests. Many of these endemic pests have increased activities due to the poor forest health conditions. These poor conditions result in large part from suppression of the once common low intensity, high

frequency fires. The most prolific forest pests in the area are the western pine beetle (*Dendroctonus brevicomis*) and dwarf mistletoe, followed by mountain pine beetle, red turpentine beetle (*D. valens*), pine engraver beetle (*Ips spp*) and various root rots.

Mixed conifer zone

The upper valley, north of Kettle Falls to Onion Creek near the boundary, traverses a forest dominated by ponderosa pine, Douglas fir, and western larch (*Larix occidentalis*). Some lodgepole pine (*Pinus contorta*), grand fir, rocky mountain maple (*Acer glabrum*), Western paper birch (*Betula papyrifera*), and quaking aspen (*Populus tremuloides*) can also be found. Among the pines and in dry, rocky areas, a variety of shrubs occur, including mallow ninebark (*Physocarpus malvaceus*), Creeping Oregon grape (*Berberis repens*), elderberry, chokecherry, snowberry, deer brush (*Ceanothus sanguineus*), and red-stem ceanothus (*Ceanothus velutinus*). Dominant grassland species include bluebunch wheatgrass, Idaho fescue, and pinegrass. Small portions of this area could be considered part of the mixed-conifer zone that occurs farther north and higher in elevation.

Invasive weeds

Another important plant component is invasive plants. These plants are non-native, invasive, aggressive, and are defined in the Washington Administrative Code 16-1750. A preliminary survey of 1,233 terrestrial park acres (10% of LARO) in the mid-2000's identified 181 acres containing 12 different invasive plant species. Some important "noxious weeds" include diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*C. maculosa*), yellow star-thistle (*C. solstitialis*), leafy spurge (*Euphorbia esula*), Dalmatian toadflax (*Linaria dalmatica*), Canada thistle (*Cersium arvense*), tumblemustard (*Sisymbrium altissimum*), and cheatgrass. Weeds not listed by the state, but still of concern to LRNRA include black locust (Robinia pseudoacacia), tree of heaven (Ailanthus altissima), puncturevine (Tribulus terrestris), and baby's breath (Gypsophila paniculata). Black locust control measures are the subject of another environmental assessment and therefore not addressed in this fire management plan environmental assessment. These and other invasive weeds may see their ability to invade an area enhanced by fires and are an important consideration in dealing with the effects of fire. Staff at LRNRA conduct invasive weed control activities in cooperation with county weed control programs, adjacent landowners, and other affected parties at Lake Roosevelt. However, invasive vegetation continues to be a serious problem due to several factors including limited staff and funding, weeds spreading from neighboring lands, heavy public use in developed areas, and the narrow linear nature of LRNRA with numerous roads and waterways providing corridors for seed dispersal into and out of the area.

Response of major plant communities to fire.

Most of the plant communities at LRNRA have the potential to sustain fire and to be impacted at different levels by wildfires dependent on the timing, severity, and climatic factors at the time of the wildfire. The most prominent plant community, ponderosa pine, is considered fire adapted. The plant communities will be discussed from the driest, steppe/shrub-steppe, to the wettest, the mixed-conifer zone.

Steppe/shrub-steppe zone

As with other vegetation communities at LRNRA, fire exclusion has altered the natural succession and composition of grassland communities. Some grassland communities are being invaded by ponderosa pine that would have been controlled as seedlings by frequent lightning or human (aboriginal) caused fires (Moir, 1966). As pine canopies close in over grassland areas the composition of the understory begins to change from bunchgrasses to more shade tolerant species such as snowberry, Oregon grape, and ceanothus or the grasses are suppressed as they are covered in thick mats of needles and dead branches. Some grassland habitats are rapidly changing from open areas with scattered pine, to thick stands of pine regeneration. Conversion of grasslands to forested stands of pine can create more dangerous fire suppression problems in and around developed recreation zones with grass fuels intermixed with dog hair thickets of pine. In a similar way fire exclusion also favors an increase in sagebrush in certain grassland communities.

Shrubs make up a critical portion of the shrub steppe plant communities. Big sagebrush along with antelope bitterbrush makes up important habitat for many wildlife species. These shrubs are most often killed by fire, and must regenerate from seeds that are produced from plants that survived within or along the fire perimeter. Threetip sagebrush (*Artemisia tripartata*) and rabbitbrush can resprout from rootstock that survives low to moderate severity fires. Big sagebrush, in combination with several species of grasses that compose the understory, is the dominant shrub in LRNRA's shrub-steppe zone in the southern third of LRNRA. Rabbitbrush is a common associated shrub.

Big sagebrush is easily killed by fire but prolific seed production from nearby unburned plants (if available) and from soil-cached seed, coupled with high germination rates enable seedlings to establish rapidly following fire. Wind-, water-, and animal- carried seed can also contribute to regeneration on a site (Johnson et al., 1968). Seedling establishment may begin immediately following a disturbance, but it usually takes a decade or more before big sagebrush dominates the site, assuming there is a suitable seed source nearby (Tirmenstein, 1999). Transplanted big sagebrush is noted to begin reproduction in 3 to 7 years.(Plummer et al., 1968) In areas where historic grazing has occurred at LRNRA, a large component of cheat grass may be present in the understory of big sagebrush. Should a severe fire occur, cheat grass along with rabbit brush, could end up dominating the site for several years.

Threetip sagebrush is listed by Daubenmire (1981) as being the most common sagebrush plant in the region that encompasses the southern third of LRNRA. Fire will kill Threetip sagebrush but this plant can sprout weakly after a fire (Volland et al., 1981). It is also a vigorous seeder if enough plants are left after a fire.

Antelope bitterbrush is one of the more important shrub species in the shrub steppe plant communities of LRNRA. It is also an important understory component of ponderosa pine communities, to be discussed below. Antelope bitterbrush is a very important winter browse species for large ungulates (deer, elk, and bighorn sheep) in the southern half of LRNRA. It is

utilized by a variety of wildlife for cover, browse, and seeds (Zlatnik, 1999). Wildfire and improper use of prescribed fire may reduce or eliminate this species in some areas.

Antelope bitterbrush regenerates after fire either by sprouting or from off-site seeds cached by rodents (Nord, 1965). The type of bitterbrush that survives fire best is a low decumbent form that is not dominant at LRNRA. The upright form is typically found in LRNRA, which usually dies from fire (Bunting et.al., 1985), although both forms of antelope bitterbrush occur in the area. The age of the antelope bitterbrush also affects the plants ability to resprout. It is reported that plants less than 5 or greater than 60 years old do not sprout well (Zlatnik, 1999). LRNRA has a large amount of antelope bitterbrush that is probably older than 60 due to the 100 plus years of fire suppression activities. As wildfires occur at LRNRA in areas with bitterbrush it can be expected that much of this shrub component will be lost. Prescribed fires can be timed to minimize the effects of fire on antelope bitterbrush and they can be conducted in areas that create firebreaks thereby protecting larger stands of antelope bitterbrush from wildfires Even though antelope bitterbrush is sensitive to fire effects, its presence in and near plant communities with a high fire frequency attests to its adaptability to survive in these environments.

Transition Forest Zone

The primary tree species at LRNRA is ponderosa pine. It occurs at the transition from steppe/shrub-steppe plant communities to continuous forest cover in the mixed-conifer zone. Ponderosa pine is the dominant tree species on more than half of LRNRA. This species plays a critical role in wildlife habitat, species diversity, and aesthetics. Ponderosa pine is a fire adapted species, typified by frequent fires of low intensity. Investigations throughout the western United States and southern British Columbia have revealed that prior to 1900 most ponderosa pine stands experienced surface fires at intervals ranging from 1 to 30 years (Arno, 1988).

Fire impacts on ponderosa pine, both prescribed and wildfire, have immediate effects in terms of injury and mortality, as well as indirect effects in altering the environmental conditions within the stand. Direct effects can be observed in terms of scorching and charring of the tree bole, limbs and needles. Fires can cause "cat facing" or depressions at the base of the tree where fire burns through the bark layers into the interior tissue. These depressions can often claim more than 60 percent of the base of the tree without effecting the trees survival. Charring of external bark on ponderosa pine, while not aesthetically pleasing, is often of no consequence in the long-term health of the tree. Older trees have external bark layers up to 1.5 inches thick, which protects the internal cambium from injury. In areas where natural fires occur, the canopy of the ponderosa pine starts 50-70 feet up the tree bole. This is caused by previous fires, which "prune" off the lower branches making it more resistant to canopy scorch injury. Research has demonstrated that ponderosa pine can sustain up to 90 percent crown scorch and survive (Harrington, 1981). Experience at nearby Turnbull Wildlife Refuge shows this level of crown scorch is survivable, but the tree often dies in following years due to mountain pine beetle infestations, injury to surface root systems, or some combination of factors (Plantrich, 2000). Fire mortality can result in creation of important snags for wildlife use, such as nesting platforms for bald eagles, bat roosts under sloughing bark, and cavity nest sites for birds and wildlife. Old snags can be partially consumed by fire and fall, creating log habitat on the forest floor.

Mixed-conifer zone

This forest zone is a minor plant community at LRNRA in relation to the previous two zones. Yet it provides an additional environment/habitat with important resource values. It occurs along the northern portion of LRNRA, especially on north aspects and in protected draws. James Agee (1993) identifies four types of mixed-conifer forests in the Pacific Northwest, with the Douglas fir mixed-conifer forest being most typical at LRNRA. In this plant community Douglas fir is the climax tree species. At LRNRA, this mixed conifer zone is often steep, north facing slopes or in areas just a little drier than usual for this zone. Prior to 1900 this zone was probably reduced with the ponderosa pine zone being much larger due to the presence of frequent fire (Franklin, et al. 1988). Various studies in eastern Washington have shown mean fire return intervals in Douglas fir forests (in the dry end of the zone) ranging from 10 –24 years (Agee, 1993).

Surface fires often kill Douglas fir saplings because their low branching habit allows fire to carry into the crown. These saplings are more susceptible to mortality from surface fires than ponderosa pine saplings (Arno and Gruell, 1983). In general, the trees that survive fire tend to be taller and have larger bole diameters (Bevins, 1980). It takes about 40 years for Douglas fir to develop fire-resistant bark on moist sites in the northern Rockies (Fischer and Bradley, 1987). Because they have thicker bark and larger crowns, large trees can withstand proportionally greater bole and crown damage than small trees.

Douglas fir regenerates through dispersal of winged seeds. These seeds establish on mineral soil and organic seedbeds less than 2 inches thick (Ryker, 1975). Germination begins soon after snowmelt, and seedling survival is best under partial shade. Fire suppression has allowed this more shade tolerant species to re-invade these sites where it had formerly been in check due to frequent fire. This increase in Douglas fir can lead to more insect and disease problems in ponderosa pine and to denser stands of trees creating a stressed forest stand for non-shade tolerant trees. As these forests gain higher tree densities, the chance for a high intensity stand replacing fire increases (Agee, 1993)

Western larch or tamarack is a seral species in the mixed-conifer zone and is part of the moist forest plant associations within LRNRA. It is not as tolerant of summer drought as many other conifers and is generally found on north- or east facing slopes, in the bottom of drainages, at higher elevations, and on other relatively moist sites (Arno and Hammerly, 1977). It is a minor, but important forest species within LRNRA.

Western larch is the most fire-resistant tree species in the Inland Northwest. It has very thick bark containing little resin, a high and open branching habit, deep roots, and low-flammability foliage (Flint, 1925). In the Pacific Northwest, western larch serves as an indicator of previous severe fires on fair to good sites (Hall, 1973). Fire favors the establishment of this species on moister sites because it quickly invades openings, grows rapidly, and needs full sunlight. This requirement of needing full sunlight limits this tree's ability to dominate a site that is invaded by more shade tolerant species such as Douglas fir. Western larch relies on its relative longevity (Franklin, 1979) to survive until the next fire comes through to create the conditions for its regeneration.

Deciduous forests and woodlands are rare at LARO, mainly limited to mesic riparian, north-facing slopes and along the reservoir shoreline. The main native tree species found in this study include quaking aspen, paper birch and black cottonwood. Quaking aspen stands are primarily limited to the northern half of LARO whereas the paper birch and black cottonwood tended to be scattered throughout the entire project area. All three species form associations with deciduous shrubs such as narrowleaf willow (*Salix exigua*) and common snowberry. Pacific/golden willow trees are also scattered along the shoreline of the lake.

Shrublands are common throughout LARO, again trending from more mesic, deciduous species in the north to drier, evergreen shrubs in the south. Starting in the north, small pockets comprised of a mix of Saskatoon serviceberry, smooth sumac (*Rhus glabra*), rose (*Rosa* spp.), and common snowberry can be found in forest canopy openings and in minor drainages. As moisture increases in riparian settings other tall shrubs dominate including alder (*Alnus* spp.), water birch, and hawthorn. In the wettest areas along the reservoir shoreline and in major drainages willows become more prevalent. In the southern portion of the project area moist sites next to rock outcrops and drainage ways support pockets of chokecherry (*Prunus virginiana*) and Lewis' mock orange.

Many shrub species are associated with the mixed conifer and ponderosa pine plant communities. These understory plants often help define the different plant associations described for these trees. As a general rule, these shrubs will re-sprout after a fire and often are more palatable and nutritious to wildlife than in their previous unburned condition (Saveland and Bunting, 1988). The following species will be briefly characterized as to their response to fire and fire suppression:

- **Snowberry** (*Symphoricarpos albus*) is a survivor of low to moderate intensity fires (Fischer, Clayton, 1983). It is shade tolerant, although production tends to decrease as over story canopy increases (Zimmerman, 1979). Wildfire and prescribed fire can increase the abundance of this species.
- **Chokecherry** (*Prunus virginiana*) is well adapted to fire according to generalized fire effects information (Gartner, Wesley, 1973). Although easily top-killed, it resprouts vigorously from surviving root crowns and rhizomes (Habeck, et al., 1980). To a lesser degree, post-fire regeneration also involves the germination of off-site seed dispersed by mammals and birds (Volland, Dell, 1981).
- **Mallow ninebark** (*Physocarpus malvaceous*) sprouts vigorously following fire. Sprouts originate from horizontal rhizomes, of which a high proportion is situated in mineral soil. From 36 to 99 percent of its rhizomes are buried in mineral soil, ensuring its potential for survival and sprouting following a fire. It has been ranked in the highest fire-survival category in a Western Montana study (Bradley, 1984; Crane and Fischer, 1986; Noste and Bushey, 1987)
- **Serviceberry:** Serviceberry sprouts from the root crown and/or shallowly buried rhizomes after light- to moderate-severity fire. Deeply buried rhizomes enable serviceberry to sprout after even the most intense wildfire. Seedling establishment is apparently not an important post-fire regeneration strategy. Serviceberry in forests is fire-adapted and declines with fire exclusion. It may persist in the understory for decades, but eventually dies out with canopy closure. The decline of serviceberry in ponderosa pine habitat types has been attributed to canopy closure with fire exclusion. Low intensity

prescribed fire is expected to restore Serviceberry habitat to the benefit of various wildlife species known to occur at LRNRA. Serviceberry is a valuable forage plant (i.e. deer and elk brows twigs and foliage; black bear, beaver, and hares consume twigs, foliage, fruits, and bark; upland game birds consume the fruits and buds; rodents and songbirds eat the fruits (Martin, et al., 1951)).

- **Hollyleaved & creeping barberry *(Mahonia aquifolium*** and ***repens*)** (Oregon grape) - Oregon-grape is rhizomatous and can sprout from rhizomes after fire. Seedling regeneration can also occur from onsite or offsite sources. Oregon-grape seeds are dispersed onto burns by birds and mammals. Although top-killed by fire, Oregon-grape survives fire by sprouting from deep-buried rhizomatous buds. They often increase the 1st year after fire. Eventually their numbers decrease as shade and competition from the regeneration of trees shades and crowds them out.

Invasive Weeds

Since fire usually sets back succession and creates openings, burned areas have a potential for invasive weed invasion if a seed source is available. This is of particular concern where the soil surface is disturbed (suppression lines, fire camps, or helispot construction) or where intense heat from fire exposes mineral soils (pile burns, where 1000 hour fuels have burned, in intense wildland fire areas). LRNRA has identified over 25 weed species that are considered exotic to the park and have or could become invasive. The following is a brief discussion on the more prevalent species:

Cheatgrass is an invasive annual species common throughout LRNRA, especially in the steppe/shrub steppe habitats. It has spread throughout the U.S. using disturbances such as overgrazing, cultivation, or frequent fire to get a foothold. Once established, even without these factors it is able to creep into the inter-plant bare areas often found in bunchgrass and shrub-steppe communities. Cheatgrass effectively out competes native vegetation (Zouhar, 2003). Its ability to sprout in the fall and overwinter or sprout and begin growing very early in the spring give it a marked advantage over most native plants. It is an annual grass that survives fire by producing plentiful seed that is harbored in any unburned duff. Cheatgrass is very flammable and dries out up to 6 weeks earlier than the native perennial grasses (Stewart, 1949). Large stands of cheatgrass can create severe, frequent fires that cause the native grasses and shrubs to decline. Although wildfire can reduce seed production and set back plant density in the short term, surviving plants quickly take advantage of open seedbeds and bare mineral soils to colonize and outcompete native species.

Diffuse and spotted knapweed are biennials that resist low-severity fires because of stout taproots and by reducing the surrounding vegetation through releases of allelopathic chemicals. Their plentiful seeds are often buried in the unburned duff and soils allowing them to survive most fires (Zouhar, 2001). Once again, their ability to colonize areas cleared of vegetation by fire and to establish in bare mineral soils makes them an immediate threat after a wildland fire.

Non-native thistles (Canada, bull, Scotch, musk, and plumeless) are a constant threat to disturbed lands within LRNRA. Canada thistle is a perennial that invades by both rhizomes and seed production. The other thistles are biennials that sprout a rosette the first year and then bolt and

produce prolific seed crops the second year. The seed has the ability to float on the breeze and to infest new areas miles away from the parent plant. Some of rozettes (Scotch in particular) grow large basal leaves that shade out all adjacent vegetation thereby creating bare areas for the next years seed crop.

Dalmation toadflax, St. John's wort (*Hypericum perforatum*), mullein, sulfur cinquefoil (*Potentilla recta*), houndstongue (*Cynoglossum officinale*), longspine sandbur (*Cenchrus longispinus*), leafy spurge, and a relatively new arrival, hoary alyssum (*Berteroa incana*), represent a host of additional weeds already found in the park. Dependent on their proximity to a treatment area, they each exhibit an amazing ability to infest native habitats and to almost immediately pose a threat to the native plant communities. Another weed that has escaped from cultivation and is becoming very common in the forested habitats of the park is hairy or winter vetch (*Victa villosa*). It produces a large volume of vegetation and seed in the shady habitats and greatly increases the fuels on the forest floor as it dries in late summer. It is becoming a concern because of the amount of additional fuel it is creating on the forest floor and the apparent ease it is showing in expanding to new areas.

Wildlife

Wildlife present at LRNRA are typical for the semi-arid temperate and upland forest conditions in the park and the resulting habitat types. Some species, such as white-tailed deer, can be considered quite abundant. Little information is available regarding rare species present at LRNRA, as no systematic surveys have been conducted for any animal species except for fish and some aquatic invertebrates. The 2005 certified list of species found at LRNRA includes 71 species of mammal, 241 species of birds, 15 species of reptile, and 6 species of amphibians which occur either seasonally or year-round. Little is known about terrestrial invertebrate species in LRNRA. The observations of other federal, state, and tribal biologists contribute additional information about the occurrence, abundance, and distribution of species at LRNRA. Many species found in the park may become habituated to the presence of humans, particularly near developed areas. This may include rodents, rabbits, skunks, raccoons, coyotes, geese, jays, ravens, etc.

Given the linear nature of the national recreation area, areas solely on NPS lands with enough terrestrial habitats for larger wildlife is limited. Although LRNRA is too narrow to provide all aspects of a large mammal's range and habitat, it does provide important habitat to some common species. Two examples would be white-tailed deer (*Odocoileus virginiana*) and bald eagles. The Washington Department of Fish and Wildlife's (WDFW) Priority Habitats and Species program has listed areas along the Columbia River in LRNRA as important winter range for deer. For bald eagles, a delisted species, large ponderosa pine trees and snags provide critical nesting and roosting habitat.

Hunting and fishing is permitted within LRNRA during established seasons. The WDFW establishes the hunting and fishing seasons and related regulations. National Park Service and tribal rangers, state game agents, and county sheriffs enforce the regulations.

Mammals

Common large mammal species using the area include whitetail and mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*) and black bear (*Ursus americanus*). Less common large mammals present include elk (*Cervus elaphus*), moose (*Alces alces*), and mountain lions (*Felis concolor*). These larger species tend to move through the area in response to daily and/or seasonal migrations.

Small mammals found in the area include river otter (*Lutra canadensis*), muskrat *(Ondatra zibethicus*), mink (*Mustela vison*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*). In addition, bats, beaver (*Castor canadensis*), porcupine (*Erethizon dorsatum*), Nuttall's cottontail rabbit (*Sylvilagus nuttallii*), red squirrel (*Tamiasciurus hudsonicus),* Columbian ground squirrels (*Spermophilus columbianus*), chipmunks (*Tamias spp*.), yellowbellied marmot (*Marmota flaviventris*), shrew (*Sorex spp*.), voles, pocket gophers (*Thomomys spp*.), rats, and various species of mice are common.

Mule deer can be trapped and killed by fast-moving fires, although uncommon (Innes, 2013). In general, fires that create mosaics of forage and cover are beneficial for deer (Innes, 2013). Also fire rejuvenates and improves grasslands, which are important winter range in some areas (Johnson, 1989). However, in areas where sagebrush is the only cover, its complete removal can be detrimental to mule deer populations (Innes, 2013, and USDA, 1973). A major impact of fire at LRNRA is the loss of antelope bitterbrush. This is a highly preferred browse species and is sensitive to burning. Loss of this species will be one of the greatest impacts to deer. Many other shrubs that provide browse for deer will be stimulated by fire if the intensity and severity are low.

White-tailed deer as well are rarely killed by fire (Bendell, 1974). Like mule deer, patchy burns that create a mosaic of browse and cover are usually beneficial to whitetail populations. As mentioned above, a major impact of fire at LRNRA is the loss of antelope bitterbrush. This is a highly preferred browse species and is sensitive to burning. Loss of this species will be one of the greatest impacts to deer. Many other shrubs that provide browse for deer will be stimulated by fire if the intensity and severity are low.

Coyotes are very mobile and probably escape most fires. Fires that reduce vegetation height and create open areas can increase hunting efficiency by coyotes but may reduce prey species such as jackrabbit. Surface fires often open substrates for quieter stalking and easier capture of prey than can occur in closed forests (Tesky, 1995).

Raccoons are very mobile and probably escape most fires. Effects of fire are more variable for raccoons. Loss of cover can be detrimental to raccoons, as can the loss of plants that provide fruits. In California studies, raccoons benefited from early and mid seral chaparral and grassland systems (Tesky, 1995).

Important habitat for red squirrels includes mature trees unlikely to be adversely affected by low-severity fire. Severe fire would have negative impacts on red squirrels due to the loss of large trees and their associated canopy. Although in most areas squirrels may be able to move to new

areas, this would be a negative impact. Fires in the ponderosa pine forest may in some areas create a more open canopy that would not be suitable for red squirrels.

Badgers are able to survive fires by burrowing in the ground. The most important effect of fire on badger habitat is its effect on prey populations. Badgers probably leave a burned area if rodent populations decline; however some rodents increase on fire-disturbed areas, making it likely that badger activity would also increase in those areas. If the prey base was decreased, badgers can move to new areas of more abundant prey populations (Sullivan, 1996). Pocket gophers, which are a major prey item for badgers in western North America, often increase on lands disturbed by fire (Sullivan, 1996).

Deer mice, chipmunks, tree squirrels and other small rodents can be directly killed by fire, and indirectly by predation, loss of food supply, etc. Many survive by moving into underground burrows. Deer mice increased in a ponderosa pine forest in Arizona after fire. The increase was attributed to increased food and cover in the form of stumps and fallen logs; the highest populations occurred in areas with significantly more cover and forbs (Sullivan, 1995). In other studies, deer mice in grasslands tend to use burned plots more than adjacent unburned plot (Sullivan, 1995).

Up to 11 of the 15 species of bats found in the state of Washington may migrate through or spend their summers in the park. Species such as hoary bats (*Lasiurus cinereus*), big brown bats (*Eptesicus fuscus*), long-legged myotis (*Myotis volans*), and silver-haired bats (*Lasionycteris noctivagans*) use a variety of tree species and roost in trees more frequently. The following information is from the State of Washington Bat Conservation Plan: "*Mines, caves, buildings, trees, tree hollows, rock crevices, bridges, and shrubs are among the most common types of night roosts. Thirteen of the 15 bat species found in Washington make widespread use of cavities, crevices, and foliage in trees or tree snags as day, night, or winter roosts. Crevices beneath loose bark can be efficient in trapping heat and offer large spaces for rearing young, whereas cavities provide more stable temperatures and humidity. Crevices used by bats are typically beneath sloughing tree bark or exist as cracks or breaks in tree trunks and limbs. Snags and trees used by crevice- and cavity-roosting bats in western forests are generally large in diameter (≥50 cm), height (≥18 m), or both, and are in the early to intermediate stages of decay"* (Hayes and Wiles 2013). Those species utilizing trees and hollows in snags for roosting and nursery colonies present a management concern although they are highly mobile species. Mitigation measures that may be taken include leaving larger diameter dead and decadent trees in place, unless they present an immediate threat to life or property, during summer control treatments. All mechanical treatments using timber harvesting equipment, when large numbers of large diameter trees will be removed, will occur before and after the known nursery/rearing period of late May to July. All prescribed burns occur before and after the known nursery/rearing period of late May to July and though some roosting/nursery habitat may be lost during a prescribed fire (i.e. snags igniting and falling over), additional tree mortality usually occurs and new habitat is provided over the ensuing years between treatments.

Birds

The abundance of water and small adjacent areas of riparian and wetland habitats attract an abundance of avian species. Lake Roosevelt is within the Pacific Flyway and serves as a resting area during migration. Resident and migratory birds common to the area include large populations of waterfowl, shorebirds, gallinaceous birds, pigeons, woodpeckers, hummingbirds, raptors, and passerines.

Several species of raptors nest, roost or forage in the area. Among these are the osprey (*Pandion haliaetus*), golden eagle (*Aquila chrysaetos*), bald eagle, red-tailed hawk (*Buteo jamaicensis*), Northern harrier (*Circus cyaneus*), rough legged hawk (*Buteo lagopus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), and peregrine falcon (*Falco peregrinus*). Peregrine falcons were reintroduced in LRNRA in the 1990's in an effort to restore a breeding population to the area. At present, no aeries are known to exist, but individual peregrines are sometimes observed. Owls include great-horned owl (*Bubo virginianus*), Northern saw-whet owl (Aegolius *acadicus*), Western screech owl (*Otus kennicottii*), short-eared owls (*Asio flammeus*), and barn owls (*Tyto alba*).

Dozens of species of passerines use the area for foraging and nesting. The most common of these include swallows, finches, jays, chickadees (*Parus spp*.), ravens (*Corvus corax*), American crow (*Corvus brachyrhynchos*), black-billed magpies (*Pica pica*), Western meadowlarks (*Sturnella neglecta*), American robins (*Turdus migratorius*), sparrows, starlings, blackbirds, mourning doves (*Zenaida macroura*), pigeons and juncos (*Junco hyemalis*).

Common waterbirds include surface feeding ducks (mallards (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and teal (*Anas spp*.), diving ducks (redheads (*Aythya americana*), buffleheads (*Bucephala albeola*), lesser scaup (*Aythya affinis*), and golden eyes (*Bucephala spp.)*, western grebe (*Aechmophorus occidentalis*), coot (*Fulica americana*), common merganser (*Mergus merganser*), common loon (*Gavia immer*), and Canada geese (*Branta canadensis*). Wading and shorebirds in the area include sandpipers, northern killdeer (*Charadrius vociferous*), great blue heron (*Ardea herodias*), gulls, Wilson's snipe (*Galinago delicate*), belted kingfisher (*Megaceryle alcyon*), long-billed curlew (*Numenius americanus*), and yellowlegs (*Tringa spp*.).

Common gallinaceous birds include a combination of native and introduced species. Native species include ruffed grouse (*Bonasa umbellus*) and blue grouse (*Dendragapus obscurus*). Introduced species include the ring-necked pheasant (*Phasianus colchicus*), chukar (*Alectoris chukar*), Hungarian partridge (*Perdix perdix*), wild turkey (Meleagris gallopavo) and California quail (*Lophortyx californica*).

Adult birds can generally escape wildfires and move to areas not impacted by the fire. Major impacts to birds from wildfire include: interruption of nesting, death of baby birds in the nest (McMahon and David, 1990), alteration and loss of preferred cover; and drastic change in habitat structure. Generally speaking large, intense fires that burn an area clean may not have any clear benefit to (steppe) wildlife species in the short term (Clark and Starkey, 1990).

Impacts to raptor species should be limited to ground nesters, impacts to burned nest and roost trees/snags and negative effects to prey species habitats. Fires are noted to have effects on golden and bald eagles, which are impacted by severe wildfires that destroy nest and roosting trees. Regular burning helps to keep habitats in a suitable condition for many prey species of the golden eagle and increases hunting efficiency (Landers, 1987). These same general impacts are reported for red-tailed hawks (Landers, 1987), great horned owls (Lehman, 1989), and osprey (Tesky, 1993). Some species have been adversely affected by fire suppression, such as the prairie falcon (Lehman, 1989) in which trees have encroached on grassland habitats, whereas some have benefited, such as red-tailed hawks (Palmer, 1988), where trees have moved into vast treeless grassland areas. Peregrine falcons can benefit from low to moderate intensity fire that creates a mosaic of habitat for its prey species (Luensmann, 2010).

Passerine birds, like other birds can escape fire, but if the fire occurs during nesting negative impacts can occur. Some research has shown black-capped chickadees decrease following fire, probably due to a decrease in habitat complexity and available food (Niemi, 1978). Burning can lead to increased ground nesting by mourning doves (Soutiere and Bolen, 1973) which may make future nests more vulnerable to fires. Conversely mourning doves have been found to prefer burned areas for feeding (Mason, 1981), indicating that a mosaic created by a low to moderately severe fire could benefit this bird. Western bluebird's nest's and nestling are probably vulnerable to fire (Nichols and Menke, 1984). Once again post-fire communities are usually attractive to western bluebirds (Saab, 1995).

Woodpeckers are likely to benefit with fires that create additional, and retain existing snags. Generally speaking, fire can benefit or degrade a species based on the severity of the fire and on what type of habitat is affected compared to the preferential habitat of the species in question. Fire effects to water birds can be detrimental to the species in that many nests in grass or grass like vegetation, which readily burns, would be destroyed. The main impacts to waterfowl is the loss of nest and nestlings in the spring nesting period and this includes: mallard (Hodson, 1965), Canada goose (Snyder, 1993), Northern pintail and blue-winged teal (*Anas discors*) (Bellrose 1980). Adult waterfowl could be affected if a fire occurred during molting. Fire has other notable benefits and impacts to ducks, these include: reduction of predator cover (Fritzell, 1975), creation of more nesting materials and areas (Vogl, 1967), and reduction of the vegetation's ability to hold snow and thus recharge spring ponds (Ward, 1968).

Gallinaceous birds are also very vulnerable to fire because many nest on the ground in grassy, shrubby vegetation. As with other ground nesters, the adults can escape fires but the young and associated nests can be destroyed by early spring fires. This includes the following gallinaceous birds: chukar (Bohl, 1957), ruffed grouse (Grange, 1948), wild turkey (Hurst, 1981), and sharp-tailed grouse (*Tympanuchus phasianellus*) (Grange, 1948). Like other grassland and ground related birds, fire can benefit these birds in the following ways: turkeys and chukar by reducing ground cover exposing seeds and dead insects, an important food source (Wright, 1982; Hurst, 1978); reduce ground cover that in turn reduces predator cover and makes it easier for these birds to travel along the ground. Increasing diversity in plant communities can increase food sources for these birds (forbs and insects).

The impacts of fire on birds vary according to the timing, severity, location, and extent. Generally speaking lower intensity fires that create a mosaic of habitats tend to benefit the greatest number of species based on the previous discussion, and especially when they are prescribed burns conducted outside of the nesting/rearing season or only in areas with no known nests. Large, severe wildfires will have the greatest impacts on the most species overall. Fire suppression without additional prescribed burning may lead to larger impacts to birds on the landscape.

Reptiles and Amphibians

A systematic inventory of reptile and amphibian species was completed in 2005 A little is now known about species occurrence, but information on abundance, distribution, and critical habitat is reliant on literature and studies conducted in the region around LRNRA. Known reptiles and amphibians include the sagebrush lizard (*Sceloporus graciosus*), short-horned lizard (*Phrynosoma douglasii*), western rattlesnake (*Crotalus viridis*), gopher snake (*Pituophis catenifer*), garter snakes (*Thamnophis spp*.), western toad (*Bufo boreas*), great basin spade-foot toad (*Spea intermontana*), Pacific tree frog (*Pseudacris regilla*), western painted turtle (*Chrysemys picta*), and salamanders (*Ambystoma spp*.). The mobility of each of these species allows them to move out of most areas that may be subjected to treatments.

Fisheries

Lake Roosevelt and its tributaries in the National Recreation Area support a varied fish community that today is considerably different from the native fish community of the early 1900's. The changes over time were caused by the introduction of nonnative species, and habitat alterations such as water pollution, damming of rivers and reservoir draw-downs. Surveys and literature searches have identified 45 species of fish in LRNRA (2005 data). Seven of these species were found in low numbers, with many represented by only one individual in one survey out of eight. Biologists believe that these individuals may occasionally wash down from reservoirs and lakes upstream or are brought in by unauthorized human introductions. Of the 45 species detected, at least 14 are not native to the Columbia River. The most abundant species include large-scale sucker (*Catostomus macrocheilus*), smallmouth bass (*Micropterus dolomieui*), burbot (*Lota lota*), walleye (*Stizostedion vitreum*), kokanee salmon (*Oncorhynchus nerka*), and rainbow trout (*Salmo gairdneri*) (Bonneville Power Administration, 1997). Northern pikeminnow (Ptychochelius oregonensis), longnose suckers (Catostomus macrocheilus), and an assortment of dace (Rhinichthys spp.), sculpins (*Cottus spp*.), and bullheads (*Ameiurus spp.)* are other native species of importance. Introduced game fish include brown trout (*Salmo trutta*), walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), black crappie (*Pomoxis nigromaculatus*), and common carp (*Cyprinus carpio*). The introduction of walleye and smallmouth bass in particular have resulted in noticeable drops in many of the native forage fish that inhabit the reservoir and in the survival of the young of native trout, sturgeon and most of the other native fishes.

The white sturgeon (*Acipenser transmontanus*) is a park species of concern, because of its sensitivity to some of the pollutants now found in the reservoir; the impacts of introduced voracious predator fish on reproductive success; and the impacts of the reservoir backwater on sturgeon spawning habitat. White sturgeon are a long-lived (70+ years), large prehistoric fish that can grow to lengths over 12 feet and weights over 1,000 pounds. An international recovery team and plan is in place in an effort to enhance annual recruitment in the free-flowing portions of the Upper Columbia River up into Canada.

Recent crayfish surveys have found that two species of crayfish inhabit much of the reservoir. Northern or virile crayfish, (*Orconectes virilis)* are a non-native species that appear to be expanding their range. The native signal crayfish (*Pacifastacus leniusculus)* still inhabits portions of the reservoir, but like white sturgeon may be limited in numbers and distribution due to non-native predators, competition from non-native species, pollutants and the annual drawdowns.

Fire can negatively impact fish species. The prescribed fire program proposed for LRNRA is not expected to impact fish species in a negative way. LRNRA controls only short "mouth" portions of small tributaries, so prescribed fire will have little impact to raising the temperature of these streams. Present conditions on the main stem and tributary mouths of LRNRA are already impacted by reservoir conditions that preclude significant additions to factors that negatively impact fish. Prescribed fire at LRNRA should have minimal impact on fish. A benefit that may occur will be the reduction of fuel conditions on LRNRA that would minimize the potential for a high intensity and severe fire that would leave the NPS boundary and move onto private land and negatively impact a large portion of a tributary's watershed thereby affecting water temperatures, water quality, and sediment/ash inputs.

Sensitive Species

Sensitive plant species

Known sensitive species identified by the U.S. Fish and Wildlife Service (USFWS) and potentially present in LRNRA includes two plants:

The Ute ladies' tresses (*Spiranthes diluvialis)*, is listed as Federal Threatened and State Endangered. This species is not known to be located in LRNRA (currently only known to occur in Okanogan & Chelan Counties) but could potentially be present. It primarily grows in wetland complexes and has not been found within the park in any prior botanical studies or on any monitored fire plots. A relative, Hooded Ladie's-tresses (Spiranthes romanzoffiana) was the only Spiranthia found.

Spaldings' silene or catchfly (*Silene spaldingii*) is Federal Threatened and State Threatened and occurs in the Blue Mountains and Columbia Basin. It primarily grows in open, mesic grasslands or sagebrush-steppe plant communities. Occasionally it is found within open pine forests. It grows at elevations of 1200' to 5300' usually in deep, productive loess soils. Plants are generally found in swales or on north facing slopes where soil moisture is relatively higher. Current

occurrence maps show it south of the Spokane River and Lake Roosevelt in Lincoln and several other counties of SE Washington. It has not been found in the park, but in-depth surveys have not been conducted.

There are a number of state listed species of concern that have known locations in or near Lake Roosevelt.

Three species were not found during the 2005 parkwide plant inventory, but are State listed for portions of the counties surrounding and including LRNRA. These species will be on a watch list and will be inventoried for prior to any treatments occurring. They include

- Palouse milkvetch (*Astragalus arrectus*). It is State Threatened and has been found in Lincoln County growing on grassy hillsides, sagebrush flats, river bluffs, and open ponderosa/Douglas fir forests in grassy or shrub dominated openings. It grows on all slope aspects in soil ranging from rocky and dry to moist and rich at elevations from 100' to 4000'.
- Least bladdery milkvetch (*Astragalus microcystis*). It is State listed as Sensitive and occurs in Lincoln County with historic (pre-1980) sightings in Ferry and Stevens Counties, In Eastern WA, the species occurs on gravelly to sandy areas, from riverbanks to open woods at 1400' to 6200' elevations.
- Gray stickseed (*Hackelia cinerea*). All the known occurrences are along the Spokane River or its tributaries. It occurs in open or sparsely forested areas, especially on cliffs, or talus slopes or rock faces often in the mossy cracks at elevations from 1600' to 1900'.

Table 5 documents those species that would be associated within the elevation ranges, moisture regimes, and plant associations that occur in the park (Washington Natural Heritage Program 2012).

Those plants not found during the park plant inventory and that are closely associated with habitats not present in the park or that are found at much higher elevations in the Okanogan Highlands are not included on the list. These are not further discussed herein. Those species included in Table 5 will be included on a species of concern list for LRNRA staff and FEM crews to watch for and ensure that they do not fall within any proposed treatment units. LRNRA will protect any state listed species found in a treatment unit through mitigation actions or by redefining the unit to exclude the area where the species is known to occur.

Table 5 Washington State Sensitive Species that have known sightings in or near Lake Roosevelt

Common Name	Scientific Name	State Status	Federal Status	LARO 2005 Plant Inventory	Counties where found	Preferred Habitat
Ute ladies'-tresses	Spiranthes diluvalvis	Endangered	LT	Not found	Okanogan	…wetland complexes…inundated wet meadow zones… elevations from 720' to 1500'.
Columbia crazyweed	Oxytropis campestris	Endangered	--	Present	Ferry Stevens	Gravelly banks along Columbia River from the

Common Name	Scientific Name	State Status	Federal Status	LARO 2005 Plant Inventory	Counties where found	Preferred Habitat
	var. columbiana					confluence with the Spokane River north to near the Canadian border – gravel bars and stony river or lake shores between 1200 & 3000 feet. Most populations…extirpated due to habitat destruction by…Grand Coulee Dam.
Nuttall's pussytoes	Antennaria parvifolia	Sensitive	--	Present	Lincoln Stevens Ferry	Dry, open areas with sandy or gravelly soil along rivers, creeks, & lake shores usually in ponderosa pine forests…elevations from 1400' to 2600'.
Palouse milk-vetch	Astragalus arrectus	Threatened	--	Not found	Lincoln	grassy hillsides, sagebrush flats, river bluffs, and open ponderosa/Douglas fir forests in grassy or shrub dominated openings growing on all aspects in soil ranging from rocky and dry to moist and rich…elevations from 100' to 4000'.…
Least bladdery milkvetch	Astragalus microcystis	Sensitive	--	Not found	Lincoln & historically in Ferry & Stevens	In Eastern WA, the species occurs on gravelly to sandy areas, from riverbanks to open woods…1400' to 6200' elevations
Gray stickseed	Hackelia cinerea	Sensitive	--	Not found	Lincoln Stevens	…all known occurrences along Spokane River or its tributaries…occurs in open or sparsely forested areas, especially on cliffs, or talus…often in mossy cracks. Elevations…from 1600' to 1900'.
Idaho gooseberry	Ribes oxyacanthoi-des	Sensitive	--	Not found	Ferry Stevens (historic along river)	…found along streams, meadow openings…and slopes of moist to dry canyons…with conifers…elevations from 3000' to 5000'.
Western ladies'-tresses	Spiranthes porrifolia	Sensitive	--	Not found	Lincoln Okanogan	Wet meadows, along streams, in bogs & on seepage slopes…elevations 60' to 6800'.
Yellow lady's-slipper	Cypripedium parviflorum	Threatened	--	Not found	Ferry, Stevens, Okanogan	Bogs and wet forests. In the channeled scablands…around periphery of ponds and in low moist areas…elevations from 2100' to 3440'

Common Name	Scientific Name	State Status	Federal Status	LARO 2005 Plant Inventory	Counties where found	Preferred Habitat
Yellow sedge	Carex flava	Sensitive	--	Not found	Stevens, Ferry, Lincoln	Wet meadows, forested wetlands, bogs, and shores of streams or lakes…elevation from 2000' to 4300'.
Black snake-root	Sanicula marilandica	Sensitive	--	Not found	Okanogan Ferry Stevens	Moist low ground, such as meadows, riparian flood plains, moist woods, and marsh edges…elevations from 1500' to 2900'.
Spaldings' silene or catchfly	Silene spaldingii	Threatened	Threatened	Not found	southern Lincoln	…occurs in Blue Mtn. and Columbia Basin…primarily within open grasslands with a minor shrub component and occasionally with scattered conifers …at elevations of 1900' to 3050'.

The following two state-listed sensitive plant species were found during the 2004-2005 LRNRA Plant Inventory conducted by specialists from the NPS Upper Columbia Basin Network Inventory & Monitoring office located in Moscow, Idaho. They are:

Columbia crazyweed (*Astragalus campestris var. Columbiana*), a State Endangered species that has been verified in the park. It is found in Ferry and Stevens County on the gravelly banks along the Columbia River from the confluence with the Spokane River north to near the Canadian border. It grows on gravel bars and stony river or lake shores between 1200 & 3000 feet. Most populations were likely extirpated due to habitat destruction when Lake Roosevelt was filled after the completion of Grand Coulee Dam. The habitat would be further limited due to the extensive amount of slides and steep, nearly vertical banks resulting from reservoir impacts along the shoreline. Generally, this species would not grow in an area that would be treated by fire or fuels treatments.

Nuttall's pussytoes (*Antennaria parvifolia),* a State listed Sensitive species. *It is* a mat-forming perennial in the composite family and was found in 2005 and earlier inventory efforts. It was initially found and identified by Cathy Allenschlagger, USFS Botanist for the Colville National Forest, and reconfirmed by Jean Wood of the University of Wyoming (Hebner, 2002). The state of Washington recognizes Nuttall's pussytoes as "demonstrably secure globally, but locally vulnerable to extirpation (with less than 6 to 20 occurrences)" (Washington Natural Heritage Program, 2012). It is known to occur in Lincoln, Pend Orielle, Spokane and Stevens Counties but comprehensive surveys are yet to be completed. Lake Roosevelt has set up plots in areas where the species was found and collected data to observe the results of management actions and to apply adaptive management if necessary. A 2002 survey within NPS developed areas and proposed fuel reduction sites found the plants in 38 percent of the locations. Significant threats were identified by the state at the time of listing, but those of logging, thinning and burning were not noted. The proposed prescribed burn plots where this species is found will analyze impacts to the Nuttall's pussytoes, in relation to survival and regeneration.

Very little is known about the effect of fire on Nuttall's pussytoes; however it is suspected that it is killed by fire (Fryer, 2011). It is known to colonize bare mineral soil by wind-dispersal of seeds, and is therefore considered to be an initial offsite colonizer (Steele and Geier-Hayes 1993), and may establish itself following burning. The broad and scattered range of Nuttall's pussytoes within the burn-units inhibits the avoidance of this species during prescribed burning. It is therefore advisable to map and monitor changes in these populations before and after burning. Strategies such as raking pine needles away from plants and/or wetting down plants may aid plant survival and reduce the effects of fire on this species. A LRNRA natural resource specialist will be responsible for doing plant surveys and implementing mitigation measures with the assistance of the NOCA FEM team.

Sensitive animal species

The listed wildlife species identified by the USFWS that may occur in the vicinity of LRNRA include: grey wolves *(Canis lupus- Federal Delisted in Eastern Washington, State Endangered), g*rizzly bear *(Ursus arctos horribilis- Federal Threatened, State Endangered),* Canada lynx *(Lynx Canadensis – Federal Threatened, State Threatened), w*olverine *(Gulo gulo luscus – Federal Proposed Threatened Candidate and State Candidate,* pygmy rabbit *(Brachylagus idahoensis – Federal Endangered (Columbia Basin DCP), State Endangered),* and bull trout *(Salvelinus confluentis- Federal Threatened).*

The grey wolf and grizzly bear have not been confirmed in LRNRA. However, since 2012, sightings of both species have occurred in the "Wedge" area between the Kettle River and Columbia River where they enter the U.S. from Canada. As figure 1 below notes, the State of Washington has also completed a wolf management plan and NE Washington is now home range for a number of packs with several close to LRNRA (Wedge, Smackout, Huckleberry, Boulder Creek, and Ne'ion).

Figure _1_Wolf Packs in Washington (as of February 2013)

The Canada lynx is known to occur in the more remote, mountainous areas of Stevens and Ferry County and especially in the mountains of Okanogan County, where many sightings and state funded research is ongoing. Sightings of wolverines in Washington are becoming more frequent and a female with young was verified in NOCA in 2012. Neither species has state or federal critical habitat identified that would include LRNRA nor have they been sighted in the park.

The Columbia Basin Distinct Population Segment (DPS) pygmy rabbit is endangered. It is only found in a few known populations in Grant and two other counties of Washington. All known populations are far removed from Lake Roosevelt, though the rocky talus slopes along the original river and coulees may have harbored these rabbits historically before the area was covered by reservoir waters.

The bull trout, a threatened species, is not believed to live or reproduce in Lake Roosevelt according to Spokane Tribal Fisheries and WDFW biologists. Approximately three bull trout have been collected in Lake Roosevelt during intensive fish surveys over the last three decades. It is believed that the three fish captured were entrained into the system from upstream bodies of water above other dams. Experts with extensive fishery experience on Lake Roosevelt, state that lake conditions including temperature are not suitable for the long term existence of bull trout.

The following are the Washington State listed species that occur in or near the park. The first list of species may experience potential impacts from prescribed fire or fuels projects in forested areas and mitigation actions will be taken if they are found in a treatment unit. These include:

- Bald Eagle is a State Sensitive species now delisted (Species of Concern) by the USFWS. The park maintains a database of known bald eagle and osprey nesting sites along the

shoreline and nest inventories are conducted for new or occupied nests before any treatments occur. Bald eagles, along with golden eagles, are still protected under the federal Bald and Golden Eagle Protection Act.

- Golden Eagle is a State Candidate species due to low reproduction rates and lead bio-accumulation issues. One known nesting area occurs in the park near China Bend. There are no planned treatments in the vicinity.
- Townsend's Big-eared Bat (*Corynorhinus townsendii*) is a State Candidate, Federal Species of Concern. Inhabit ponderosa pine forests and woodlands, shrub-steppe, riparian, and open fields. Caves, lava tubes, mines, old buildings, rock crevices, bridges, and very large trees with basal hollows are commonly used for day roosts in Washington. Maternity roosts do not appear to occur in trees in Washington. Of 30 known maternity roosts found since 1980, none occurred in trees (WDFW Wildlife Survey Data Management database). This species has been verified in the park and potentially could reproduce and find maternity roosts. Inventories for breeding populations of this species should occur prior to summer projects in large diameter, overstory trees. Fall and spring projects should only cause individual bats to have to relocate and find new roosting trees if large diameter snags are being cut for safety purposes.

Sensitive wildlife species listed by the State of Washington, that are present or may be present in the park, but are not expected to experience impacts from prescribed fire or fuels treatment projects include:

- American White Pelican (*Pelecanus erythrorhynchos*) – State Endangered; - It has been verified in LRNRA but sightings are rare. It only uses water habitats.
- Ferruginous Hawk (*Buteo regalis*) – State Threatened, Federal Species of Concern, This species uses shrub-steppe habitats of central and southern Washington. Some nesting occurs in Grant County, but only rare sightings of transient birds have occurred in LRNRA.
- Sandhill Crane (*Grus Canadensis*) – State Endangered. Occasional migrating visitor to park but not known to breed in the area. Does not use forested habitats.
- Upland Sandpiper (*Bartramia longicauda*) – State Endangered and likely extirpated from the NE corner of Washington. Habitat areas used included open grasslands, prairie, and meadows.
- Common Loon – State Sensitive – Verified, but uncommon visitor to park. Not known to nest along the shoreline or adjacent wetlands of the reservoir. Does not use forested habitats.
- Peregrine Falcon – State Sensitive, Federal Species of Concern. Rare visitor to park. Several released in the park in the 1990's. No known breeding pairs in the park.
- Washington Ground Squirrel (*Urocitellus washingtoni*) – State Candidate and Federal Candidate Species. Occur south of Columbia and Spokane Rivers in Columbia Basin region. Not found in park.
- Northern Leopard Frog (*Lithobates pipiens*) – State Endangered, Federal Species of Concern. Not known to occur in park. Historical and recent records include one sighting in central Okanogan County and several in central Grant County.
- Greater Sage Grouse (*Centrocercus urophasianus*) – State Threatened, 2013 Federal Candidate species. LRNRA's limited land base does not provide adequate expanses of shrub/grasslands or sage habitat. Historically they may have occurred along the edges of

the Columbia River. The elimination of natural sagebrush and bunchgrass communities on adjacent lands to allow for large expanses of dryland farming has reduced many native populations of shrub-steppe dependent species. At this time LRNRA does not have any prescribed fire projects planned for shrub-steppe habitat areas.

- Sharp-tailed Grouse – State Threatened. Persist in seven scattered populations in Lincoln County, northern Douglas County, the Colville Indian Reservation, and valleys and foothills east and west of the Okanogan River in Okanogan County, none of which fall within the boundaries of LRNRA

Migratory Bird Treaty Act (MBTA) Protected Species

The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations.

Inventories for nesting birds protected under the Migratory Bird Act of 1918 will occur in each treatment unit prior to initiation of a project if the project falls between April 1 and July 15. NPS specialists will do an inventory at each site for any bird nesting or rearing activities. Should winter to early spring (January 1 to March 30) projects occur, a nesting survey will be conducted for great horned owls and bald eagles since both of these species may begin mating & nesting in late January. If any MBTA listed species are found in the treatment unit the project(s) will be delayed until after the nesting/rearing season (all chicks have fledged – usually by July 15th). See Appendix 4 for a list of MBTA bird species that have been sighted within LRNRA. This is especially important for a subset of MBTA listed birds identified as Birds of Conservation Concern (USFWS, 2008). The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." Birds of Conservation Concern 2008 (USFWS, 2008) is the most recent effort to carry out this mandate. See Appendix 5 for the list of BCC birds in the two regions encompassing LRNRA.

Cultural Resources:

Lake Roosevelt Reservoir contains a rich assortment of both prehistoric and historic sites that contain evidence of the last 9000 years of human occupation in the Upper Columbia River Valley. Native American sites include house-pit villages, seasonal camps, fishing locations, plant procurement, and burial sites. Most of the prehistoric sites in the reservoir have been subjected to some degree by erosion caused by the dam operations, but excavations in the 1970s and 1990s demonstrate that intact deposits still exist at many sites. Of the 280 sites recorded in the recreation area, 58 are located above the reservoir high water line and subject to possible adverse effects from both fire and fire suppression activities. Another 10 sites located in the reservoir near the high water line could suffer disturbances from fire suppression activities if they occurred during a draw-down.

Historic sites in the recreation area document the successive developments of Euro-American settlement of the region from the early fur trade to the development of small towns servicing the

developing mining, agricultural, and logging economies of the late 19th and early 20th century. The most important Early Fur Trade site in the recreation area is Fort Colville, located in the reservoir. Other important historic sites include the reconstructed St Paul's Mission at Kettle Falls and Fort Spokane located on a terrace above the confluence of the Spokane and Columbia Rivers. Later historic sites include homesteads, mining, orchard, and former town sites. Most of the structures were removed from these sites when the reservoir area was being cleared prior to inundation. Later surveys have documented abundant archaeological deposits associated with the sites.

Two historic districts in LRNRA have been nominated for listing in the National Register of Historic Places. The Kettle Falls Historic District encompasses the pre-reservoir Kettle Falls and includes 21 Native American sites, Fort Colville and the St. Paul's Mission located on the bluff overlooking the falls. The Fort Spokane Military Reserve Historic District encompasses 88 of the 640 acres of the original reserve and includes the primary structural complex of the Fort.

The National Historic Preservation Act (NHPA), as amended in 1992 (16 USC 470 et seq.); the National Environmental Policy Act; NPS Cultural Resource Management Guideline (NPS, 1994), and NPS *Management Policies* (NPS, 2006a) require the consideration of impacts on cultural resources listed on, or eligible for listing on, the National Register of Historic Places. Management actions described in this document are also subject to Section 106 of the NHPA.

Visitor Use:

The NPS mission, as outlined in the Organic Act of 1916, defines the purpose of all parks to "…conserve the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same…". Scenic (visual) values, recreational activities, and general visitation within and around fire-treated areas may be temporarily impacted; thus visitor use will be considered an impact topic.

Visitor use at Lake Roosevelt reached one million visitors in 1987 and has continued to top that since (See Figure 2). Visitation between 1.2 million and 1.8 million has been common since 2000 with the last 10 years averaging 1.4 million visitors. Although the recreation area is open all year, similar to most areas in the National Park System, visitor use is not evenly distributed throughout the calendar year. Visitor use is relatively low and stable between November and March, but begins to rise in April, until it reaches a summertime peak in July and August, whereupon it falls until November.

Visitor use is also uneven over the many individual dispersed visitor access points within the recreation area. A 1997 study showed the highest levels of visitor use at Kettle Falls (304,080), followed by Fort Spokane (119,088 for the visitor center and 116,714 for the campground), Spring Canyon (103,251), Seven Bays Marina (100,949), Keller Ferry Campground (88,053), Hunters Campground (77,832), and 61,687 (Hawk Creek Campground). Six areas accounted for between 4-8 percent of total visitor use, while four recorded more than 100,000 visits in 1997. Nine other areas accounted for one quarter of one percent to three percent of visitor use (NPS, 2000). A majority of the visitors come from the Pacific Northwest including Spokane and the I-5 Corridor between Olympia and Seattle.

Fire activities, and especially smoke from prescribed fire and area wildfires can impact visitor use and experience. Many of the treatment units are specifically set-up to manage fuels near developed areas and neighboring developments (WUI areas). Short term impacts to visitors include 1 to 5 days of smoke, small areas of the park being closed, and additional traffic from fire and crew vehicles.

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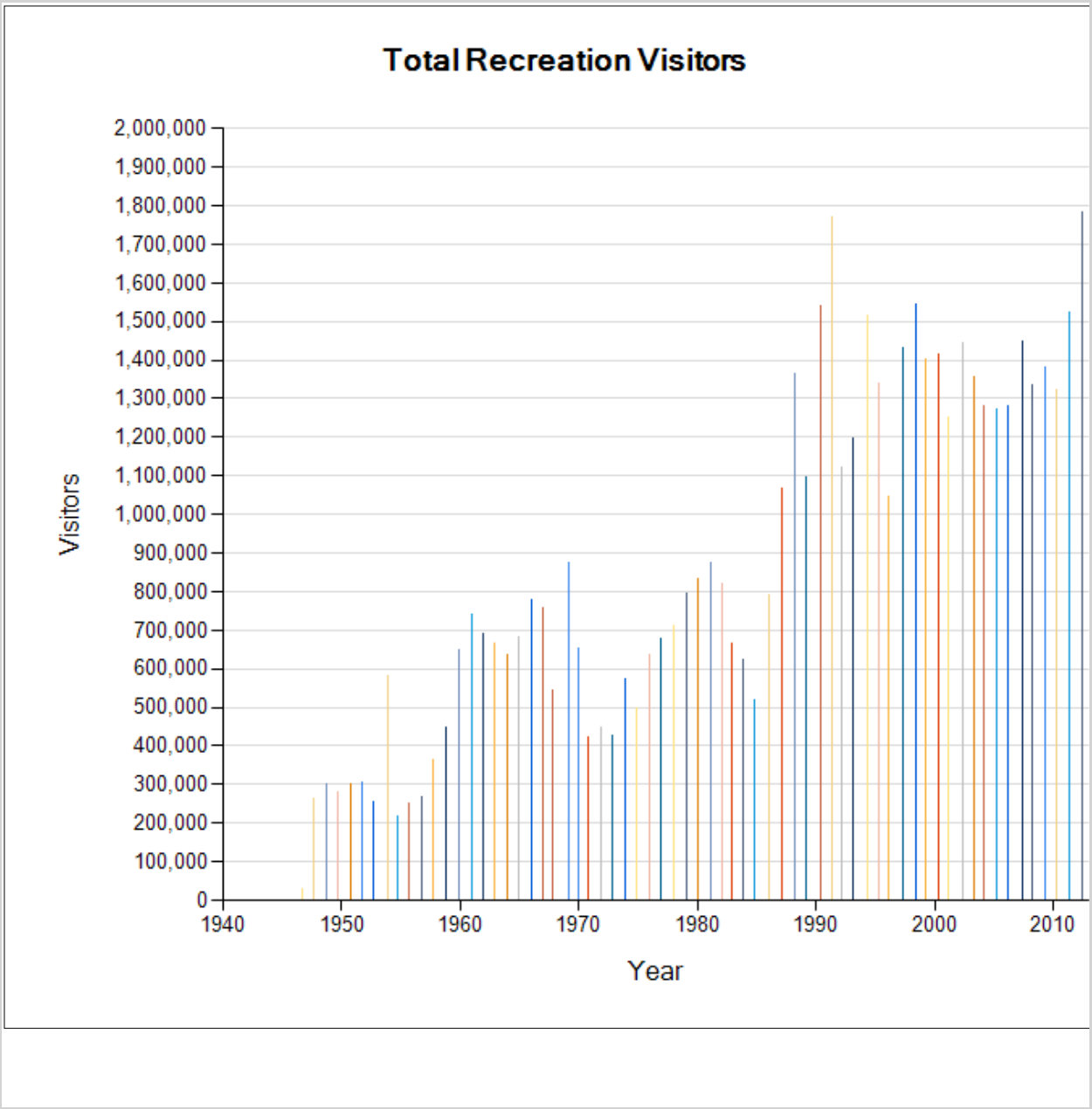
Figure 2 Lake Roosevelt National Recreation Area Historical Visitor Use



Safety:

Safety of the public, park staff, and of all personnel engaged in fire suppression and fire management projects is the primary concern of LRNRA. Federal Wildland Fire Policy-2009 as expressed through NPS *Management Policies* (NPS, 2006a) and NPS DO-18 makes safety the highest priority in determining fire management strategies. The preferred alternative will

increase the level of safety for staff or partners involved in fire suppression within or adjacent to park infra-structure and WUI areas by reducing the fuels and potential intensity of wildfires. Fire intensity of prescribed burns will also be reduced through multiple entrees that address fuels reduction and reduction of ladder fuels. Resistance to control in these areas will be decreased by fuel model conversion.

The increase in acreage and number of treatment units, longevity of this plan, and number of possible entries/treatment actions needed to bring treatment units to desired condition all involve exposing staff to a higher possibility of injury from accomplishing duties that are inherently dangerous. The use of chainsaws, prescribed fire, hand tools, and working around fire and timber harvesting equipment are only compounded by environmental factors such as thunderstorms, rocky and steep terrain, poisonous snakes and plants, stinging/biting insects that may carry diseases, and wet and slippery work conditions. The use of PPE, the requirement to be trained in operating dangerous tools, holding daily tail-gate sessions that review current environmental conditions, job hazard analysis worksheets, promotion of "operational leadership" decision making, and safety reviews are all measures that are undertaken to mitigate the dangers of getting the work done in the safest possible manner.

Neighboring Lands:

Since the filling of Lake Roosevelt, there has been a steady increase in the amount of neighboring lands that have been subdivided and developed into summer homes and permanent residences. The outstanding vistas, natural settings, easy access to a large, publicly managed body of water, and the many other recreational opportunities available in the region all make living near Lake Roosevelt a very desirable choice. In the past 20 years this has especially been recognized and home and land values have risen accordingly. In relation to wildland fire and management of NPS resources, this continues to add a complexity to the overall management of wildfires, prescribed burns, and even fuels reduction projects. In addition, a number of encroachments have been identified in recent years as fire management planning occurs. Typically NPS staff discover that neighbors have 'adopted' a portion of the public lands and have integrated them into their private property. This has included outbuildings, decks, lawns, lake access roads, and even tree removal operations (to open the "view") occurring on NPS lands. The park also receives numerous requests for defensible space projects for homeowners who have built close to the NPS property boundary and now want the NPS managed forests limbed and thinned to help protect the substantial investment made by the neighbor.

Since the 1940's, the amount of neighboring private residences and developments has steadily increased from 100 or so small farm and ranch homes/outbuildings to what is now over 4,000 summer and permanent residences within 1 km of the LRNRA boundary (NPS, 2011). Many of these homes have values well over $100,000 with some approaching $1,000,000. The amount of WUI lands with higher densities of homes have also increased. Places like Seven Bays, Hansen Harbor, Lincoln Mills, Moccasin Bay, Barstow, Marcus, Evans, and the Old Town of Kettle Falls areas have been subdivided, developed and now include 20 to 100 homes in the immediate vicinity of LRNRA.

Once again this FMP emphasizes the need to control all wildfires as quickly and safely as possible. The overall goal is to control any wildfires that start on NPS lands before they leave the

park. Of course the narrow nature and small land base of the park makes this difficult. The goal of the numerous fuel reduction projects previously completed and the new ones included in this plan are to create managed fuel break areas that drop the intensity of the wildfires and allow for control before they leave the park and can impact the numerous WUI and private homes surrounding the park.

Defensible space projects that follow *Firewise* guidelines will also continue to be planned and funded – however, these projects will not negatively impact NPS lands where limited county zoning guidelines, development planning, and home placement put valuable homes and private property on the immediate boundary of the park. This puts the NPS in a situation where the park is asked to create a *Firewise* protective zone 30 to 100 feet onto NPS lands in order to protect the private home and associated improvements. In addition, the choosing of non-fire resistant building and roofing materials by neighbors is also not a reason for the NPS to take substantially more costly and time consuming defensible space actions to try and protect the structures. LRNRA will continue to work with county commissioners on improved zoning ordinances, and with realtors and neighboring homeowners to promote *Firewise* planning guidelines and to provide fire planning educational materials through the park's website and printed brochures.

Impacts Considered but Dismissed from Further Analysis

The impact topics listed below either would not be affected, would be affected only negligibly or do not exist within the project areas. Therefore, these impacts will not be analyzed further. Negligible effects are localized effects that would not be detectable above existing conditions.

Floodplains: Executive Order 11988 (Floodplain Management) requires an examination of impacts to floodplains and potential risk involved in placing facilities within floodplains. (FEMA, 1977) NPS *Management Policies* (NPS, 2006a), and DO-12 (NPS, 2006b) provide guidelines for proposals in floodplains. Executive Order 11988 requires that impacts to floodplains be addressed. Although all areas within the national recreation area that are below the 1,290 maximum pool elevation are within the floodplain of Lake Roosevelt, flooding is not a concern because it is controlled by Grand Coulee Dam and at other upriver dams and thus is predictable and occurs slowly.

Geologic Processes / Geothermal Resources / Geological Hazards: There would be no increase or decrease in potential impacts associated with geology or geological hazards from the impacts of the proposed plan. Ongoing geological hazards associated with shoreline erosion would continue and are addressed under the 'soils' and 'water quality' impact topics.

Museum Collections: NPS *Management Policies* (NPS 2006a) and other cultural resources laws identify the need to evaluate effects on NPS collections if applicable. The collections at LARO would not be affected by the proposed project, except by the potential addition of material to the collections if any is found (see mitigation measures under *Cultural Resources* in the *Environmental Consequences* section). Requirements for the management of museum objects are defined in 36 CFR 79.

Energy Consumption: Implementation of the proposed actions would not cause measurable increases or decreases in the overall consumption of electricity, propane, wood, fuel oil, gas or diesel associated with visitation or for park operations and maintenance.

Environmental Justice: Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. This Executive Order does not apply to the subject of this Environmental Assessment. The actions evaluated in this Environmental Assessment would not adversely affect socially or economically disadvantaged populations.

The following impact topics/resources do not occur within LARO and therefore will also not be evaluated further; Wilderness and Wilderness related resources, Non-federal lands, Indian Trust Resources, and Unique Wildlife habitat.

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4.0 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental and sociological impacts of the two alternatives described in Section 2.0. It is organized by each affected resource, as presented in Section 3.0, Affected Environment. The impacts of Alternative 1 & 2 will be discussed for each resource. To get the overall impact of each alternative, read only the sections for a single alternative all the way through this portion of the document.

Impairment

The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute impairment, but an impact would be more likely to constitute impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park; or
- Identified as a goal in the park's 2000 GMP or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. Following completion of the public review period, the park manager's determination of no impairment in regards to the plan recommended for approval will be completed.

A. Methodology:

Consequences of the two alternatives were estimated through a combination of the following:

Discussions and observations during interdisciplinary team meetings, NOCA/LARO fire planning meetings, management team meetings, and during field trips in LRNRA with Park Service resource personnel.

Phone and E-Mail communications with Park Service and contracted personnel.

Existing LRNRA resource documents including the 2000 GMP, NPS *Management Policies* (NPS, 2006a) and previous fire management planning and NEPA documents.

Research of existing literature and USFWS, WDFW, and WDNR websites pertinent to the impact topics.

Use of the 2012 LARO Fire Effects Report (Kopper and Drake, 2012) and earlier reports documenting ongoing benefits and issues with fire management practices.

Environmental impacts are analyzed in terms of context, intensity, duration and timing. They are further described as direct, indirect, and cumulative consequences, both in short and long term periods. Direct impacts are those that are caused by alternatives at the same time and at the same place as the action. Indirect effects are impacts that occur later in time, or farther in distance than the actions of the alternatives. Cumulative effects are additive impacts to a particular resource, without regard to ownership and include impacts from the past, present, and foreseeable future.

Included in the analysis of environmental consequences is a conclusion statement for each impact area. In managing units of the National Park System, the Service may undertake actions that have both beneficial and adverse impacts on park resources and values. However, the Service is prohibited from taking or authorizing any action that would, or is likely to, impair park resources or values.

The purpose and values for establishing LRNRA are described in the background section of Chapter 1. Briefly, the purpose for the Park is to:

- Provide opportunities for diverse, safe, quality, outdoor recreation experiences for the public.
- Preserve, conserve, and protect the integrity of natural, cultural, and scenic resources.
- Provide opportunities to enhance public appreciation and understanding about the area's notable resources.

The National Environmental Policy Act requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. Consideration of context, intensity and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts are also required under NEPA.

Environmental Impact Analysis

The analysis in the Environmental Consequences section compares the effects of the alternatives based on the following definitions of context, type of impact, duration of impact, and area of impact as well as cumulative impacts. Unless otherwise stated or demonstrated in the resource section in Environmental Consequences, analysis is based on the best available science and information.

Context

Setting within which impacts are analyzed – such as the project area or region, or for cultural resources the area of potential effects.

Type of Impact

A measure of whether the impact will improve or harm the resource and whether that harm occurs immediately or at some later point in time.

- **Beneficial**: Reduces or improves impact being discussed.
- **Adverse**: Increases or results in impact being discussed.
- **Direct**: Caused by and occurring at the same time and place as the action, including such impacts as animal and plant mortality, damage to cultural resources, etc.
- **Indirect**: Caused by the action, but occurring later in time at another place or to another resource, including changes in species composition, vegetation structure, range of wildlife, offsite erosion or changes in general economic conditions tied to park activities.

Duration of Impact

Duration is a measure of the time period over which the effects of an impact persist. The duration of impacts evaluated in this Environmental Assessment may be one of the following:

- Short-term: Often quickly reversible and associated with a specific event, one to five years
- Long-term: Reversible over a much longer period, or may occur continuously based on normal activity, or for more than five years.

Area of Impact

- Localized: Detectable only in the vicinity of the activity
- Widespread: Detectable on a landscape scale (beyond the affected site)

Cumulative

The Council on Environmental Quality (CEQ) describes a cumulative impact as follows (CEQ, 1978):

> A "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The cumulative projects addressed in this analysis include past and present actions, as well as any planning or development activity currently being implemented or planned for implementation in the reasonably foreseeable future. Cumulative actions are evaluated in conjunction with the impacts of an alternative to determine if they have any additive effects on a particular resource.

All Impacts, Except Special Status Species and Cultural Resources

Note: Special Status Species and Cultural Resources impact determinations are formally determined under the Endangered Species Act (Section 7) and Section 106 of the NHPA, respectively.

- **Negligible**: Measurable or anticipated degree of change would not be detectable or would be only slightly detectable. Localized or at the lowest level of detection.
- **Minor**: Measurable or anticipated degree of change would have a slight effect, causing a slightly noticeable change of approximately less than 20 percent compared to existing conditions, often localized.
- **Moderate**: Measurable or anticipated degree of change is readily apparent and appreciable and would be noticed by most people, with a change likely to be between 21 and 50 percent compared to existing conditions. Can be localized or widespread.
- **Major**: Measurable or anticipated degree of change would be substantial, causing a highly noticeable change of approximately greater than 50 percent compared to existing conditions. Often widespread.

Note: Cultural resources impacts are also initially characterized as noted above, however the conclusion follows the format below, and makes a formal determination of effect under Section 106 of the NHPA. In accordance with NPS *Management Policies* (NPS, 2006a), the analysis in this Environmental Assessment fulfills the responsibilities of the NPS under Section 106 of the NHPA.

Cultural Resources Impacts

- **No Effect**: There are no historic properties in the Area of Potential Effect (APE); or, there are historic properties in the APE, but the undertaking will have no impact on them.
- **No Adverse Effect**: There will be an effect on the historic property by the undertaking, but the effect does not meet the criteria in 36 CFR Part 800.5(a)(1) and will not alter characteristics that make it eligible for listing on the National Register. The undertaking is modified or conditions are imposed to avoid or minimize adverse effects. This category of effects is encumbered with effects that may be considered beneficial under NEPA, such as restoration, stabilization, rehabilitation, and preservation projects.
- **Adverse Effect**: The undertaking will alter, directly or indirectly, the characteristics of the property making it eligible for listing on the National Register. An adverse effect may be resolved by developing a memorandum or program agreement in consultation with the SHPO, Advisory Council on Historic Places (ACHP), American Indian tribes, other consulting parties, and the public to avoid, minimize, or mitigate the adverse effects (36 CFR part 800.6(a)).
- **Significant Impact**: An impact to a National Register historic property would be considered significant when an adverse effect cannot be resolved by agreement among

SHPO, ACHP, American Indian tribes, other consulting and interested parties, and the public. The impact will diminish the integrity of location, design, setting, materials, workmanship, feeling or association characteristics that make the historic property eligible for inclusion in the National Register Historic Places.

Sensitive Species Impacts

- **No Effect**: The project (or action) is located outside suitable habitat and there would be no disturbance or other direct or indirect impacts on the species. The action will not affect the listed species or its designated critical habitat (USFWS, 1998).
- **May Affect, Not Likely to Adversely Affect**: The project (or action) occurs in suitable habitat or results in indirect impacts on the species, but the effect on the species is likely to be entirely beneficial, discountable, or insignificant. The action may pose effects on listed species or designated critical habitat but given circumstances or mitigation conditions, the effects may be discounted, insignificant, or completely beneficial. Insignificant effects would not result in take. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur (USFWS, 1998).
- **May Affect, Likely to Adversely Affect**: The project (or action) would have an adverse effect on a listed species as a result of direct, indirect, interrelated, or interdependent actions. An adverse effect on a listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions and the effect is not: discountable, insignificant, or beneficial (USFWS, 1998).

B. IMPACT TOPICS

Table 6:Comparison of Alternatives and their expected effects.

IMPACT TOPIC	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
Air Quality	Every effort will be made to suppress all wildfires thereby reducing the effects on air quality. This alternative includes the completion of a reduced amount of prescribed burning for fuels reduction and maintenance burns. This is expected to lead to a short-term, minor to moderate, direct, localized, negative effect on air quality in the area around the park. In the long-term, this alternative may lead to increased negligible to moderate, widespread, indirect, adverse effects to LRNRA and regional air quality should larger, more	Every effort will be made to suppress all wildfires thereby reducing the effects on air quality. The short-term effect on air quality is expected to be a minor to moderate, localized, direct, adverse effect because of the increased number of acres treated using prescribed fires. In the long-term, it is expected there will be a minor to moderate, indirect, widespread, beneficial effect on LRNRA and regional air quality as the potential for severe wildfires coming off of the park is greatly decreased and the amount of smoke from those wildfires is reduced. This is a result of the significantly

IMPACT TOPIC	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
	severe wildfires occur and be more difficult to contain because of the reduced level of fuels management.	higher amount of park acreage treated for reduced fuel loads and to serve as fire breaks.
Water Resources	The short-term effect to water resources is expected to be a negligible to minor, localized, direct, adverse effect on surface waters near those acres proposed for treatment. Under this alternative fewer park acres are treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is the potential for more severe wildfires on more extensive areas of the park and neighboring lands thus leading to a minor to major, indirect, widespread, adverse impact to water quality.	The expected effect to water resources is a negligible to minor, indirect, localized, negative effect in the short-term with mitigation actions taken on those acres proposed for treatment. Under this alternative an additional 2,430 acres of park lands will be treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is a minor to moderate, indirect, widespread, beneficial effect from this alternative as the potential for large wildfires and their moderate to high, widespread, direct, adverse effect on water quality may be reduced significantly.
Soils	The short-term effect to soil resources is expected to be a negligible to minor, localized, direct, adverse effect on those acres of soils proposed for treatment. Under this alternative fewer park acres are treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is the potential for a build-up of fuels on the significantly higher amount of untreated areas of soils in the park which may increase wildfire effects on more extensive areas of the park and neighboring lands thus increasing the likelihood of moderate to high, widespread, direct, adverse impacts to soil resources.	The expected short-term effect to soil resources is a negligible to minor, localized, direct, adverse effect, with mitigation measures in place, on those acres proposed for treatment. Under this alternative an additional 2,430 acres of park lands will be treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is a minor to moderate, widespread, indirect, beneficial effect on a greater number of park acres as the potential for the start and spread of severe wildfires and their moderate to high negative direct effects on soil health is expected to be reduced.
Plants	The short-term effect to plant resources is expected to be a negligible to minor, localized, direct, adverse effect on those acres proposed for treatment. Under this alternative 2,379 park acres will be treated through 2020 for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, the minor to moderate, localized, direct, beneficial effect from healthier plants and reduced fuels may be negated as the potential for the start and spread of severe wildfires and their moderate to major, direct, widespread, adverse impacts on plant health and plant community composition is more likely to occur.	Plant resources are expected to see a short-term, negligible to minor, localized, direct adverse effect on individual and small areas of plants on those acres subjected to treatment in 1 or more entries. There may also be short-term, minor, localized, indirect, adverse impact from invasive plant species attempting to colonize disturbed or burned soils. Overall plant community health sees a long-term, moderate, localized, direct, beneficial effect as competition for water, light, and nutrients is reduced. All wildfires are immediately suppressed. Also in the long-term, there is a minor to moderate, widespread, indirect, beneficial effect on a greater number of acres as the potential for the start and spread of severe wildfires and their moderate to major, widespread, direct, adverse effects on native plant communities and forest health is expected to be reduced.

IMPACT TOPIC	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
Wildlife and Fish	The strategy of immediate suppression of all wildfires will continue to protect large blocks of wildlife habitat from uncontrolled, severe wildfires. This alternative includes expected short-term, negligible to minor, direct, localized, adverse impacts to wildlife as fuels reduction and prescribed fire actions occur in the identified treatment units. The long-term, minor, localized, indirect effect on wildlife/fish and their habitats is beneficial, but to a lesser degree than Alternative 2, as the scheduled treatments and maintenance actions protect fewer blocks and areas of wildlife habitat from the effects of severe wildfires.	The use of prescribed fire and mechanical fuels treatments in this alternative for fuel reduction purposes will cause short-term, minor, localized, direct, adverse effects to a small number of wildlife species. There will be a negligible potential for indirect, localized, adverse effects to fish and fish habitat from soil erosion or ash entering the park's waterways. The planned treatments are expected to lead to overall minor to moderate, localized, direct and indirect beneficial effects in the long-term as forest health and wildlife habitats improve. Long term, minor to major, indirect, widespread beneficial effects from selecting this alternative include the reduced possibility of wildfires starting on and/or spreading to a larger proportion of the park. Wildfires that do occur should burn in more of a mosaic pattern which creates 'edge effect' and reduces the amount of wildlife habitat returned to early seral stage plant communities.
Sensitive Species	The strategy of immediate suppression of all wildfires in this alternative leads to an overall minor, direct, localized, beneficial effect to all sensitive plant and animal species in the short and long term. The reduced amount of treatment units results in fewer chances for a possible short-term, negligible to moderate, direct, localized, adverse effect on one sensitive (state listed) species – Nuttall's pussytoes and on a host of bird species protected under the MBTA. There is expected to be a long-term, minor to moderate, indirect, widespread, beneficial effect from the use of prescribed fire and mechanical fuels reduction treatments for improving habitats and reducing wildfire extent and severity. This positive effect will be on a smaller amount of park lands and may allow a higher potential for severe wildfires and their effects on the listed sensitive species and their habitats to occur. For all federally listed wildlife species noted as possibly occurring on park lands, a determination of **May Affect, Not Likely to Adversely Affect** any of those species has been made. For ESA listed plant species a determination of **No Effect** is made because they have not been identified in the park.	The strategy of immediate suppression of all wildfires in this alternative leads to an overall direct, beneficial effect to all sensitive plant and animal species in the short and long term. In relation to Nuttall's pussytoes, birds protected by the MBTA, and sensitive bat species, which are most likely to be impacted by the proposed treatments, the additional treatments proposed in this alternative could have a short-term, minor, direct, localized, adverse effect with all mitigation measures taken. The additional fuels reduction treatments for forest health and a further potential reduction in wildfire severity and size are expected to have a long-term, minor to moderate, widespread, indirect, beneficial effect on protecting current and potential habitat for all sensitive plant and animal species from the impacts of severe wildfires. For all federally listed wildlife species noted as possibly occurring on park lands, a determination of **May Affect, Not Likely to Adversely Affect** any of those species has been made. For ESA listed plant species a determination of **No Effect** is made because they have not been identified in the park.
Cultural Resources	The strategy in this alternative is immediate suppression of all wildfires parkwide. The expected short-term effects to Cultural	The strategy in this alternative is also immediate suppression of all wildfires parkwide. The expected short-term effect on Cultural

IMPACT TOPIC	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
	Resources from these actions and the planned treatments for fuels reduction and forest health is a negligible to minor, localized, direct, adverse effect with mitigation. The planned treatments however may lead to long-term minor to moderate, indirect, localized, beneficial effects in the long-term as these resources are better protected from severe wildfires that could remove consumable cultural resources and/or cause heat or soil erosion damage to archeological resources.	Resources from these actions and the planned treatments for fuels reduction and forest health on an additional 2,172 acres through 2020 is a negligible to minor, localized, direct, adverse effect with mitigation. This however is expected to lead to a long-term, minor to moderate, widespread, indirect, beneficial effect as more cultural resources are better protected from severe wildfires that could remove consumable cultural resources, cause heat or soil erosion damage to known and unknown archeological resources, and have more wildfire suppression related damages. For the impact topic Cultural Resources - In accordance with NPS *Management Policies* (NPS, 2006a), the analysis in this Environmental Assessment fulfills the responsibilities of the NPS under Section 106 of the NHPA. Each site will be surveyed prior to treatment and mitigation actions will be added to the treatment plan ensuring that a determination of **No Effect** or **No Adverse Effect** can be made before project initiation.
Visitor Use and Experience	There is expected to be short-term, negligible to minor, localized, direct adverse effects to visitor use and experience from the proposed fuels and prescribed fire actions in any particular treatment area. Because less park land is having fuels reduction treatments under this alternative, there is an increased likelihood for more severe wildfires on a larger proportion of the park in the long-term causing possible minor to major, widespread, direct, adverse effects to visitors use and experience over time.	There is expected to be short-term, negligible to minor, localized, direct, adverse effects to visitor use and experience under this alternative as an additional 2,172acres are treated. In the long-term, the overall effects are expected to be a minor to major, widespread, direct, beneficial effect as fewer and less severe wildfires occur. This ensures fewer restrictions on visitor use and access during suppression and rehabilitation activities and less chance for long-term changes to the scenic landscapes of the park by wildfire.
Safety	When considering the safety of the public, LRNRA staff, and firefighters this alternative will have a short-term, negligible to minor, localizes, direct, adverse effect on safety for all involved during both planned treatments and immediate suppression of wildfires. With a limited fuels reduction program this can have a long-term, negligible to major, indirect, adverse effect on safety dependent on the size and intensity of any wildfires that occur.	When considering the safety of the public, LRNRA staff, and firefighters this alternative will have a short-term, negligible to minor, localized, direct, adverse effect on safety for all involved in completing inherently dangerous activities during both planned treatments and the immediate suppression of wildfires. Training, personal protective equipment, JHA's, and adhering to operational leadership guidelines and practices are mitigation measures that will be taken to reduce the risks. This enhanced fuels reduction program is expected to have long-term, minor to moderate, localized, indirect, effect on public, neighbor, and staff safety as the size and severity of any wildfires that occur

IMPACT TOPIC	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES
		should be significantly reduced.
Neighboring Lands	The strategy for this alternative is immediate suppression of all wildfires starting on or entering park lands. The proposed fuels reduction and prescribed fire projects can have a short-term, negligible to minor, localized, direct, adverse effect on neighboring lands during the treatments. Defensible space and fuels reduction treatments immediately adjacent to some homes/outbuildings will have a long-term, moderate to high, localized, direct beneficial effect. However, the reduced amount of treated acreage parkwide can have a long-term, minor to major, indirect, adverse effect on a majority of neighboring lands/homes dependent on the number and severity of any wildfires that start on park lands and spread to neighboring lands.	The strategy for this alternative is immediate suppression of all wildfires starting on or entering park lands. The larger number of proposed fuels reduction and prescribed fire projects may have a short-term, negligible to minor, localized, direct, adverse effect on a higher amount of neighboring lands during the treatments. Defensible space and fuels reduction treatments immediately adjacent to some homes/outbuildings will have a long-term, moderate to high, localized, direct beneficial effect. In addition, the increased amount of treated acreage is expected to have a long-term, minor to major, widespread, indirect, beneficial effect on protecting many additional areas of private property/homes from any wildfires originating on park lands.

Air Quality:

Alternative 1 – (No Action) – Continue full suppression of all wildfire, use of mechanical treatment, and limited use of prescribed fires.

Under this alternative, air quality would be impacted by wildfires burning within or adjacent to LRNRA before they are suppressed. Contributing to overall air quality would be smoke generated from LRNRA prescribed fire projects. Prescribed fire not only includes broadcast burning (understory burning and maintenance burning at LRNRA) but also includes pile burning (machine piles and handpiles) Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Implementation of the burns through 2020 would be spread over a minimum of 30 days producing an estimated 349 tons of particulates: 193 tons of particulates for underburns, 52 tons of particulates for pile burns, and 104 tons of particulates for maintenance burns. Additionally Alternative I would add 158 acres of Maintenance burns in 2021 and beyond and 75 acres of pile burns per year in 2021 and beyond producing 51 tons of particulates through maintenance burns, and 5 tons of particulates per year for piles. (See Table 8 Alternative 1: *Possible Particulate Matter per Alternative*)

Alternative 1 estimates an average of 56 acres of underburns conducted per year, an average of 107 acres of pile burns conducted per year, and an average of 45 acres of maintenance burns conducted per year. It is important to note that the average acres treated is just that, an average. The actual acreage treated can be higher or lower based on funding, crew availability and actual environmental parameters needed for a successful burn. Under Alternative 1 particulate matter released by prescribed fire underburns through 2020 will average at most 22.5 tons/year of

Particulate Matter10 (PM10) and 21 tons a year of Particulate Matter 2.5 (PM2.5). Pile burns will average 2 tons/year of PM10 and 2 tons/year of PM2.5. Maintenance burns could average 5 tons a year of PM10 and 5 tons a year of PM2.5. (See Table 7). All State Implementation Plans (SIP) regulations and MM5 smoke modeling will be used to minimize prescribed burning effects to air quality. The timing of prescribed fire implementation is closely regulated by DNR to minimize air quality impacts.

Due to a less aggressive approach to managing overstocked tree stands this alternative will prolong the environmental conditions that differ from the historical conditions of forest stands. This continuing variance from historical conditions will create greater smoke production from the burning of accumulated fuels such as dense tree canopies, deadfall, ladder fuels, pine needle duff, and grass thatch that were historically removed by more frequent wildland fires.

Table 7:**Estimated Average Particulate Matter Per Year Per Alternative**

	Underburns	Maintenance Burns	Pile Burns
Alternative 1			
PM	33	7	3
PM10	22.5	5	2
PM2.5	21	5	2
Alternative 2			
PM	44	7	6
PM10	30	5	4
PM2.5	28	5	4

Per year Alternative 1 averages:
56Acres underburns
45Acres Maintenance burns
107 Acres Pile burns

Per year Alternative 2 averages:
123Acres underburns
45Acres Maintenance burns
172Acres Pile burns

The effects of this alternative will lead to fewer occasions of fire overall, due to a smaller number of prescribed fire projects, but the wildfires that do burn may be more damaging, create more smoke and may occur during times of poor smoke dispersal due to the fuel that is not removed through prescribed fire treatments. The large amount of smoke produced by wildfires and the possibility of poor smoke dispersal during wildfire events may lead to fewer, but longer, periods of very unhealthy air quality. The smoke from large wildfires will also impact air quality region-wide and not just in small local areas. Recreation users, LRNRA personnel, adjacent landowners, and much of the population in the region may experience these negative impacts.

Mitigation: Coordination for Prescribed fires will be conducted with the Washington DNR smoke management office in Olympia. All state and federal regulations for smoke management will be followed.

Conclusions: Every effort will be made to suppress all wildfires thereby reducing the effects on air quality. This alternative does include the completion of a reduced amount of prescribed burning for fuels reduction and maintenance burns. This is expected to lead to a short-term, minor to moderate, direct, localized, negative effect on air quality in the area around the park. In the long-term, this alternative may lead to increased negligible to moderate, widespread, indirect, adverse effects to LRNRA and regional air quality should larger, more severe wildfires occur and be more difficult to contain because of the reduced level of fuels management.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document. By the end of fiscal year 2020 Lake Roosevelt proposes to reduce fuel loading on approximately 2,379 acres.

In the short-term, smoke creating air quality concerns would increase in the area because there would be a similar amount of wildfires as in Alternative 1 along with the additional deterioration caused by an increase in acres treated with prescribed fire.

Prescribed fire not only includes broadcast burning (mostly understory burning at LRNRA) but also includes pile burning (machine piles and handpiles) Implementation of these burns through 2020 would be spread over a minimum of 92 days producing an estimated 628 tons of particulates: 438 tons of particulates for understory burns, 81 tons of particulates for pile burns, and 109 tons of particulates for maintenance burns. Implementation of treatments from 2021 and beyond would be spread over at least 100 days producing an estimated 350 tons of particulates: 142 tons of particulates for understory burns, 54 tons of particulates for maintenance burns, and 154 tons of particulates for pile burns

Alternative 2 estimates an average of 123 acres of underburns conducted per year, an average of 172 acres of pile burns conducted per year, and an average of 45 acres of maintenance burns conducted per year. Under Alternative 2 particulate matter released by prescribed fire underburns through 2020 will average at most 30 tons/year of PM10 and 28 tons a year of PM2.5 see: *Table 7:Estimated Average Particulate Matter Per Year Per Alternative*. Pile burns will average 4 tons/year of PM10 and 4 tons/year of PM2.5. Maintenance burns could average 5 tons a year of PM10 and 5 tons a year of PM2.5. All state SIP regulations and MM5 smoke modeling will be used to minimize prescribed burning effects to air quality.

Eventually the overall amount of smoke that would raise air quality concerns would decrease for three reasons: 1. The more areas burned during good smoke dispersal periods would reduce the intensity of wildfires that might occur in that area and will reduce overall particulates in the air. This would in turn reduce the air quality impacts during poor smoke dispersal periods leading to

a net gain in air quality. 2. Prescribed fires will only be conducted when optimal smoke dispersion periods are present leading to limited air quality impacts in the immediate area. 3. Prescribed fires produce less smoke/emissions because they are carried out under less extreme conditions and burn less fuel than many wildfires.

The overall effect of this alternative to air quality will not be known due to the unpredictable nature of wildfire. A wet period of low wildfire activity may lead to lower fire/smoke impacts. A hotter, droughty period may lead to more frequent, more intense fire/smoke activities that could increase the impact to air quality. Prescribed fire will reduce the impact overall by burning during times that the environment is able to absorb and disperse the smoke. This will reduce the impacts on the ground to humans, plants, animals, and resources.

Mitigation: Coordination for Prescribed fires will be conducted with the Washington DNR smoke management office in Olympia. All state and federal regulations for smoke management will be followed. Additionally, spot weather forecasts will be obtained and consultation with meteorologists will occur in order to burn under optimal smoke dispersal conditions to minimize impacts.

Conclusions: Every effort will be made to suppress all wildfires thereby reducing the effects on air quality. The short-term effect on air quality is expected to be a minor to moderate, localized, direct, adverse effect because of the increased number of acres treated using prescribed fires. In the long-term, it is expected there will be a minor to moderate, indirect, widespread, beneficial effect on LRNRA and regional air quality as the potential for severe wildfires coming off of the park is greatly decreased and the amount of smoke from those wildfires is reduced. This is a result of the higher amount of park acreage treated for reduced fuel loads and to serve as fire breaks: Alternative 2's 6,233 acres versus Alternative 1's 2,851 acres.

In summary the predicted total particulate matter per alternative is shown in Table 8.

Table 8 Possible Total Particulate Matter Per Alternative

	TOTAL RX		UNDERSTORY RX		MAINTENANCE RX		PILE RX	
	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons
ALTERNATIVE I 2014 – 2020	**1,447**		***382***		***318***		***747***	
TOTAL PM		*148*		*83*		*43*		*22*
PM2.5		*98*		*53*		*30*		*15*
PM10		*103*		*57*		*31*		*15*
Total tons particulates		***349***		***193***		***104***		***52***
ALTERNATIVE I 2021 +					***158***		***75/year***	
TOTAL PM		*23*				*21*		*2*
PM2.5		*16.5*				*15*		*1.5*
PM10		*16.5*				*15*		*1.5*
Total tons		***56***				***51***		***5***

	TOTAL RX		UNDERSTORY RX		MAINTENANCE RX		PILE RX	
	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons
particulates								
ALTERNATIVE II 2014 – 2020	**2,379**		***859***		***318***		***1,202***	
TOTAL PM		*269*		*189*		*45*		*35*
PM2.5		*175*		*120*		*32*		*23*
PM10		*184*		*129*		*32*		*23*
Total tons particulates		***628***		***438***		***109***		***81***
ALTERNATIVE II 2021 +	**2,649**		***277***		***158***		***2,214***	
TOTAL PM		*149*		*61*		*22*		*66*
PM2.5		*99*		*39*		*16*		*44*
PM10		*102*		*42*		*16*		*44*
Total tons particulates		***350***		***142***		***54***		***154***

Water Resources:

Alternative 1 – (No Action) – Continue full suppression of all wildfire, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

By focusing on just those treatment units identified in the LRNRA 2009 and earlier fire management plans, this alternative would have the potential to impact water resources on fewer acres during fuel treatments and prescribed burns. There would therefore be a reduced potential in the amount of acres and impact to water quality by management actions. There would be a negligible to minor effect on water quality from the 1,952.8 acres currently treated and being maintained or proposed for one or more treatments out to the year 2025.

Fewer acres will be treated for fuels management and forest health which may leave areas of the park much more prone to wildland fires. The potential level of impact would be dependent upon the incident rate, location, size, and time needed for suppression of any wildfires that would occur. If fuel load situations and forest health are not improved by the reintroduction of prescribed fire and fuels management then individual wildfires may become larger and more intense further impacting soil and vegetation. This will in turn increase the amount of potential erosion and influx of ash that impacts water quality. The effects may last longer depending on total acreage, severity of wildfire, and suppression impacts.

Soils that are severely burned, become hydrophobic and do not allow water to infiltrate, which in turn increases run-off and soil erosion. Severely burned soils and vegetation have a longer recovery time which will subsequently increase sediment run-off and sedimentation of nearby waterways. Exotic weeds can become established further slowing the recovery of native vegetation that tends to hold and protect soils from erosion better. Riparian vegetation could also be adversely affected dependent on fire severity. Removal of vegetative sediment buffers found in affected riparian areas, may increase the chance for water quality degradation both from more eroded soils entering the stream and water temperatures increasing from loss of shade.

Additional suppression activities will likely occur in large wildfire situations increasing the chances for soil disturbance and possible water quality degradation. Because the timing and location of wildfires cannot be predicted, suppression activities are usually carried out under emergency type situations and there may not be ample time for the careful development of plans to avoid disturbance to soils.

Mitigation: Where necessary, install silt fences at strategic points to prevent soil erosion downslope of areas where major soil disturbance occurs and cannot be avoided or in small dry channels within the treatment unit that are experiencing a headcut from reservoir operation or previous disturbances. Mechanical fuel reduction treatments will not be planned in riparian habitats. State/county regulations for cutting near riparian zones will be followed.

Conclusions: The short-term effect to water resources is expected to be a negligible to minor, localized, direct, adverse effect on surface waters near those acres proposed for treatment. Under this alternative fewer park acres are treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is the potential for more severe wildfires on more extensive areas of the park and neighboring lands thus leading to a minor to major, indirect, widespread, adverse impact to water quality.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document. By the end of fiscal year 2020 Lake Roosevelt proposes to reduce fuel loading on an additional 2,379 acres.

An enhanced fuels and forest health management program may have a short-term negligible to minor negative effect on water quality due to possible entry of ash and eroded soils into nearby waterways following fuels or prescribed fire treatments on the proposed 2,550 additional acres. This would involve an additional 19.7% of total park lands should all treatment units receive one or more treatments by 2025. This increase in the short-term would be mitigated by the fact that the treatments for fuels, forest health and returning fire as an ecological component all lead to healthier forest plant communities and more fire ‘breaks’ that can reduce the severity of future wildfires on vegetative cover and soils thereby reducing long-term potential impacts to water quality.

Mitigation: Where necessary, install silt fences at strategic points to prevent soil erosion downslope of areas where major soil disturbance occurs and cannot be avoided or in small dry channels within the treatment unit that are experiencing a headcut from reservoir operation or previous disturbances. Mechanical fuel reduction treatments will not be planned in riparian habitats. State/county regulations for cutting near riparian zones will be followed.

Conclusions: The expected effect to water resources is a negligible to minor, indirect, localized, negative effect in the short-term with mitigation actions taken on those acres proposed for treatment. Under this alternative an additional 2,430 acres of park lands will be treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is a minor to moderate, indirect, widespread, beneficial effect from this alternative as the potential for large wildfires and their moderate to high, widespread, direct, adverse effect on water quality may be reduced.

Soils:

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Short-term impacts to soil from prescribed fire and fuel reduction treatments under this alternative are expected to be negligible to moderate on the currently planned acreage proposed in the fuels and forest health treatments. Soils will be impacted by the use of heavy equipment to assist in mechanical fuel reduction. Soil disturbance from use of heavy equipment to remove portions of the trees may lead to increased soil compaction, vulnerability to erosion, reduced regeneration productivity, and removal of vegetative ground cover thereby potentially impacting soils. Prescribed burns will be managed within prescriptions to minimize the amount of intense heat that can lead to bare mineral soils and hydrophobic soil surfaces.

Long-term effects of fire on the soil will be dependent on the frequency and severity of the wildfires that occur. The potential for more frequent and less controllable wildfires may increase because of the reduced amount of acreage that will be treated under this alternative. Hotter and larger wildfires have proportionally greater negative effects on soil productivity by: reducing nutrients; killing soil micro-organisms that are critical to the soils fertility; altering soil structure, increasing impermeable soil layers; and removing the forest floor and vegetation leading to increased erosion (Walstad et al, 1990).

More frequent or larger wildfires resulting from selecting this alternative could lead to increased use of heavy equipment across the landscape. Use of caterpillars, tractors, wildland fire trucks, and hand line construction to suppress wildfires could lead to greater disruption of the soil. Because the timing and location of wildfires cannot be predicted, suppression activities are usually carried out under emergency type situations. During these events, firefighters respond

quickly and there may not be ample time for the careful development of plans to avoid disturbance to soils.

The ever-growing threat of climate change may further result in more long-term impacts to soils as the potential for climatic conditions conducive to increasing numbers and sizes of wildfires continues to develop. These intense fires will have greater acute and long-term impacts on the soils. McNabb and Cromack (1990) state that "natural wildfires, particularly conflagrations that burn hundreds to thousands of acres, have a far greater potential to seriously affect soil fertility than current prescribed burns … because the weather is usually more severe and fuel moistures are normally lower."

Mitigation: Mechanical equipment such as tractors will not be used during wet periods when soil compaction can occur. Operating equipment on frozen or snow covered ground will be the preferred mitigation for both soils and cultural resource protection. Sound justifications must be noted before operation of equipment on dry soils is authorized. Low ground pressure machines will be used in any skidding operations. Skid trails will be designated before cutting operations begin. An integrated arch to lift one end of logs will be required. No heavy equipment will be allowed on slopes greater than 25 percent. Skid trails on slopes or dry gullies with active eroding headcuts in the treatment unit that are adjacent to a waterbody will have silt fences installed or be water-barred and seeded immediately after treatment to minimize soil erosion.

Prescribed fire impacts would be minimized as control lines/fire breaks would utilize existing roads, trails, water bodies and other natural barriers where possible. Where possible, heavy accumulations of 1000 hour fuels will be removed through thinning treatments, salvage harvesting, and/or firewood removal prior to prescribed burn treatments.

Piles will be burned during the winter season to minimize soil temperatures. Seeding of burn pile ash may occur when native seed is available and/or the piles burn especially hot.

The use of Cut-To-Length (CTL) Harvesting and Log Forwarding systems will be the favored method for the removal of overstory trees in mechanical thinning operations.

Conclusions: The short-term effect to soil resources is expected to be a negligible to minor, localized, direct, adverse effect on those acres of soils proposed for treatment. Under this alternative fewer park acres are treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is the potential for a build-up of fuels on the larger amount of untreated areas of soils in the park which may increase wildfire effects on more extensive areas of the park and neighboring lands thus increasing the likelihood of moderate to high, widespread, direct, adverse impacts to soil resources.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

Short-term impacts to soil from prescribed fire and fuel reduction treatments under this alternative are expected to be negligible to moderate on the currently planned and an additional 2,430 acres proposed in the fuels and forest health treatments. Soils will be impacted by the use of heavy equipment to assist in mechanical fuel reduction. Soil disturbance from use of heavy equipment to remove portions of the trees may lead to increased soil compaction, vulnerability to erosion, reduced regeneration productivity, and removal of vegetative ground cover thereby potentially impacting soils. Prescribed burns will be managed within prescriptions to minimize the amount of intense heat that can lead to bare mineral soils and hydrophobic soil surfaces.

Long-term effects of fire on the soil will be less, but still dependent on the frequency and severity of the wildfires that occur. The potential for fewer and more controllable wildfires is expected because of the greater amount of park acreage that will be treated under this alternative. Many more acres of reduced fuels and scattered firebreaks should reduce the negative effects of hot, intense wildfires on soils.

This alternative should better address the ever-growing threat of climate change through the use of mechanical and prescribed fire tools to promote healthier forest ecosystems and reduced fuels.

All burning, whether wildfire or prescribed, disrupts the cycling of nutrients in forest ecosystems by changing the form, distribution, and amount of nutrients. But McNabb and Cromack (1990) state "…sites with a history of frequent wildfires have already adapted to repeated cycles of nutrient losses and are less likely affected by prescribed burning". The cycle of prescribed burning at LRNRA will attempt to simulate natural frequencies so as not to severely impact forest soils.

Mitigation: Mechanical equipment such as tractors will not be used during wet periods when enhanced soil compaction can occur. Operating equipment on frozen or snow covered ground will be the preferred mitigation for both soils and cultural resource protection. Sound justifications must be noted before operation of equipment on dry soils is authorized. Low ground pressure machines will be used in any skidding operations. Skid trails will be designated before cutting operations begin. An integrated arch to lift one end of logs will be required. No heavy equipment will be allowed on slopes greater than 25 percent. Skid trails on slopes or dry gullies with active eroding headcuts in the treatment unit that are adjacent to a waterbody will have silt fences installed or be water-barred and seeded immediately after treatment to minimize soil erosion.

Prescribed fire impacts would be minimized as control lines/fire breaks would utilize existing roads, trails, water bodies and other natural barriers where possible. Where possible, heavy

accumulations of 1000 hour fuels will be removed through thinning treatments, salvage harvesting, and/or firewood removal prior to prescribed burn treatments.

Piles will be burned during the winter season to minimize soil temperatures. Seeding of burn pile ash may occur when native seed is available and/or the piles burn especially hot to improve ground cover and reduce the threat of invasive weed infestations.

The use of CTL Harvesting and Log Forwarding systems will be the favored method for the removal of overstory trees in mechanical thinning operations.

Conclusions: The expected short-term effect to soil resources is a negligible to minor, localized, direct, adverse effect, with mitigation measures in place, on those acres proposed for treatment. Under this alternative an additional 2,430 acres of park lands will be treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, there is a minor to moderate, widespread, indirect, beneficial effect on a greater number of park acres as the potential for the start and spread of severe wildfires and their moderate to high negative direct effects on soil health is expected to be reduced.

Plants:

Impacts Common to All

Both alternatives propose to continue fire suppression of all wildfires occurring in or trying to enter the park in order to protect the valuable plant resources from larger and more intense wildfires. The primary impact from this is the continued loss of a naturally cycling fire regime on the native plant communities of the park. Both alternatives however, also propose a number of treatment units that will be treated with prescribed burns for reducing fuels and maintaining healthy forest ecosystems. Another impact of long-term fire suppression is the expansion of certain plant communities beyond their typical range. This FMP primarily focuses on the management tools for existing forest stands and does not propose to restore areas to native grasslands.

The use of prescribed fire under both alternatives will have varying effects on the different ecoregions of LRNRA.

- Very little treatment of grassland or shrub-steppe plant communities is expected in this ecoregion. Small areas of grasses, shrubs, and/or shrub-steppe plants along the edges of the pine and mixed conifer forested areas scheduled for treatment in this ecoregion may be included in prescribed fire burn units. This allows for the use of natural and man-made fire breaks and can help in reducing the creep of conifers out into natural grasslands and shrub steppe areas.
- Ponderosa pine is the dominant tree species on more than half of LRNRA lands. It is the most dominant species in the mixed conifer ecoregion. Ponderosa pine is a species adapted to a regime of frequent fires of low intensity historically. The sub-dominant species of the mixed conifer areas is Douglas fir. This species is more susceptible to fire

than that of ponderosa pine and has benefitted from a long history of humans suppressing wildfires. A higher mortality rate is expected in Douglas fir following the use of prescribed fire, especially in the saplings because their low branching habit allows fire to carry into the crown. Many of the shrubs associated with the mixed conifer forest including snowberry, chokecherry, and mallow ninebark will re-sprout after a fire and often are more palatable and nutritious to wildlife than in their previous unburned condition (Saveland and Bunting, 1988). As such, the introduction of prescribed fire does not typically have a negative impact to these species.

Ponderosa Pine : Fire effects research demonstrates that the effect of fire on rates of ponderosa pine mortality and regeneration is variable and dependent upon individual tree characteristics (e.g. diameter and height), stand conditions (e.g. density, time since previous fire, vigor), seasonal variation and fire behavior (Busse, et al., 2000). There is expected mortality with prescribed fire depending on fuel loads and prescriptions (weather and fuel parameters). Mortality can be utilized in some cases to thin stand densities in areas with limited to no access. Fire is also a good randomizer of spacing further simulating stand composition of areas within the historic range of variability.

Douglas fir: Douglas fir regeneration has been successful in LRNRA due to past fire exclusion. The increase of Douglas fir in the understory also creates a fuel ladder in the forest canopy threatening the surrounding forest habitats. By removing these ladder fuels in a controlled fashion using fuel reduction treatments and prescribed fire, future catastrophic fires can be avoided. Mature trees should not be killed by prescribed fire due to thick, fire-resistant bark and scattered young fir trees will be left in forest openings to allow for historical levels of regeneration.

Western Larch: Western larch is a very minor component of LRNRA's forests. As it is considered the most fire-resistant tree species in the Inland Northwest, existing western larch trees will likely not be impacted by prescribed fire. Western larch can also benefit from reduction of ladder fuels and thinning of dense dog-hair stands of pine that can carry fire into the overstory and present major competition for young larch trees.

Understory shrub response: The following information is provided on the most prevalent understory shrubs; Research shows that by opening patches of the canopy an increase can be expected in the diversity and density of the dominant understory shrubs, forbs, and grasses. Total understory production is related to tree crown cover, with production below 200 kg/ha in greater than 50% crown cover, 300 kg ha in less than 50% crown cover and 665 kg ha with tree spacing of 5.6 meters (McConnell and Smith, 1970).

Snowberry: Common snowberry is top-killed by fire, but belowground parts are very resistant. It is a rhizomatous sprouter, and is thus among the first to re-colonize a site after fire. Severe fire intensity may eliminate the rhizomatous sprouting by killing the roots and rhizome system.

Chokecherry: Although easily top-killed, chokecherry resprouts vigorously from surviving root crowns and rhizomes. It also produces prolific amounts of seed that may be carried and dispersed into a burned-over area by birds.

Serviceberry: Serviceberry sprouts from the root crown and/or shallowly buried rhizomes after light- to moderate-severity fire. Deeply buried rhizomes enable serviceberry to sprout after even the most intense wildfire.

Mallow ninebark: This plant sprouts vigorously following fire. Sprouts originate from horizontal rhizomes. The plant is deeper rooted with most of the roots in the mineral soils.

Hollyleaved & creeping barberry (Oregon grape): Oregon-grape is rhizomatous and can sprout from rhizomes after fire. Seedling regeneration can also occur from onsite or offsite sources. Although top-killed by fire, Oregon-grape survives fire by sprouting from deep-buried rhizomatous buds.

Invasive Weed Species

Invasive weed problems can be exacerbated by ground disturbing activities such as fire and mechanical treatment of vegetation. In areas scheduled for mechanical or prescribed fire treatments, surveys will be conducted to map the scope and scale of any invasive weed infestations. If invasive weeds are found, measures such as minimizing ground disturbance, cleaning seed from any mechanical equipment used, and/or avoidance of dense stands of invasive weeds will be implemented to help avoid spreading and increasing the abundance of the weeds. Other strategies may be planned and scheduled to treat the invasive weeds before fuels or fire treatments occur and to monitor for and treat them after an area is burned. LRNRA will consider the full range of integrated pest management tools before initiating invasive weed control. Particular attention will be paid to the invasive species that are known to benefit from the use of fire such as cheatgrass, the knapweeds, the exotic thistles, etc.

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Wildfires will occur regardless of which alternative is selected. A full suppression response to all wildfires will be applied to LRNRA under this alternative. The planning and use of fuels

treatments and prescribed fires will not be increased thereby reducing the benefits on LRNRA park lands to improve forest health and reduce fuel accumulations from past fire suppression. By completing those acres included in this alternatives treatment plan, there will be some long-term benefits to the forest communities receiving those treatments. It will also reduce the likelihood of intense wildfires starting on or entering the park while providing fire breaks to help reduce the spread of wildfires.

Mitigation: Heavy fuel loads and dense overstories of large diameter trees will be mechanically treated and much of the bole wood (1000 hr. fuels) will be removed prior to prescribed burn treatments in one or more mechanical treatments. All burn prescriptions will include estimates of desired mortality and measures taken to prevent excessive loss of trees.

In areas that require mechanical treatment and/or prescribed burns, invasive weeds will be surveyed to determine the species and frequency of weeds present before ground disturbing activities are conducted. If weeds are found to be present, measures will be implemented to help avoid spreading and increasing the abundance of the weeds present. In areas with dense or fire-benefitted invasive weeds, a range of Integrated Pest Management activities will occur, including pre and post herbicide treatments to reduce weed seed crops and seedlings. Native grass mixes may be planted on sterile soils left by intense wildfires, dense 1,000 hour fuel areas, and after pile burning to limit invasive weed production.

Important large diameter conifers (in campgrounds and developed areas, along roadways, in scenic vistas, etc.) will have needle piles and duff raked away from the base of the tree prior to prescribed fire treatments to reduce mortality from the intense heat caused by burning dense, accumulated duff.

Conclusions: The short-term effect to plant resources is expected to be a negligible to minor, localized, direct, adverse effect on those acres proposed for treatment. Under this alternative 2,379 acres of park land will be treated for management of fuels, forest health, and the return of fire as an ecological component. All wildfires are immediately suppressed. In the long-term, the minor to moderate, localized, direct, beneficial effect from healthier plants and reduced fuels may be negated as the potential for the start and spread of severe wildfires and their moderate to major, direct, widespread, adverse impacts on plant health and plant community composition is more likely to occur.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

After treatments, individual trees and forested areas are better able to withstand forest pest attacks because of reduced completion and improved tree health. Ladder fuels are removed reducing the immediate threat of wildland fires reaching forest canopies. Under this alternative

an additional 2,430 acres of park lands will be treated for management of fuels, forest health, and the return of fire as an ecological component.

Wildfires may occur regardless of which alternative is selected. A full suppression response to all wildfires will be applied to LRNRA under this alternative as well. The planning and use of fuels treatments and prescribed fires on an additional 2,430 acres of LRNRA park lands to improve forest health, reduce fuel accumulations from past fire suppression, and better protect park and neighboring developments are all seen as having long-term benefits to the forest communities receiving those treatments. It will also reduce the likelihood of intense wildfires starting on or entering the park while providing fire breaks to help reduce the spread of wildfires.

Mitigation: Heavy fuel loads and dense overstories of large diameter trees will be mechanically treated and much of the bole wood (1000 hr. fuels) will be removed prior to prescribed burn treatments using mechanical treatments on one or more entries. All burn prescriptions will include estimates of desired mortality and any measures taken to prevent excessive loss of trees.

In areas that require mechanical treatment and/or prescribed burns, invasive weeds will be surveyed to determine the species and frequency of weeds present before ground disturbing activities are conducted. If weeds are found to be present, measures will be implemented to help avoid spreading and increasing the abundance of the weeds present. In areas with dense or fire-benefitted invasive weeds, a range of Integrated Pest Management activities will occur, including pre and post herbicide treatments to reduce weed seed crops and seedlings. Native grass mixes may be planted on sterile soils left by intense wildfires, dense 1,000 hour fuel areas, and after pile burning to limit invasive weed production.

Important large diameter conifers (in campgrounds and developed areas, along roadways, in scenic vistas, etc.) will have needle piles and duff raked away from the base of the tree prior to prescribed fire treatments to reduce mortality from the intense heat caused by burning dense, accumulated duff.

Conclusions: Plant resources are expected to see a short-term, negligible to minor, localized, direct adverse effect on individual and small areas of plants on those acres subjected to treatment in 1 or more entries. There may also be short-term, minor, localized, indirect, adverse impact from invasive plant species attempting to colonize disturbed or burned soils. Overall plant community health sees a long-term, moderate, localized, direct, beneficial effect as competition for water, light, and nutrients is reduced. All wildfires are immediately suppressed. Also in the long-term, there is a minor to moderate, widespread, indirect, beneficial effect on a greater number of acres as the potential for the start and spread of severe wildfires and their moderate to major, widespread, direct, adverse effects on native plant communities and forest health is expected to be reduced.

Wildlife and Fish:

Impacts Common to All

Under both alternatives, all wildfires will be fully suppressed thereby reducing the impacts of fires on most wildlife species found within LRNRA. Fire and fuel treatment effects on wildlife are complex because they are often indirect, affecting habitat more than individuals. Some species tend to be "winners" and others "losers" as prescribed fire and fuels treatments alter the habitat. Many species, common to LRNRA are favored by habitat changes that reduce or enhance forest cover: moose, deer, elk, mountain lion, coyote, black bear, beaver, turkey, pheasant, ruffed grouse, blue grouse, and some waterfowl. Others such as the red squirrel are reported to decrease after prescribed burn and forest thinning occurs (Agee, 1993).

All species are negatively impacted during large-scale wildfire events by immediate loss of large areas of habitat, the loss of nest/rearing areas and young, the need to escape dangerous heat & smoke levels, and the higher potential for injury during these natural/man-made disasters. Of course the more mobile species have fewer impacts and are less likely to die in a large wildfire. Nearly all wildlife can utilize Lake Roosevelt as an escape area should a wildfire start on NPS lands or enter the park from neighboring lands.

Since the management tools utilized by both alternatives are the same and only the number and scope of the treatments are different, the following brief reviews of the potential risks and affects on wildlife are common to both alternatives:

Mammals

Mule and whitetail deer will likely benefit overall from fuels treatments and prescribed fire due to the mosaic which tends to stimulate growth and nutrition of preferred forage plants. A minor impact to deer will be the loss of small amounts of antelope bitterbrush in the treatment units to mechanical injury or fire. Coyotes will likely benefit from prescribed fire. One of the primary benefits to coyotes will be the mosaics created by thinning and prescribed fire. This often improves the hunting efficiency by coyotes. Raccoons, skunks, badger, and other smaller wildlife may lose some hiding/rearing habitat as snags and other woody debris is removed during fuels reduction or prescribed burn treatments. They may benefit from an increase in shrub produced fruits or prey that feeds on these.

Red squirrels may see negative impacts from prescribed fires. One of the eventual goals of prescribed fire in the ponderosa pine forest will be the reduction in forest stem densities. This may create a more widely spaced tree canopy that does not favor this tree squirrel. Deer mice and other small rodents may also see negative impacts in the short term by prescribed fire and fuels treatments due to loss of hiding cover, the presence of loose ash, and/or lack of food. Once again, additional shrub production of fruits and berries may provide a longer-term benefit once they recover from prescribed burn treatments.

Bats utilizing trees and hollows in snags for roosting and nursery colonies present an additional concern although they are a highly mobile species. Mitigation measures that will be taken include leaving snags in place (unless they present an immediate threat to life or property) during summer fuels treatments. All prescribed burns occur before and after the known nursery/rearing period of late May to July and though some roosting/nursery habitat may be lost during a prescribed fire (i.e. snags igniting and falling over), additional tree mortality usually occurs and new habitat is provided over the ensuing years between treatments.

Birds

Particular care will be given to monitoring for those bird species protected by the MBTA. Treatment areas must be surveyed if the planned treatments occur during the nesting/rearing season (April 1 to July 15). Particular care will be taken to ensure that surveys for any nesting raptors are thorough. This is also true of other sensitive species listed by federal or state wildlife agencies.

Mitigation measures for cavity creating and nesting bird species includes leaving snags in place during mechanical fuels treatments unless they present a pending threat to life or property. The scattered trees killed by prescribed burns will increase both feeding and cavity creating opportunities in between future treatment entries. Gallinaceous birds are ground nesters so their nests and young may be destroyed by fire or harvesting equipment. There may be short-term losses of cover and long-term increases in shrub fruit production

Impacts to waterfowl by prescribed fire are expected to be minimal at LRNRA with rare occasions where small segments of shoreline vegetation (primarily reed canary grass) may burn when using the shoreline as a firebreak. Once again, nesting surveys will be conducted if the prescribed burn occurs between April 1 and July 15.

Reptiles and Amphibians

Published information regarding fire impacts to amphibians is not readily available. The proposed fuels treatments/prescribed fires will not likely include a large portion of wet or riparian habitats so should have limited effects on amphibians. Reptile habitats are more likely to be impacted. Both herptile groups may suffer some mortality of individuals during prescribed burns on small acreages or from direct and indirect mortality during mechanical fuel treatments.

Fisheries

The fuels and prescribed fire treatments proposed for LRNRA are not expected to impact fish species in any negative way. LRNRA controls only short “mouth” portions of small tributaries, so prescribed fire will have little impact to raising the temperature of these streams. Present conditions on the main stem and tributary mouths of LRNRA are already impacted by reservoir operations

Alternative 1 – (--No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Mitigation: Known raptor nest trees will be identified and protected during any mechanical treatment or prescribed burning. Snags will be left as wildlife habitat when determined to not be a safety hazard. Mechanical fuel reduction treatments will not be allowed within riparian habitats. Surveys for the nests of birds protected under the MBTA will occur on projects scheduled to occur between April 1 and July 15. Observations for bat maternity roosting colonies in cavities of large snags/trees will also be conducted during this time period. For projects scheduled in late winter (Jan. 15 to Mar. 30), nest surveys for great horned owls will be conducted in concert with bald eagle nest surveys. Treatments will not occur within 400 meters of active nests of either species.

Conclusions: The strategy of immediate suppression of all wildfires will continue to protect large blocks of wildlife habitat from uncontrolled, severe wildfires. This alternative includes expected short-term, negligible to minor, direct, localized, adverse impacts to wildlife as fuels reduction and prescribed fire actions occur in the identified treatment units. The long-term, minor, localized, indirect effect on wildlife/fish and their habitats is beneficial, but to a lesser degree than Alternative 2, as the scheduled treatments and maintenance actions protect fewer blocks and areas of wildlife habitat from the effects of severe wildfires.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

Wildfires will occur regardless of which alternative is selected. A full suppression response to all wildfires will be applied to LRNRA under this alternative as well. The planning and use of fuels treatments and prescribed fires on an additional 2,430 acres of LRNRA park lands to improve forest health, reduce fuel accumulations from past fire suppression, and better protect park and neighboring developments from large-scale, catastrophic wildfires are all seen as having long-term benefits to the wildlife habitat areas/forest communities receiving those treatments.

The beneficial effects of reducing the threat from severe wildfires will occur on a much larger portion of the park. With mitigation measures in place, only a few common species (red squirrels, gallinaceous bird species, woodpeckers, small rodents, a few tree roosting individual bats, etc.) should see any short-term, negligible to minor effects from either fuels or prescribed burn treatments due to loss of hiding, feeding, escape, or other habitat components. None of the

scheduled actions should have a long lasting impact and may result in increased production of fruits and other foods as well as the prey species that may utilize them.

Mitigation: Known raptor nest trees will be identified and protected during any mechanical treatment or prescribed burning. Snags will be left when determined not a safety hazard. Mechanical fuel reduction treatments will not be allowed within riparian habitats. Surveys for the nests of birds protected under the MBTA will occur on projects scheduled to occur between April 1 and July 15. Observations for bat maternity roosting colonies in cavities of large snags/trees will also be conducted during this time period. For projects scheduled in late winter (Jan. 15 to Mar. 30), nest surveys for great horned owls will be conducted in concert with bald eagle nest surveys. No project activities will occur within 400 meters of an active nest of either species.

Conclusions: The use of prescribed fire and mechanical fuels treatments in this alternative for fuel reduction purposes will cause short-term, minor, localized, direct, adverse effects to a small number of wildlife species. There will be a negligible potential for indirect, localized, adverse effects to fish and fish habitat from soil erosion or ash entering the park's waterways. The planned treatments are expected to lead to overall minor to moderate, localized, direct and indirect beneficial effects in the long-term as forest health and wildlife habitats improve. Long term, minor to major, indirect, widespread beneficial effects from selecting this alternative include the reduced possibility of wildfires starting on and/or spreading to a larger proportion of the park. Wildfires that do occur should burn in more of a mosaic pattern which creates 'edge effect' and reduces the amount of wildlife habitat returned to early seral stage plant communities.

Sensitive Species

Sensitive Plant Species

Impacts Common to All

Under both alternatives, all wildfires will be fully suppressed thereby reducing the impacts of fires on most sensitive plant species found within LRNRA. Fire and fuel treatment effects on plants are complex dependent on timing, duration, heat produced, and fuel loads.

Those few sensitive plant species known to be present in the park may be negatively affected during large-scale wildfire events dependent on if they grow in areas with other vegetation (Nuttall's pussytoes) or out on open gravelly slopes (Columbia crazyweed)

The management tools utilized by both alternatives are the same and only the number and scope of the treatments are different. The brief reviews of the potential risks and effects on sensitive plant and wildlife species found in the Affected Environment are common to both alternatives.

The following are Washington State listed species that occur in or near the park. Following the mitigation actions listed in the Affected Environment section of this document would result in

"no effect" to these species from prescribed fire or fuels projects in forested areas if they are found in a treatment unit. These include:

- Bald Eagle: The park maintains a database of known bald eagle and osprey nesting sites along the shoreline and nest inventories are conducted for new or occupied nests before any treatments occur.
- Golden Eagle is a State Candidate species due to low reproduction rates and lead bio-accumulation issues. One known nesting area occurs in the park near China Bend. There are no planned treatments in the vicinity.
- Townsend's Big-eared Bat has been verified in the park and potentially could breed. Inventories for breeding populations of this species in overstory trees will occur prior to initiation of summer fuels projects.

Other sensitive species listed by the State of Washington, that are present or may be present in the park, but are not expected to experience impacts from prescribed fire or fuels treatment projects are listed in the Affected Environment section of this FMP.

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and no use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Mitigation: Adverse impacts will be mitigated through identification and, if necessary, avoidance of these species in project planning and implementation.

- Areas scheduled for fuels treatments or prescribed burns will be surveyed for the presence of Nuttall's pussytoes. If found within the project area, the NPS will consider boundary locations, project modifications, or additional fireline construction within the project boundary to avoid areas of plant concentrations. Within each unit scheduled to be treated with prescribed fire that has this sensitive plant species, the NPS will establish plots and monitor fire effects on the existing plants. Based on the results of this initial monitoring, the NPS will re-evaluate the use of prescribed fire and mechanical fuels treatments and their effects on Nuttall's pussytoes and any other sensitive species found in a treatment unit.
- Surveys of known nests and all large diameter trees in new treatment areas for nesting bald eagles will occur prior to starting any projects between January 1 and July 15. Measures may be taken to reduce ladder fuels around known nest trees reducing potential wildfire effects. Large trees and snags with cavities will also be observed for evidence of use by Townsend big-eared bats for maternity roosts on any fuels reduction projects planned during May to July. Trees and a 30 meter buffer area will be avoided if bats are identified.

Conclusions: The strategy of immediate suppression of all wildfires in this alternative leads to an overall minor, direct, localized, beneficial effect to all sensitive plant and animal species in the short and long term. The reduced amount of treatment units results in fewer chances for a possible short-term, negligible to moderate, direct, localized, adverse effect on one sensitive (state listed) species – Nuttall's pussytoes and on a host of bird species protected under the MBTA. There is expected to be a long-term, minor to moderate, indirect, widespread, beneficial effect from the use of prescribed fire and mechanical fuels reduction treatments for improving

habitats and reducing wildfire extent and severity. This positive effect will be on a smaller amount of park lands and may allow a higher potential for severe wildfires and their effects on the listed sensitive species and their habitats to occur.

For all federally listed wildlife species noted as possibly occurring on park lands, a determination of **May Affect, Not Likely to Adversely Affect** any of those species has been made. For ESA listed plant species a determination of **No Effect** is made because they have not been identified in the park.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

Sensitive plant species

Mitigation measures:
Areas scheduled for fuels treatments or prescribed burns will be surveyed for the presence of Nuttall's pussytoes. If found within the project area, the NPS will consider boundary locations, project modifications, or additional fireline construction within the project boundary to avoid areas of plant concentrations. Within each unit scheduled to be treated with prescribed fire that has this sensitive plant species, the NPS will establish plots and monitor fire effects on the existing plants. Based on the results of this initial monitoring, the NPS will re-evaluate the use of prescribed fire and mechanical fuels treatments and their effects on Nuttall's pussytoes and any other sensitive species found in a treatment unit.

Sensitive animal species

Mitigation measures:

- Surveys for nests in all trees in treatment areas for nesting bald eagles and all bird species protected under the MBTA will occur prior to starting any projects between April 1 (January 15 for bald eagles & great horned owls) and July 15. Measures may be taken to reduce ladder fuels around known eagle nest trees/snags reducing potential wildfire effects. During prescribed fire operations, actions will be taken to minimize the impact to old growth trees. Actions may include black lining around groves of large trees and snags along the reservoir; protection of individual known roost trees by mechanically reducing the fuel around the base of the tree; and exclusion of certain areas from the prescribed fire. Inventories of large trees for cavities will be occur and be monitored for possible maternity colony use by Townsend long-eared bats during the summer months. A 30 meter buffer will be placed around any tree having a sensitive bird nest or bat roost. Treatment/control in that area will be deferred until after the breeding/nesting season is past.

Conclusions: The strategy of immediate suppression of all wildfires in this alternative leads to an overall direct, beneficial effect to all sensitive plant and animal species in the short and long term. In relation to Nuttall's pussytoes, birds protected by the MBTA, and sensitive bat species, which are most likely to be impacted by the proposed treatments, the additional treatments proposed in this alternative could have a short-term, minor, direct, localized, adverse effect with all mitigation measures taken. The additional fuels reduction treatments for forest health and a further potential reduction in wildfire severity and size are expected to have a long-term, minor to moderate, widespread, indirect, beneficial effect on protecting current and potential habitat for all sensitive plant and animal species from the impacts of severe wildfires.

For all federally listed wildlife species noted as possibly occurring on park lands, a determination of **May Affect, Not Likely to Adversely Affect** any of those species has been made. For ESA listed plant species a determination of **No Effect** is made because they have not been identified in the park.

Cultural Resources

Impacts Common to All

More extensive suppression activities are likely to occur in wildfire situations increasing the chances for soil disturbance and cultural resource damage. Because the timing and location of wildfires cannot be predicted, suppression activities are usually carried out under emergency type situations. During these events, firefighters respond quickly and there may not be ample time for the careful development of plans to avoid disturbance to cultural resources. While some of the disturbances caused by suppression can be avoided by careful planning of hand lines and rehab work, the ability to consider cultural resources during a wildfire is much less likely to occur.

Mechanical thinning and prescribed fire treatments for fuels reduction and forest health purposes is also a potential threat to cultural resources. Even with the best planning and mitigation measures in place, there is still the chance that cultural resource damage will occur. Prior to any actions being taken on a new treatment unit, trained archeologists will check known archeological sites and will conduct a walk-through inventory of the entire unit looking for evidences of new sites. They may request to be on-site during mechanical fuels treatments when heavy timber harvesting equipment is involved. They will also conduct post-prescribed burn monitoring to determine if any archeological/cultural resources were exposed by the removal of ground cover and duff. This will facilitate the planning of protective measures for these new sites should additional entries and treatments be necessary. Only sites with known archeological resources will receive additional monitoring during second and later entries into a unit for removal of additional fuel loads or to conduct maintenance burns.

The short-term effects to cultural resources from wildfire and mechanical thinning are similar for both alternatives with just the amount of acreage involved being different. Impacts to these resources can result from fire management activities. Three types of impact can be viewed as:

- Direct: Impacts resulting from fire itself, including heat and smoke damage.

- Operational: Impacts resulting from fire and fuel management operations such as fireline construction, mechanical thinning, snag felling, etc.
- Indirect: Changes in local context, often resulting from fire and/or fire operation that result in possible impacts including: movement or loss of artifacts by erosion; mortality of trees important to the 'historic' landscape; additional looting because archeological items are uncovered or more readily seen after removal of duff and vegetation; etc.

Mitigation Measures Common to All

Mechanical equipment such as tractors will not be used during wet periods when enhanced soil compaction can occur. Operating equipment on frozen or snow covered ground will be the preferred mitigation for both soils and cultural resource protection. Sound justifications must be noted before operation of equipment on dry soils is authorized. Low ground pressure machines will be used in any skidding operations. Skid trails will be designated before cutting operations begin. An integrated arch to lift one end of logs will be required. No heavy equipment will be allowed on slopes greater than 25 percent. Skid trails on slopes or dry gullies with active eroding headcuts in the treatment unit that are adjacent to a waterbody will have silt fences installed or be water-barred and seeded immediately after treatment to minimize soil erosion.

Prescribed fire impacts would be minimized as control lines/fire breaks would utilize existing roads, trails, water bodies and other natural barriers where possible. Where possible, heavy accumulations of 1000 hour fuels will be removed through thinning treatments, salvage harvesting, or firewood removal prior to prescribed burn treatments.

Piles will be burned during the winter season to minimize soil temperatures. Seeding of burn pile ash may occur when native seed is available and/or the piles burn especially hot.

The use of CTL Harvesting and Log Forwarding systems will be the favored method for the removal of overstory trees in mechanical thinning operations.

Additional measures will be incorporated to prevent adverse effects to cultural resources in addition to avoidance. Conducting a cultural resource survey for each project and developing avoidance stipulations for cultural sites during the Section 106 process will accomplish this. Additional protective measures may include, but not be limited to, any of the following:

- Foaming of wooden structures and artifacts;
- Clearing of brush around structures and rock art panels;
- Restrictions on the use of heavy equipment on and around cultural sites;
- Restrictions on the use of hand lines or other ground disturbing activities on cultural sites;
- Preservation of brush and trees that cover features on cultural sites.
- Monitoring by an onsite archeologist during any ground disturbing activity.
- Providing cultural resource data to Resource Advisors during a wildfire.
- Consultation with SHPO and Tribes under Section 106 for additional protective measures

If it is determined after further analysis and consultation that the cultural resources of a particular unit could not be adequately protected through implementation of the above or similar mitigation measures, then the proposed activities or the treatment unit boundaries will be substantially modified or removed from consideration. In the event that archeological or historic materials are discovered during project activities, work in the immediate vicinity will be discontinued, the area secured, and the SHPO and THPO notified as appropriate.

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

In the long-term, wildfire will have a more devastating effect on cultural resources under this alternative as compared with Alternative 2 because there is a greater likelihood for larger, more devastating fires on more acres of the park. Fuel loads will continue to accumulate and eventually, a large wildfire with high intensity heat will occur. The greater heat intensity will penetrate deeper into subsurface sites causing more damage to artifacts as compared with the effects from a small, cooler fire.

Mitigation: See measures common to all.

Conclusions: The strategy in this alternative is immediate suppression of all wildfires parkwide. The expected short-term effects to Cultural Resources from these actions and the planned treatments for fuels reduction and forest health is a negligible to minor, localized, direct, adverse effect with mitigation. The planned treatments however may lead to long-term minor to moderate, indirect, localized, beneficial effects in the long-term as these resources are better protected from severe wildfires that could remove consumable cultural resources and/or cause heat or soil erosion damage to archeological resources.

For the impact topic Cultural Resources in accordance with NPS *Management Policies* (NPS, 2006a), the analysis in this Environmental Assessment fulfills the responsibilities of the NPS under Section 106 of the NHPA. Each site will be surveyed prior to treatment and mitigation actions will be added to the treatment plan ensuring that a determination of **No Effect** or **No Adverse Effect** can be made before project initiation.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

The use of mechanical treatments and prescribed fires on an additional 2,430 acres will of course increase the potential for effects on more known and unrecorded sites. The Fire Management Plan states that all fire-management activities, particularly the development of prescribed burn plans, will adhere to the NHPA and the Native American Graves Protection and Repatriation Act (NAGPRA). The adverse effects of fire and fire suppression activities will thus be minimized or avoided by pre-burn surveys, implementing cultural resource protection procedures (such as foaming a wood structure), and by carefully locating ground-disturbing activities away from cultural sites. Prior to any actions being taken on a new treatment unit, trained archeologists will check for known archeological sites and conduct a walk-through inventory of the entire unit. They may request to be on-site during mechanical fuels treatments when heavy timber harvesting equipment is involved. They will also conduct post-prescribed burn monitoring to determine if any archeological/cultural resources were exposed by the removal of ground cover and duff. Only sites with known archeological resources will receive additional monitoring during second and later entries into a unit for removal of additional fuel loads or to conduct maintenance burns.

Although the larger number of treatment units and possible entries into the unit will result in more ground disturbance than in Alternative 1, this effect is expected to be offset by the reduction in the potential damage from uncontrolled wildfires in the Recreation Area. The NPS will use the mitigation measures described to minimize the potential for cultural resource damage.

Mitigation: See measures common to all.

Conclusions: The strategy in this alternative is also immediate suppression of all wildfires parkwide. The expected short-term effect on Cultural Resources from these actions and the planned treatments for fuels reduction and forest health on an additional 2,430 acres is a negligible to minor, localized, direct, adverse effect with mitigation. This however is expected to lead to a long-term, minor to moderate, widespread, indirect, beneficial effect as more cultural resources are better protected from severe wildfires that could remove consumable cultural resources, cause heat or soil erosion damage to known and unknown archeological resources, and have more wildfire suppression related damages.

For the impact topic Cultural Resources in accordance with NPS *Management Policies* (NPS, 2006a), the analysis in this Environmental Assessment fulfills the responsibilities of the NPS under Section 106 of the NHPA. Each site will be surveyed prior to treatment and mitigation actions will be added to the treatment plan ensuring that a determination of **No Effect** or **No Adverse Effect** can be made before project initiation.

Visitor Use & Experience

Impacts Common to All:

Visitor use and experience would be impacted by wildfire in the short-term as has occurred historically. Short-term impacts would include restrictions of use by visitors in areas affected by the spread of the wildfire event. Management actions such as visitor evacuations, entry

restrictions and other strategies removing visitors from areas impacted by wildland fire would continue to be instituted. Additionally, during the fires and suppression efforts dangerous smoke conditions, facilitation of firefighter vehicle traffic, and the use of the lake to fill aerial attack aircraft could lead to possible temporary road and lake closures to visitors and local residents. Hazards left over after the suppression efforts, such as hazard trees or erosion of hillsides, may also impact visitor use. These impacts to visitor use would occur during the hottest driest part of the fire season, which correlates to the period of highest visitor use.

Long-term impacts on visitor use could also be experienced following a large-scale or severe wildfire event. Closures to visitor entry into areas experiencing burned area rehabilitation projects, closures due to possible mud slides and other events off the denuded landscape, closures of damaged park infrastructures until repairs are completed, and other types of visitor use restrictions may occur.

There would be additional effects to visitors from mechanical fuels treatments and prescribed fire projects under both alternatives. These effects would be short-term and negligible to minor in extent. If harvesting equipment is being utilized the entire treatment unit will have restricted entry for safety reasons. If timber falling is being conducted by field crews, then NPS staff will ensure that any visitors or neighbors near the project site are notified and warned to stay out of the area. Prescribed fires (including the burning of piles) would generally be undertaken during the pre- and post-visitor use seasons when fire danger is lower and fewer visitors are present. Those occurring in the fall could have localized effects on hunters. There would be restrictions on public entry into prescribed fire project areas during the burn and mop-up stages. These restrictions would be of short duration, generally two to four days, and the restrictions would be for a specific treatment unit ranging from 5 to 130 acres in size.

The timing of visitor use restrictions for mechanical fuels reduction and prescribed fire projects can be adjusted by project managers should local visitor events or planned activities be scheduled near a particular treatment unit. Of course this is not the case for wildfire suppression actions.

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Under this alternative, visitors use and experience is affected when they are restricted from accessing areas of the park where mechanical fuels or prescribed fire operations are occurring. The majority of the planned fuels treatment areas will occur in dispersed recreation areas and most have already experienced one or more entries. These areas will not be signed for limited use during mechanical fuels treatments, but fuels staff will advise visitors of temporary avoidance areas to ensure public safety. Prescribed fire signage that notifies visitors that the visible smoke and fires are part of the prescribed fire program will be posted during prescribed burns. Park and fuels staff will be posted at trailheads and on roads that pass through project areas during prescribed fire treatments to answer questions and address any concerns or issues

that may arise. The same procedures will be followed in any treatments occurring in or adjacent to concentrated recreation areas. In Alternative I, an estimated 31 projects would occur in 2014 - 2020 representing 213 days of potential restrictions. An estimated 11 projects would occur in 2021 – 2026 representing 104 days of potential restrictions.

Conclusions: There is expected to be a short-term, negligible to minor, localized, direct adverse effect to visitor use and experience from the proposed fuels and prescribed fire actions in any particular treatment area. Because less park land is having fuels reduction treatments under this alternative, there is an increased likelihood for more severe wildfires on a larger proportion of the park in the long-term causing possible minor to major, widespread, direct, adverse effects to visitors use and experience over time.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

Under this alternative, visitors use and experience is affected on a potential 2,550 additional acres when they are restricted from accessing areas of the park where mechanical fuels or prescribed fire operations are occurring. The majority of the planned fuels treatment areas will occur in dispersed recreation areas. These areas will not be signed for limited use during mechanical fuels treatments, but fuels staff will advise visitors of temporary avoidance areas to ensure public safety. Prescribed fire signage that notifies visitors that the visible smoke and fires are part of the prescribed fire program will be posted during prescribed burns. Park and fuels staff will be posted at trailheads and on roads that pass through project areas during prescribed fire treatments to answer questions and address any concerns or issues that may arise. The same procedures will be followed in any treatments occurring in or adjacent to concentrated recreation areas. In Alternative 2, an estimated 44 projects would occur in 2014 - 2020 representing 355 days of potential restrictions. An estimated 24 projects would occur in 2021 – 2026 representing 240 days of potential restrictions.

Potential long-term impacts on visitor use and experience could be reduced as hazard fuels are removed, forest health is improved, and the chance for large wildfires moves from potential high intensity, long duration, to lower intensity, shorter duration events.

Conclusions: Completing prescribed fires and mechanical fuels reduction operations on additional treatment units and with multiple entries will cause some short-term, negligible to minor, localized, direct, adverse effects to visitor use and experience under this alternative as an additional 2,430 acres are treated. In the long-term, the overall effects are expected to be a minor to major, widespread, direct, beneficial effect as fewer and less severe wildfires occur. This ensures less restrictions on visitor use and access during suppression and rehabilitation activities and less chance for long-term changes to the scenic landscapes of the park by wildfire.

Safety:

Impacts Common to All

Safety of the public and LRNRA personnel is the number one priority of the LRNRA fire management program. Federal Wildland Fire Management Policy as implemented through NPS DO-18 reinforces that concept. This alternative relies on full suppression actions of all wildfires to insure the safety of the public and park personnel, with any strategies to achieve full suppression insuring the safety of wildland fire fighters.

Short-term impacts on safety during wildfires are directly related to the severity of the wildfires, its location, and weather conditions at the time of ignition. The more severe the fire, the more difficult it will be for fire suppression resources to stop the spread. The larger a wildfire grows the more potential it will have to impact the safety of the public, LRNRA personnel, and assigned firefighters.

The use of the full array of safety related personal protective equipment will occur during any/all fuels reduction, prescribed fire, and wildfire suppression actions. These activities all include inherently dangerous tasks and equipment. Job and safety training are important components of the LRNRA safety program. Job hazard analysis and operational leadership worksheets are prepared for each treatment action and address site specific differences in each treatment unit and the host of environmental dangers (thunderstorms, windstorms, snow, ice, poisonous snakes & plants, biting/stinging insects, etc.) that can change on an hourly and daily basis. More details on safety and use of personal protective equipment are available in the LRNRA FMP.

Long-term benefits for safety are expected under both alternatives from the phased reduction of unnatural fuel loading through mechanical fuels and prescribed fire projects. The removal of hazard trees and their resultant fuels, reductions in ladder and 1000 hour fuels, and creation of thinned forests and firebreaks will all reduce the intensity and spread of wildfires and their possible effects, which are often uncontrollable, on the safety of the public, park personnel and firefighters.

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

Operational safety considerations are directly related to the number of projects being implemented. Alternative 1 has fewer proposed treatments and therefore less opportunities for accidents to occur. However, because a smaller number of acres are scheduled for fuels reduction treatments, the potential for more wildfires and their negative effects on human safety can be expected in the long-term.

Conclusions: When considering the safety of the public, LRNRA staff, and firefighters this alternative will have a short-term, negligible to minor, localizes, direct, adverse effect on safety for all involved during both planned treatments and immediate suppression of wildfires. With a limited fuels reduction program this can have a long-term, negligible to major, indirect, adverse effect on safety dependent on the size and intensity of any wildfires that occur.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document.

There will be an increase in planned fuels treatment and prescribed fire events under Alternative 2 encompassing an additional 2,430 acres and additional treatments. This effort will involve more opportunities for accidents by staff and contractors from the inherently dangerous operation of harvesting equipment, chainsaws, transport of logs, hand piling, lopping & scattering, accessing the new treatment units, and assisting with the suppression of the smaller number of expected wildfire starts. In the short-term, wildfires starting in the park will exhibit current fire behaviors, with associated safety concerns. Safety concerns for the additional proposed prescribed fires, when burning in prescription, should be minimal. This is due to the controlled nature of a prescribed burn, as outlined in the individual LRNRA prescribed fire plans prepared for each burn unit.

In the long-term there will be a decrease in the potential for and severity of wildland fires as more of the park's acreage with heavy fuels are treated with prescribed fire and mechanical fuel reduction projects. With lighter fuel loads, more firebreaks, and a higher amount of forested park land being managed, it is expected that a decrease in fire intensity and ability to spread will occur. This in turn reduces the effort needed to stop a wildfire's spread, the amount of time that the public, park personnel, and firefighters are exposed to the wildfire situation, and all of the associated safety risks.

Reduced fuel loads on more acres of the park will also reduce the risk of wildfire spreading to and from adjacent private property and neighboring lands. This will make it safer for neighbors living next to the LRNRA boundary in the long-term.

Conclusions: When considering the safety of the public, LRNRA staff, and firefighters this alternative will have a short-term, negligible to minor, localized, direct, adverse effect on safety for all involved in completing inherently dangerous activities during both planned treatments and the immediate suppression of wildfires. Training, personal protective equipment, JHA's, and adhering to operational leadership guidelines and practices are mitigation measures that will be taken to reduce the risks. This enhanced fuels reduction program is expected to have long-term, minor to moderate, localized, indirect, effect on public, neighbor, and staff safety as the size and severity of any wildfires that occur should be reduced.

Adjacent Landowners:

Alternative 1 – (No Action) – Continue full suppression of all wildfires, use of mechanical treatment, and limited use of prescribed fires.

Alternative 1 would continue the treatments outlined in the LRNRA 2001 and 2009 FMP, and as described under the Alternatives section of this document.

In the long-term, there will be a slower reduction of unnatural fuel loads in LRNRA under Alternative 1. With higher fuel loading existing over a longer time period, there is a higher potential for wildfires that originate on LRNRA lands to have more intensity as they spread to neighboring lands. Effects from these escaped fires would depend on the severity of the fire and the available fuels on the adjacent lands. The impacts to private residences, outbuildings, and forest resources could range from minor, if defensible space and Firewise measures are in place, to severe if no fire protection/forest health measures have been implemented.

Mechanical fuel and prescribed fire treatments on LRNRA lands may cause some negative effects to adjacent landowners in the form of noise from chainsaws and other equipment and 1 to 4 day periods of smoke from nearby prescribed burns. These effects would be short-term and minor in nature. There will also be a limited number of positive, long-term benefits as defensible space projects are planned and completed on NPS lands immediately adjacent to neighboring residences.

Conclusions: The strategy for this alternative is immediate suppression of all wildfires starting on or entering park lands. The proposed fuels reduction and prescribed fire projects can have a short-term, negligible to minor, localized, direct, adverse effect on neighboring lands during the treatments. Defensible space and fuels reduction treatments immediately adjacent to some homes/outbuildings will have a long-term, moderate to high, localized, direct beneficial effect. However, the reduced amount of treated acreage parkwide can have a long-term, minor to major, indirect, adverse effect on a majority of neighboring lands/homes dependent on the number and severity of any wildfires that start on park lands and spread to neighboring lands.

Alternative 2 – (Preferred Alternative) – ENHANCED PROTECTION of NEIGHBORING LANDS and PARK RESOURCES

This alternative includes 54 new treatment units encompassing 2,430 acres in addition to those outlined in the 2001 and 2009 LRNRA FMP, and as described under the Alternatives section of this document. By the end of fiscal year 2020 Lake Roosevelt proposes to reduce fuel loading on approximately 2,379 acres. Of the 2,379 acres, 36% will be treated with understory burns, 51% with pile burning, and 13% with maintenance burns. Additionally this plan proposes to treat an additional 2,649 acres from 2021 into the future. Defensible space units totaling 50 acres per year through the year 2026 are included in this total. Defensible space unit acres beyond 2026 are not included. Of these 2,649 acres, at least 10% will be treated with understory burns, 6% will be treated with maintenance burns, and 84% will be treated with pile burns. Additionally, a

portion of the area treated with pile burns may be treated with an understory burn or maintenance burn in the future.

In the long-term, this alternative proposes to treat a higher amount of acreage (2,430 acres) with a bulk of the treatment units being located near to or adjacent to some of the developing areas along the park boundary. With reduced fuel loading on park lands, it is expected that wildfires originating on LRNRA lands will have less intensity and fewer chances to spread to neighboring lands. Effects from any fires leaving park lands would depend on the severity of the fire and the available fuels on the adjacent lands. The impacts to private residences, outbuildings, and forest resources could range from minor, if defensible space and Firewise measures are in place, to severe if no fire protection/forest health measures have been implemented.

The increased amount of mechanical fuels reduction and prescribed fire treatments on LRNRA lands may cause some additional negative effects to adjacent landowners in the form of noise from chainsaws and other equipment and 1 to 4 day periods of smoke from prescribed burns. These effects would be short-term and minor in nature. There will also be an expanded number of positive, long-term benefits as defensible space projects are planned and completed on NPS lands immediately adjacent to neighboring residences.

Conclusions: The strategy for this alternative is immediate suppression of all wildfires starting on or entering park lands. The larger number of proposed fuels reduction and prescribed fire projects may have a short-term, negligible to minor, localized, direct, adverse effect on a higher amount of neighboring lands during the treatments. Defensible space and fuels reduction treatments immediately adjacent to some homes/outbuildings will have a long-term, moderate to high, localized, direct beneficial effect. In addition, the increased amount of treated acreage is expected to have a long-term, minor to major, widespread, indirect, beneficial effect on protecting many additional areas of private property/homes from any wildfires originating on park lands.

Chapter 5: List of Preparers, Consultants and Distribution List

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Distribution List

The LARO Fire Management Plan Environmental Assessment will be distributed to individuals and organizations for a formal public review. Public distribution and notification will occur through websites, press releases, CD copies, limited hard copies, and letters. An Open house meeting will be held during the public review period. The complete plan, including maps, will be available on the NPS Planning, Environment, and Public Comment (PEPC) website. The distribution list includes the following:

National Park Service, Pacific West Region
Regional Environmental Coordinator
Regional Fire Management Office

National Park Service, North Cascades NP
NOCA Fire Management Office
NPS Pacific West NW Area Fire Ecologist
LRNRA Fuels Specialist

U.S. Fish and Wildlife Service
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U.S. Forest Service
FMO 3 Rivers Ranger District, Colville NF
Colville NF FMO

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Indian Nations
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BIA Superintendent
Tribal Historic Preservation Officer

Spokane Tribe of Indians
BIA Superintendent
Tribal Historic Preservation Officer

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Appendix 1

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Appendix 2

Glossary of Terms

basal area – The area of a tree stem usually expressed in square feet or square meters; generally measured at breast height and inclusive of the bark.

broadcast burning – Prescribed burning activity where fire is applied generally to most or all of an area within well defined boundaries for reduction of fuel hazard, as a resource management treatment, or both.

crown thinning – A restoration thinning of overstory trees to a density of forests typical of those with an undisturbed fire regime.

control – To complete a control line around a fire, any spot fires, and any interior islands to be saved and cool down all hot spots that are immediate threats to the control line.

course woody debris (CWD) – Large woody debris (over 6 inches in diameter) that is left on the ground and utilized by forest resources from long term nutrient capital.

deck – A pile of logs.

diameter at breast height (dbh) – A standard forestry measurement: The diameter of a tree bole at 4.5 feet in height.

down woody fuel – Small dead woody forest fuels that accumulate on the forest floor. They are commonly divided into size classes to assist in measurement and analysis 0 – ¼ inch, ¼ - 1 inch, 1 to 3 inches and 3 plus inches.

duff – The partly decayed organic matter (leaves, needles, and twigs) on the forest floor. Decay has progressed to the extent that the fungi mycelium are usually visible, and it is difficult to distinguish between the different materials.

fire management unit (FMU) – Any land management area definable by objectives, topographic features, access, values to be protected, political boundaries, fuel types, major fire regimes, etc., that sets it apart from the management characteristics of an adjacent unit. FMU's are delineated in Fire Management Plans.

forwarder – An all wheel drive, rubber-tired tractor/trailer combination type vehicle used to transport logs from the felling site to a log landing, deck or transfer area.

landing – An area where decked logs are stored and used as a transfer/and or processing point.

litter – The uppermost layer of organic matter (leaves, needles, and twigs) on the forest floor.

mitigation actions – On-the-ground activities that will serve to increase the defensibility of the Maximum Manageable Area, check, direct, or delay the spread of fire, and minimize threats to life, property, and resources. They can include mechanical and physical non-fire tasks, specific fire applications and limited suppression actions. These actions will be used to construct firelines, reduce excessive fuel concentrations, reduce vertical fuel continuity, create fuel breaks or barriers around critical or sensitive sites or resources, create "blacklines" through controlled burnouts, and to limit fire spread and behavior.

prescribed fire – Any fire ignited by management actions to meet specific objectives, includes machine and handpile burning. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

prescribed fire plan – A plan required for each fire ignited by managers. It must be prepared by qualified personnel and approved by appropriate Agency Administrator prior to implementation.

riparian – An area of land that has standing water, occurs close to standing or flowing water, or has vegetation attributes normally associated with plants that require a high amount of water for survival.

road – a route that has been improved and/or bed material imported or existing soil manipulated. Sometimes known as skid road.

site index – It is one indicator of how tall trees may grow in 100 years. It assists in classifying and comparing other sites.

skidder – Any mechanical device, usually self propelled, tracked or rubber-tired, used to drag logs from the felling site to a log landing area.

skid road – See road.

skid trail – Any route used to transport bole material where surface conditions were not manipulated or improved (preferably with minimal soil exposure).

stand – A group of trees defined and located by their similar structural, textural geographic characteristics. This can be at the micro or macro level of examination.

understory thinning – Thinning of smaller trees that grow beneath the canopy of a taller stand. Generally, these trees will be less than 6 inches in diameter.

use of wildland fire – The management of wildland fires to accomplish specific, pre-stated resource management objectives in pre-defined geographic areas as outlined in the Fire Management Plan.

wildfire – An unwanted wildland fire.

wildland fire – Any non-structure fire, that occurs in the wildland. This term encompasses fires previously called both wildfires, prescribed natural fires and prescribed fires.

wildland fire management program – The full range of activities and functions necessary for planning, preparedness, emergency suppression operations, and emergency rehabilitation of wildland fires, and prescribed fire operations including non-activity fuels management to reduce risks to public safety and restore and sustain ecosystem health.

wildland urban interface (WUI) – The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Appendix 3

Management Effects on Fuels Discussion

Effects on Fuels

Ponderosa Pine Post Thin:

To summarize the effects of burning after thinning in ponderosa pine stands First Order Fire Effects Modeling (FOFEM5) was used to generate fuel reduction reports and graphs. The total number of acres of Ponderosa pine at LARO eligible for thinning in the preferred alternative includes 1,553 acres. This makes the total fuel load 74,078 tons. The reduction in total load from burning will reduce the tonnage by 54.9%. This leaves the remaining tonnage as 33,409 tons.

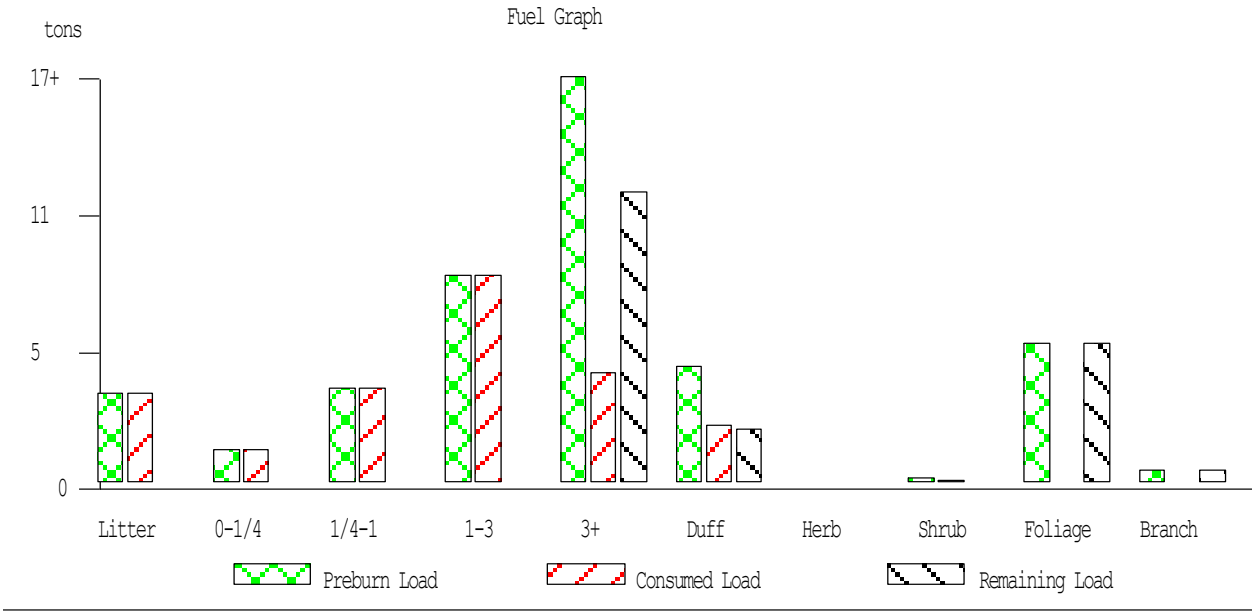
Table 9: Ponderosa Pine Post Thin

Component Quantity	**Pre Burn Load** (t/acre)	**Reduced Fuel Load** (t/acre)	**Post Burn Load** (t/acre)	Reduced (%)	Reference Number	Moisture (%)
Litter	3.90	3.90	0.00	100.0	999	
Wood (0-1/4 inch)	1.57	1.57	0.00	100.0	999	
Wood (1/4-1 inch)	4.13	4.13	0.00	100.0	999	16.0
Wood (1-3 inch)	8.80	8.78	0.02	99.8	999	
Wood (3+ inch) Sound	15.30	4.09	11.21	26.8	999	30.0
Wood (3+ inch) Rotten	1.70	0.67	1.03	39.4	999	30.0
Duff	5.00	2.59	2.41	51.8	2	75.0
Herbaceous	0.20	0.20	0.00	100.0		22.0
Shrubs	0.40	0.24	0.16	60.0		23.0
Crown foliage	6.00	0.00	6.00	0.0		37.0
Crown branchwood	0.70	0.00	0.70	0.0		38.0
Total Fuels	47.70	26.17	21.53		54.9	

Table 10: Fire Effects on Forest Floor Components

Duff Depth Consumed (in)	0.4	Equation: 6
Mineral Soil Exposed (%)	31.0	Equation: 10

Figure 3: Chart of Fire Effects on Forest Floor Components (next page)



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Appendix 4

List of Birds protected under the Migratory Bird Act that have been verified as occurring in LRNRA

Table 11: Migratory Bird Act Protected Birds Occurring in LRNRA

GENUS	SPECIES	NAME	GROUP	FAMILY
Accipiter	cooperii	Cooper's	Hawk	Accipitridae
Accipiter	gentilis	Northern	Goshawk	Accipitridae
Accipiter	striatus	Sharp-shinned	Hawk	Accipitridae
Buteo	jamaicensis	Red-tailed	Hawk	Accipitridae
Buteo	lagopus	Rough-legged	Hawk	Accipitridae
Buteo	swainsoni	Swainson's	Hawk	Accipitridae
Haliaeetus	leucocephalus	Bald	Eagle	Accipitridae
Pandion	haliaetus		Osprey	Accipitridae
Eremophila	alpestris	Horned	Lark	Alaudidae
Ceryle	alcyon	Belted	Kingfisher	Alcedinidae
Aix	sponsa	Wood	Duck	Anatidae
Anas	acuta	Northern	Pintail	Anatidae
Anas	americana	American	Wigeon	Anatidae
Anas	clypeata	Northern	Shoveler	Anatidae
Anas	crecca	Green-winged	Teal	Anatidae
Anas	cyanoptera	Cinnamon	Teal	Anatidae
Anas	discors	Blue-winged	Teal	Anatidae
Anas	platyrhynchos		Mallard	Anatidae
Anas	strepera		Gadwall	Anatidae
Anser	albifrons	Greater White-fronted	Goose	Anatidae
Aythya	affinis	Lesser	Scaup	Anatidae
Aythya	americana		Redhead	Anatidae
Aythya	collaris	Ring-necked	Duck	Anatidae
Aythya	valisineria		Canvasback	Anatidae
Aythya	marila	Greater	Scaup	Anatidae
Branta	canadensis	Canada	Goose	Anatidae
Bucephala	islandica	Barrow's	Goldeneye	Anatidae
Bucephala	albeola		Bufflehead	Anatidae
Bucephala	clangula	Common	Goldeneye	Anatidae
Chen	caerulescens	Snow	Goose	Anatidae
Cygnus	columbianus	Tundra	Swan	Anatidae
Lophodytes	cucullatus	Hooded	Merganser	Anatidae

GENUS	SPECIES	NAME	GROUP	FAMILY
Mergus	merganser	Common	Merganser	Anatidae
Mergus	serrator	Red-breasted	Merganser	Anatidae
Oxyura	jamaicensis	Ruddy	Duck	Anatidae
Aeronautes	saxatalis	White-throated	Swift	Apodidae
Chaetura	vauxi	Vaux's	Swift	Apodidae
Chaetura	vaux	Vaux's	Swift	Apodidae
Ardea	herodias	Great Blue	Heron	Ardeidae
Egretta	thula	Snowy	Egret	Ardeidae
Nycticorax	nycticorax	Black-crowned	Night-Heron	Ardeidae
Bombycilla	cedrorum	Cedar	Waxwing	Bombycillidae
Bombycilla	garrulous	Bohemian	Waxwing	Bombycillidae
Chordeiles	minor	Common	Nighthawk	Caprimulgidae
Phalaenoptilus	nuttallii	Common	Poorwill	Caprimulgidae
Passerina	amoena	Lazuli	Bunting	Cardinalidae
Pheucticus	melanocephalus	Black-headed	Grosbeak	Cardinalidae
Cathartes	aura	Turkey	Vulture	Cathartidae
Certhia	americana	Brown	Creeper	Certhiidae
Charadrius	vociferous		Killdeer	Charadriidae
Charadrius	semipalmatus	Semipalmated	Plover	Charadriidae
Himantopus	mexicanus	Black-necked	Stilt	Charadriidae
Recurvirostra	americana	American	Avocet	Charadriidae
Cinclus	mexicanus		Dipper	Cinclidae
Columba	fasciata	Band-tailed	Pigeon	Columbidae
Zenaida	macroura	Mourning	Dove	Columbidae
Corvus	brachyrhynchos	American	Crow	Corvidae
Corvus	corax	Common	Raven	Corvidae
Cyanocitta	stelleri	Steller's	Jay	Corvidae
Cyanocitta	cristata	Blue	Jay	Corvidae
Nucifraga	columbiana	Clark's	Nutcracker	Corvidae
Perisoreus	canadensis	Gray	Jay	Corvidae
Pica	hudsonia	Black-billed	Magpie	Corvidae
Amphispiza	bellii	Sage	Sparrow	Emberizidae
Calcarius	lappponicus	Lapland	Longspur	Emberizidae
Chondestes	grammacus	Lark	Sparrow	Emberizidae
Junco	hyemalis	Dark-eyed	Junco	Emberizidae
Melospiza	lincolnii	Lincoln's	Sparrow	Emberizidae
Melospiza	melodia	Song	Sparrow	Emberizidae

GENUS	SPECIES	NAME	GROUP	FAMILY
Passerculus	sandwichensis	Savannah	Sparrow	Emberizidae
Passerella	iliaca	Fox	Sparrow	Emberizidae
Pipilo	maculatus	Spotted	Towhee	Emberizidae
Plectrophenax	nivalis	Snow	Bunting	Emberizidae
Pooecetes	gramineus	Vesper	Sparrow	Emberizidae
Spizella	breweri	Brewer's	Sparrow	Emberizidae
Spizella	passerina	Chipping	Sparrow	Emberizidae
Spizella	arborea	American Tree	Sparrow	Emberizidae
Spizella	pusilla	Field	Sparrow	Emberizidae
Zonotrichia	leucophrys	White-crowned	Sparrow	Emberizidae
Zonotrichia	albicollis	White-throated	Sparrow	Emberizidae
Falco	columbarius		Merlin	Falconidae
Falco	mexicanus	Prairie	Falcon	Falconidae
Falco	peregrinus	Peregrine	Falcon	Falconidae
Falco	sparverius	American	Kestrel	Falconidae
Falco	rusticolus		Gyrfalcon	Falconidae
Carduelis	tristis	American	Goldfinch	Fringillidae
Carduelis	flammea	Common	Redpoll	Fringillidae
Carduelis	pinus	Pine	Siskin	Fringillidae
Carpodacus	cassinii	Cassin's	Finch	Fringillidae
Carpodacus	mexicanus	House	Finch	Fringillidae
Coccothraustes	vespertinus	Evening	Grosbeak	Fringillidae
Leucosticte	tephrocotis	Gray-crowned	Rosy-Finch	Fringillidae
Loxia	curvirostra	Red	Crossbill	Fringillidae
Gavia	immer	Common	Loon	Gaviidae
Grus	canadensis	Sandhill	Crane	Gruidae
Hirundo	rustica	Barn Swallow	Swallow	Hirundinidae
Petrochelidon	pyrrhonota	Cliff	Swallow	Hirundinidae
Ripari	riparia	Bank	Swallow	Hirundinidae
Stelgidopteryx	ruficollis	Southern Rough-winged	Swallow	Hirundinidae
Stelgidopteryx	serripennis	Northern Rough-winged	Swallow	Hirundinidae
Tachycineta	bicolor	Tree	Swallow	Hirundinidae
Tachycineta	thalassina	Violet-green	Swallow	Hirundinidae
Tachycineta	bicolor	Tree	Swallow	Hirundinidae
Dolichonyx	oryzivorus		Bobolink	Icteridae
Agelaius	phoeniceus	Red-winged	Blackbird	Icteridae
Euphagus	cyanocephalus	Brewer's	Blackbird	Icteridae

GENUS	SPECIES	NAME	GROUP	FAMILY
Icterus		Northern	Oriole	Icteridae
Icterus	bullockii	Bullock's	Oriole	Icteridae
Molothrus	ater	Brown-headed	Cowbird	Icteridae
Sturnella	neglecta	Western	Meadowlark	Icteridae
Xanthocephalus	xanthocephalus	Yellow-headed	Blackbird	Icteridae
Lanius	excubitor	Northern	Shrike	Laniidae
Lanius	ludovicianus	Loggerhead	Shrike	Laniidae
Chlidonias	niger	Black	Tern	Laridae
Larus	argentatus	Herring	Gull	Laridae
Larus	californicus	California	Gull	Laridae
Larus	delawarensis	Ring-billed	Gull	Laridae
Larus	philadelphia	Bonaparte's	Gull	Laridae
Sterna	caspia	Caspian	Tern	Laridae
Sterna	forsteri	Forster's	Tern	Laridae
Dumetella	carolinensis	Gray	Catbird	Mimidae
Mimus	polyglottos	Northern	Mockingbird	Mimidae
Oreoscoptes	montanus	Sage	Thrasher	Mimidae
Anthus	spinoletta	Water	Pipit	Motacillidae
Catharus	fuscescens		Veery	Muscicapidae
Poecile	atricapilla	Black-capped	Chickadee	Paridae
Poecile	gambeli	Mountain	Chickadee	Paridae
Poecile	atricapillus	Black-capped	Chickadee	Paridae
Poecile	gambeli	mountain	Chickadee	Paridae
Poecile	rufescens	Chestnut-backed	Chickadee	Paridae
Dendroica	coronata	Yellow-rumped	Warbler	Parulidae
Dendroica	nigrescens	Black-throated Gray	Warbler	Parulidae
Dendroica	petechia	Yellow	Warbler	Parulidae
Dendroica	townsendi	Townsend's	Warbler	Parulidae
Dendroica	palmarum	Palm	Warbler	Parulidae
Geothlypis	trichas	Common	Yellowthroat	Parulidae
Icteria	virens	Yellow-breasted	Chat	Parulidae
Oporornis	tolmiei	MacGillivray's	Warbler	Parulidae
Setophaga	ruticilla	American	Redstart	Parulidae
Vermivora	celata	Orange-crowned	Warbler	Parulidae
Vermivora	ruficapilla	Nashville	Warbler	Parulidae
Wilsonia	pusilla	Wilson's	Warbler	Parulidae
Pelecanus	erythrorhynchos	American White	Pelican	Pelecanidae

GENUS	SPECIES	NAME	GROUP	FAMILY
Phalacrocorax	auritus	Double-crested	Cormorant	Phalacrocoracidae
Colaptes	auratus	Northern	Flicker	Picidae
Dendrocopos	pubescens	Downy	Woodpecker	Picidae
Dendrocopos	villosus	Hairy	Woodpecker	Picidae
Dryocopus	pileatus	Pileated	Woodpecker	Picidae
Melanerpes	lewis	Lewis's	Woodpecker	Picidae
Melanerpes	lewis	Lewis's	Woodpecker	Picidae
Picoides	albolarvatus	White-headed	Woodpecker	Picidae
Picoides	pubescens	Downy	Woodpecker	Picidae
Picoides	villosus	Hairy	Woodpecker	Picidae
Picoides	albolarvatus	White-headed	Woodpecker	Picidae
Picoides	arcticus	Black-backed	Woodpecker	Picidae
Sphyrapicus	nuchalis	Red-naped	Sapsucker	Picidae
Sphyrapicus	varius	Yellow-bellied	Sapsucker	Picidae
Aechmophorus	clarkii	Clark's	Grebe	Podicipedidae
Aechmophorus	occidentalis	Western	Grebe	Podicipedidae
Podiceps	auritus	Horned	Grebe	Podicipedidae
Podiceps	grisegena	Red-necked	Grebe	Podicipedidae
Podiceps	nigricollis	Eared	Grebe	Podicipedidae
Podilymbus	podiceps	Pied-billed	Grebe	Podicipedidae
Fulica	americana	American	Coot	Rallidae
Porzana	carolina		Sora	Rallidae
Rallus	limicola	Virginia	Rail	Rallidae
Regulus	calendula	Ruby-crowned	Kinglet	Regulidae
Regulus	satrapa	Golden-crowned	Kinglet	Regulidae
Actitis	macularia	Spotted	Sandpiper	Scolopacidae
Calidris	mauri	Western	Sandpiper	Scolopacidae
Calidris	bairdii	Baird's	Sandpiper	Scolopacidae
Calidris	himantopus	Stilt	Sandpiper	Scolopacidae
Calidris	melanotos	Pectoral	Sandpiper	Scolopacidae
Calidris	pusilla	Semipalmated	Sandpiper	Scolopacidae
Capella	delicata	Common	Snipe	Scolopacidae
Gallinago	gallinago	Common	Snipe	Scolopacidae
Limnodromus	scolopaceus	Long-billed	Dowitcher	Scolopacidae
Numenius	americanus	Long-billed	Curlew	Scolopacidae
Phalaropus	tricolor	Wilson's	Phalarope	Scolopacidae
Tringa	melanoleuca	Greater	Yellowlegs	Scolopacidae

GENUS	SPECIES	NAME	GROUP	FAMILY
Tringa	flavipes	Lesser	Yellowlegs	Scolopacidae
Tringa	solitaria	Solitary	Sandpiper	Scolopacidae
Sitta	canadensis	Red-breasted	Nuthatch	Sittidae
Sitta	carolinensis	White-breasted	Nuthatch	Sittidae
Sitta	pygmaea	Pygmy	Nuthatch	Sittidae
Aegolius	acadicus	Northern Saw-whet	Owl	Strigidae
Asio	flammeus	Short-eared	Owl	Strigidae
Asio	otus	Long-eared	Owl	Strigidae
Bubo	virginianus	Great Horned	Owl	Strigidae
Glaucidium	gnoma	Northern	Pygmy-Owl	Strigidae
Otus	kennicottii	Western	Screech-Owl	Strigidae
Speotyto	cunicularia	Burrowing	Owl	Strigidae
Strix	varia	Barred	Owl	Strigidae
Piranga	ludoviciana	Western	Tanager	Thraupidae
Archilochus	alexandri	Black-chinned	Hummingbird	Trochilidae
Stellula	calliope	Calliope	Hummingbird	Trochilidae
Cystothorus	palustris	Marsh	Wren	Troglodytidae
Salpinctes	obsoletus	Rock	Wren	Troglodytidae
Telmatodytes	palustris	Marsh	Wren	Troglodytidae
Thryomanes	bewickii	Bewick's	Wren	Troglodytidae
Troglodytes	aedon	House	Wren	Troglodytidae
Troglodytes	troglodytes	Winter	Wren	Troglodytidae
Catharus	guttatus	Hermit	Thrush	Turdidae
Catharus	ustulatus	Swainson's	Thrush	Turdidae
Ixoreus	naevius	Varied	Thrush	Turdidae
Myadestes	townsendi	Townsend's	Solitaire	Turdidae
Sialia	currucoides	Mountain	Bluebird	Turdidae
Sialia	mexicana	Western	Bluebird	Turdidae
Turdus	migratorius	American	Robin	Turdidae
Contopus	cooperii	Olive-sided	Flycatcher	Tyrannidae
Contopus	sordidulus	Western	Wood-Pewee	Tyrannidae
Empidonax	oberholseri	Dusky	Flycatcher	Tyrannidae
Empidonax	traillii	Willow	Flycatcher	Tyrannidae
Empidonax	difficilis	Pacific-slope	Flycatcher	Tyrannidae
Empidonax	hammondii	Hammond's	Flycatcher	Tyrannidae
Sayornis	saya	Say's	Phoebe	Tyrannidae
Tyrannus	tyrannus	Eastern	Kingbird	Tyrannidae

GENUS	SPECIES	NAME	GROUP	FAMILY
Tyrannus	verticalis	Western	Kingbird	Tyrannidae
Tyto	alba	Barn	Owl	Tytonidae
Vireo	cassinii	Cassin's	Vireo	Vireonidae
Vireo	gilvus	Warbling	Vireo	Vireonidae
Vireo	olivaceus	Red-eyed	Vireo	Vireonidae
Vireo	solitarius	Solitary	Vireo	Vireonidae

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Appendix 5

BIRDS OF CONSERVATION CONCERN (BCC) 2008

Prepared by
U.S. Fish and Wildlife Service
Division of Migratory Bird Management
Arlington, Virginia

Suggested citation:
U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at <http://www.fws.gov/migratorybirds/>]

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the U.S. Fish and Wildlife Service (USFWS) to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." The BCC 2008 is the most recent effort to carry out this mandate. The overall goal of this report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent our highest conservation priorities. The geographic scope of this endeavor is the United States in its entirety, including island "territories" in the Pacific and Caribbean. *BCC 2008* encompasses three distinct geographic scales—North American Bird Conservation Initiative Bird Conservation Regions (BCRs), USFWS Regions, and National—and is primarily derived from assessment scores from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan.

Bird species considered for inclusion on lists in this report include nongame birds, gamebirds without hunting seasons, subsistence-hunted nongame birds in Alaska; and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species.

LRNRA is split between two BCRs. These include:

Table 12 BCR 9 (Great Basin) BCC 2008 list.	**Table 13 BCR 10 (Northern Rockies U.S. portion only) BCC 2008 list**
Greater Sage-Grouse (Columbia Basin DPS) (a)	Bald Eagle (b)
Eared Grebe (nb)	Swainson's Hawk
Bald Eagle (b)	Ferruginous Hawk
Ferruginous Hawk	Peregrine Falcon (b)
Golden Eagle	Upland Sandpiper
Peregrine Falcon (b)	Long-billed Curlew
Yellow Rail	Yellow-billed Cuckoo (w. U.S. DPS) (a)
Snowy Plover (c)	Flammulated Owl
Long-billed Curlew	Black Swift
Marbled Godwit (nb)	Calliope Hummingbird
Yellow-billed Cuckoo (w. U.S. DPS) (a)	Lewis's Woodpecker
Flammulated Owl	Williamson's Sapsucker
Black Swift	White-headed Woodpecker
Calliope Hummingbird	Olive-sided Flycatcher
Lewis's Woodpecker	Willow Flycatcher (c)

Table 12 BCR 9 (Great Basin) BCC 2008 list.	Table 13 BCR 10 (Northern Rockies U.S. portion only) BCC 2008 list
Williamson's Sapsucker	Loggerhead Shrike
White-headed Woodpecker	Sage Thrasher
Willow Flycatcher (c)	Brewer's Sparrow
Loggerhead Shrike	Sage Sparrow
Pinyon Jay	McCown's Longspur
Sage Thrasher	Black Rosy-Finch
Virginia's Warbler	Cassin's Finch
Green-tailed Towhee	
Brewer's Sparrow	
Black-chinned Sparrow	
Sage Sparrow	
Tricolored Blackbird	
Black Rosy-Finch	
Ferruginous Hawk	

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Appendix 6
LRNRA Fuels Discussion

Fuels

Associated National Forest Fire Laboratory (NFFL) and National Fire Danger Rating System (NFDRS) models are used for fire behavior predictions (Anderson 1982, Deeming and others 1977) and preparedness planning respectively. NFFL fuel models are used for predicting fire behavior. The following NFFL Fuel Models (FM) represents the wide range of vegetation types within the boundaries of LRNRA. Common fuel models in LRNRA are fuel models 1, 2, 6, 8, 9, 10 and 11. A summary of fuel/fire characteristics follows (Table 14).

Table 14. Summary of Fuel/Fire Characteristics

Fuel Model	Rates of Spread	Residual Burn Time	Resistance to Control
1	Very high	Short	Low
2	Very high	Relatively short	Moderately low
6	High	Relatively short	Moderately low
8	Low	Moderate	Moderate
9	Moderate	Moderate	Moderate
10	Moderate	Moderate	Moderate
11	Moderate	Moderate	Moderate

Fire behavior models were run using the BEHAVE 5.0.5 fire prediction system for modeling fire behavior. The following inputs were used for every Fuel Model:

- 1 hr fuel moisture – 5%
- Mid-flame wind – 6 mph
- Slope - 30%

Additionally, FM 2, FM 6, FM 8, FM 9, FM 10, and FM11 included

- 10 hr fuel moisture – 6%
- 100 hr fuel moisture – 10%

FM 2 included

- Live herbaceous fuel moisture – 75%

FM 10 included

- Live woody fuel moisture – 100%

Figure 4 LRNRA Rate of Spread and Flame Length

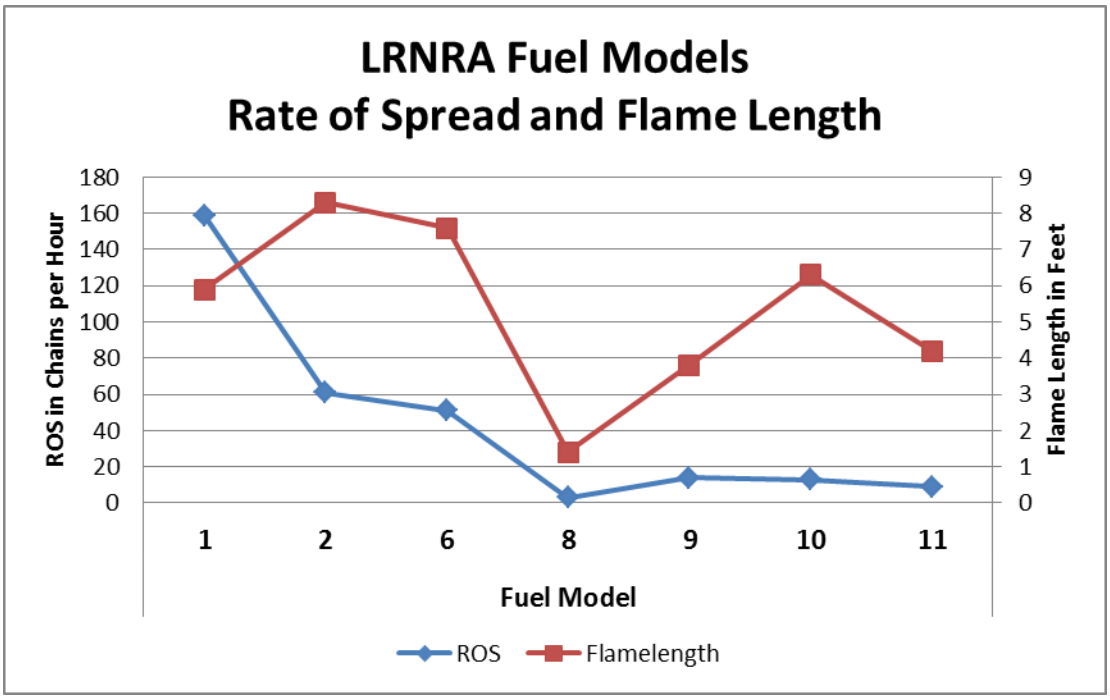

Table 15: LRNRA Fuel Models Rate of Spread and Flame Length

	LRNRA FUEL MODELS						
	1	2	6	8	9	10	11
RATE OF SPREAD	159.2	61.4	51	3.1	14.1	12.6	8.8
FLAME LENGTH	5.9	8.3	8	1.4	3.8	6.3	4.2

The following discussion provides information on fuel types and models currently being used at LRNRA.

1) Grass (NFFL MODEL #1, NFDRS MODEL L)
Open grasslands characterize these areas, which allow surface fires to move rapidly through the cured grass and associated materials. LRNRA sites with grasses representing the predominant fuel, are those areas that have experienced past wildland fire or are maintained through management actions.

The fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured govern fire spread in NFFL FM 1. Fires are surface fires that move rapidly through the cured grass and associated material. Generally, fires are of low to moderate intensity with rapid rates of spread. Spotting distances can be up to 0.3 miles. A general picture of this fuel model is shown in Figure 5.

Fire Behavior Outputs:

- Rate of Spread – 159.2 chains/hour
- Flame Length – 5.9 feet

Figure 5. LRNRA NFFL Fuel Model 1

2) Sagebrush (NFFL MODEL #2, NFDRS MODEL T)

Bitterbrush and sage are the dominant shrubs of the vegetative community existing in the southern third of LRNRA. Native and non-native grasses are also found throughout this community. Vegetation in this area remains green during the first half of the fire season. Later on, as vegetation cures, this community becomes more flammable.

Fire spread in NFFL 2 is primarily through fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead and down stemwood from open shrub growth contributes to fire intensity. An example of this fuel model is found in Figure 6. Open pine stands with grass as the primary carrier is another fuel profile common in the southern end of the LRNRA and is best represented by model 2. This profile transitions from the forest fuels into the grass and shrub models but is not pictured.

Fire Behavior Outputs:

- Rate of Spread – 61.4 chains/hour
- Flame Length – 8.3 feet

Figure 6. LRNRA Fuel Model 2

3) Sage without the Presence of Grasses and Forbs (NFFL Model #6, NFDRS MODEL F)

Sage stands and Bitterbrush that do not have a large component of grasses and forbs fit into this fuel model. As the shrubs occupy more of a site the grasses and forbs are displaced. With the loss of the fine surface fuels a sage fire must now carry through the shrub layer foliage and dead and down shrubby fuels. Winds and/or slope effects are needed for a fire to move quickly through this fuel medium. Generally the fire is a crown fire event which will drop to the ground when openings in the stand occur, or the fire moves into a flat area and the wind dies. An example of this fuel model is found in Figure 7.

Fire Behavior Outputs:

- Rate of Spread – 51.4 chains/hour
- Flame Length – 7.6 feet

Figure 7. LRNRA Fuel Model 6

4) Closed Canopy Short Needle Conifer Stands (NFFL Model #8, NFDRS Model H)

Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have
leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, and lodgepole pine, spruce, fir, and larch.

Fire Behavior Outputs:

- Rate of Spread – 3.1 chains/hour
- Flame Length – 1.4 feet

Figure 8: LRNRA Fuel Model 8

5) Long Needle Conifer Stands (NFFL Model #9, NFDRS Models C and U)

Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines, or southern pine plantations are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning. An example of this fuel model is found in Figure 9.

Fire Behavior Outputs:

- Rate of Spread – 14.1 chains/hour
- Flame Length – 3.8 feet

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Figure 9. LRNRA Fuel Model 9

6) Dense Conifer Stands (NFFL Model #10, NFDRS Model G)

Conifer stands in LRNRA that are overstocked and are now starting to build unnatural fuel loadings as stems die and fall to the ground are included in this fuel model. In LRNRA this fuel model occurs in ponderosa pine stands and in mixed conifer stands. In each case, fire historically served as a natural thinning agent, favoring those species/stems, which are most fire resistant. An example of this fuel model is shown in Figure 10.

Fire Behavior Outputs:

- Rate of Spread – 12.6 chains/hour
- Flame Length – 6.3 feet

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Figure 10. LRNRA Fuel Model 10

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7) Thinned Conifer Stands (NFFL Model #11, NFDRS Model K)

Stands that have had mechanical reduction of stem density with no post thinning fuel reduction treatment are in this category. This fuel model generates the least intense fire behavior of the three slash fuel models. An example of this fuel model is shown in Figure 11.

Fire Behavior Outputs:

- Rate of Spread – 8.8 chains/hour
- Flame Length – 4.2 feet

Figure 11. LRNRA Fuel Model 11

Appendix 7

Fire Management Projects by Alternative

Table 16. Projected Implementation Plan
Fiscal Year 2014

ALT 1: 2014 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Bradbury Beach 1 & 2 UB	Broadcast Burn		67	High	N
Ricky Point	Broadcast Burn		65	High	N
Fort Spokane	Broadcast Burn		40	High	N
Haag Cove	Broadcast Burn		56	High	N
		4	**228**		
Gifford-Cloverleaf Handpile	Hand Pile		62	High	N
ND Kettle Falls #4 HP	Hand Pile		14	High	N
Ponderosa Thin	Hand Pile		10	High	S
PW Def Space HP	Handpile		25	High	N/S
Enterprise Handpile	Hand Pile		25	High	N
		4	**136**		
PW Def Space HPB 2014	Hand Pile Burn		50	High	N/S
Enterprise Handpile Burn	Handpile Burn		40	High	N
		2	**90**		
Gifford-Cloverleaf Thin	Thin		62	High	N
ND Kettle Falls #4 Thin	Thin		14	High	N
Ponderosa Thin	Thin		10	High	S
PW Def Space Thin	Thin		25	High	N/S
Enterprise Thin	Thin		25	High	N
		5	**136**		
Na-Bor-Lee Underburn	Maintenance Burn		46	High	N
		1	**46**		

ALT 2: 2014 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Bradbury Beach 1 & 2 UB	Broadcast Burn		67	High	N
Haag Sherman Block I	Broadcast Burn		50	High	N
Haag Sherman Block II	Broadcast Burn		8	High	N
Haag Sherman Block III	Broadcast Burn		12	High	N
Ricky Point	Broadcast Burn		65	High	N
Fort Spokane	Broadcast Burn		40	High	N
Haag Cove	Broadcast Burn		56	High	N

ALT 2: 2014 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
		8	**298**		
Gifford-Cloverleaf Handpile	Hand Pile		62	High	N
ND Kettle Falls #4 HP	Hand Pile		14	High	N
Ponderosa Thin	Hand Pile		10	High	S
PW Def Space HP	Hand Pile		25	High	N
Enterprise Handpile	Hand Pile		25	High	
		5	**136**		
PW Def Space HPB 2014	Hand Pile Burn		50	High	N/S
Enterprise Handpile Burn	Handpile Burn		40	High	N
		2	**90**		
Gifford-Cloverleaf Thin	Thin		62	High	N
ND Kettle Falls #4 Thin	Thin		14	High	N
Ponderosa Thin	Thin		10	High	S
PW Def Space Thin	Thin		25	High	N/S
Enterprise Thin	Thin		25	High	N
		5	**136**		
Na-Bor-Lee Underburn	Maintenance Burn		46	High	N
		1	**46**		

Fiscal Year 2015

ALT 1: 2015 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Ricky 3 Underburn	Broadcast Burn		12	High	N
Ricky North	Broadcast Burn		25	High	N
Bradbury Beach 1 & 2 UB	Broadcast Burn		67	High	N
Haag Cove	Broadcast Burn		56	High	N
Ricky Point	Broadcast Burn		65	High	N
		4	**225**		
Gifford-Cloverleaf HPB	Hand Pile Burn		62	High	N
Ponderosa Hand Pile Burn	Hand Pile Burn		10	High	S
ND Kettle Falls #4	Hand Pile Burn		14	High	N
Enterprise Handpile Burn	Hand Pile Burn		40	High	N
PW Def Space HPB 2014	Hand Pile Burn		50	High	N/S
		5	**176**		
PW Def Space HP	Handpile		25	High	N/S
		1	**25**		
ND Gifford North Contract MP	Machine Pile		100	High	N
		1	**100**		

ALT 1: 2015 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
ND Gifford North Thin	Thin		100	High	N
PW Def Space Thin	Thin		25	High	N/S
		2	**125**		
Na-Bor-Lee Underburn	Maintenance Burn		46	High	N
Jones Bay	Maintenance Burn		37	Mod	S
Evans	Maintenance Burn		30	Mod	N
Gifford	Maintenance Burn		58	Mod	N
		4	**171**		

ALT 2: 2015 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Ricky 3 Underburn	Broadcast Burn		12	High	N
Ricky North	Broadcast Burn		25	High	N
Bradbury Beach 1 & 2 UB	Broadcast Burn		67	High	N
Haag Cove	Broadcast Burn		56	High	N
Ricky Point	Broadcast Burn		65	High	N
		4	**225**		
Gifford-Cloverleaf HPB	Hand Pile Burn		62	High	N
Ponderosa Hand Pile Burn	Hand Pile Burn		10	High	S
ND Kettle Falls #4	Hand Pile Burn		14	High	N
Enterprise Handpile Burn	Hand Pile Burn		40	High	N
PW Def Space HPB 2015	Hand Pile Burn		50	High	N/S
		5	**176**		
PW Def Space HP	Handpile		25	High	N/S
North Evans Block D HP	Handpile		9	High	N
North Gorge Block C HP	Handpile		18	Low	N
Kettle river Arm Block B HP	Handpile		66	High	N
		4	**93**		
ND Gifford North Contract MP	Machine Pile		100	High	N
		1	**100**		
ND Gifford North Contract Thin	Thin		100	High	N
PW Def Space Thin	Thin		25	High	N/S
Kettle river Arm Block B Thin	Thin		66	High	N
North Evans Block D Thin	Thin		9	High	N
North Gorge Block C Thin	Thin		18	Low	N
		5	**218**		
Na-Bor-Lee Underburn	Maintenance Burn		46	High	N
Jones Bay	Maintenance Burn		37	Mod	S
Evans	Maintenance Burn		30	Mod	N
Gifford	Maintenance Burn		58	Mod	N

ALT 2: 2015 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
		4	**171**		

Fiscal Year 2016

ALT 1: 2016 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Mission Point Underburn	Broadcast Burn		45	High	N
Ricky 3 Underburn	Broadcast Burn		12	High	N
Ricky North	Broadcast Burn		25	High	N
		4	**82**		
PW Def Space HPB 2016	Hand Pile Burn		75	High	N/S
Ponderosa Hand Pile Burn	Hand Pile Burn		10	High	S
ND Kettle Falls #4	Hand Pile Burn		14	High	N
		3	**99**		
ND Gifford North Contract MP	Machine Pile Burn		100	High	N
		1	**100**		
PW Def Space Thin	Thin		50	High	N/S
		1	**50**		
PW Def Space Hand Pile	Hand Pile		50	High	N/S
		1	**50**		
Seasonal Circle Underburn	Maintenance Burn		30	High	N
Whispering Pines	Maintenance Burn		30	Mod	N
Jones Bay	Maintenance Burn		37	Mod	S
		3	**97**		

ALT 2: 2016 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Mission Point Underburn	Broadcast Burn		45	High	N
Ricky 3 Underburn	Broadcast Burn		12	High	N
Ricky North	Broadcast Burn		25	High	N
		3	**82**		
Log Yard Block C Hand Pile	Hand Pile		14	High	N
Ricky Point South Block A Hand Pile	Hand Pile		37	High	N
River Way Block C Hand Pile	Hand Pile		12	High	N
Ricky Point Block F HP?	Hand Pile		18	Low	N
PW Def Space HP	Handpile		25	High	N/S
		5	**106**		
Kettle River Arm Block B HP Burn	Hand Pile Burn		66	High	N

ALT 2: 2016 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
North Evans Block D HPB	Hand Pile Burn		9	High	N
North Gorge Block C HPB	Hand Pile Burn		18	Low	N
PW Def Space HPB 2016	Hand Pile Burn		50	High	N/S
Ponderosa Hand Pile Burn	Hand Pile Burn		10	High	S
ND Kettle Falls #4	Hand Pile Burn		14	High	N
		6	**167**		
ND Gifford North Contract MP	Machine Pile Burn		100	High	N
		1	**100**		
PW Def Space Thin	Thin		25	High	N/S
Log Yard Block C Thin	Thin		14	High	N
Ricky Point South Block A Thin	Thin		37	High	N
River Way Block C Thin	Thin		12	High	N
Ricky Point Block F L&S/ Thin	Thin		18	Low	N
		5	**106**		
Seasonal Circle Underburn	Maintenance Burn		30	High	N
Whispering Pines	Maintenance Burn		30	Mod	N
Jones Bay	Maintenance Burn		37	Mod	S
		3	**97**		

Fiscal Year 2017

ALT 1: 2017 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Mission Point Underburn	Broadcast Burn		45	High	N
Ponderosa	Broadcast Burn		10	High	S
ND Kettle Falls #4	Broadcast Burn		14	High	N
Gifford Cloverleaf	Broadcast Burn		62	High	N
		2	**131**		
Copa HP Old Slash	Hand Pile		12	Low	N
PW Def Space HP	Handpile		50	High	N/S
		2	**62**		
PW Def Space HPB 2017	Hand Pile Burn		75	High	N/S
ND Gifford North Contract HPB	Hand Pile Burn		100	High	N
Copa Burn Old Slash	Hand Pile Burn		12	Low	N
		3	**187**		
PW Def Space Thin	Thin		50	High	N/S
		1	**50**		
Seasonal Circle Underburn	Maintenance Burn		30	High	N
Marcus	Maintenance Burn		40	Mod	N
		2	**70**		

ALT 2: 2017 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Mission Point Underburn	Broadcast Burn		45	High	N
Ponderosa	Broadcast Burn		10	High	S
ND Kettle Falls #4	Broadcast Burn		14	High	N
Gifford Cloverleaf	Broadcast Burn		62	High	N
		4	**131**		
River Way Block A HP	Hand Pile		18	High	N
River Way Block B HP	Hand Pile		24	High	N
Clark Lake 5 Handpile	Hand Pile		32	High	N
Copa HP Old Slash	Hand Pile		12	Low	N
PW Def Space HP	Handpile		25	High	N/S
		5	**111**		
PW Def Space HPB 2017	Hand Pile Burn		50	High	N/S
ND Gifford North Contract HPB	Hand Pile Burn		100	High	N
Copa Burn Old Slash	Hand Pile Burn		12	Low	N
North Evans Block D HPB	Hand Pile Burn		9	High	N
North Gorge Block C HPB	Hand Pile Burn		18	High	N
Log Yard Block C HPB	Hand Pile Burn		14	High	N
Ricky Point South Block A HPB	Hand Pile Burn		37	High	N
River Way Block C HPB	Hand Pile Burn		12	High	N
Ricky Point Block F HPB	Hand Pile Burn		18	High	N
Kettle river Arm Block B HPB	Hand Pile Burn		66	High	N
		10	**336**		
River Way Block A Thin	Thin		18	High	N
River Way Block B Thin	Thin		24	High	N
Clark Lake 5 Thin	Thin		32	High	N
PW Def Space Thin	Thin		25	High	N/S
		4	**99**		
Seasonal Circle Underburn	Maintenance Burn		30	Mod	N
Marcus	Maintenance Burn		40	Mod	N
		2	**70**		

Fiscal Year 2018

ALT 1: 2018 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Mission Point Underburn	Broadcast Burn		45	High	N
		1	**45**		

ALT 1: 2018 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
PW Def Space HP	Handpile		50	High	N/S
		1	**50**		
PW Def Space HPB 2018	Hand Pile Burn		75	High	N/S
ND Gifford North Contract HPB	Hand Pile Burn		100	High	N
Copa Burn Old Slash	Hand Pile Burn		12	High	N
		3	**187**		
PW Def Space Thin	Thin		50	High	N/S
		1	50		
Seasonal Circle Underburn	Maintenance Burn		30	Mod	N
Kettle River CG	Maintenance Burn		27	Mod	N
		2	**57**		

ALT 2: 2018 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Mission Point Underburn	Broadcast Burn		45	High	N
North Evans Block D HPB	Broadcast Burn		9	High	N
North Gorge Block C HPB	Broadcast Burn		18	High	N
Ricky Point South Block A HPB	Broadcast Burn		37	High	N
River Way Block C HPB	Broadcast Burn		12	High	N
Ricky Point Block F HPB	Broadcast Burn		18	High	N
Kettle river Arm Block B HPB	Broadcast Burn		66	High	N
		7	**205**		
River Way Block D HP	Hand Pile		34	High	N
River Way Block E HP	Hand Pile		31	High	N
Clark Lake 4 HP	Hand Pile		79	High	N
South Evans Block A HP	Hand Pile		15	Low	N
PW Def Space HP	Handpile		25	High	N/S
		5	**184**		
PW Def Space HPB 2018	Hand Pile Burn		50	High	N/S
ND Gifford North Contract HPB	Hand Pile Burn		100	High	N
Copa Burn Old Slash	Hand Pile Burn		12	High	N
North Evans Block D HPB	Hand Pile Burn		9	High	N
North Gorge Block C HPB	Hand Pile Burn		18	High	N
River Way Block A HPB	Hand Pile Burn		18	High	N
River Way Block B HPB	Hand Pile Burn		24	High	N
Clark Lake 5 HPB	Hand Pile Burn		32	High	N
Kettle river Arm Block B HPB	Hand Pile Burn		66	High	N
		9	**329**		
PW Def Space Thin	Thin		25	High	N/S

ALT 2: 2018 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
River Way Block D Thin	Thin		34	High	N
River Way Block E Thin	Thin		31	High	N
Clark Lake 4 Thin	Thin		79	High	N
South Evans Block A	Thin		15	Low	N
		5	**184**		
Seasonal Circle Underburn	Maintenance Burn		30	Mod	N
Kettle River CG	Maintenance Burn		27	Mod	N
		2	**57**		

Fiscal Year 2019

ALT 1: 2019 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
PW Def Space HPB 2019	Hand Pile Burn		75	High	N/S
Copa Burn Old Slash	Hand Pile Burn		12	High	N
		2	**87**		
PW Def Space HP	Handpile		50	High	N/S
		1	**50**		
PW Def Space Thin	Thin		50	High	N/S
		1	**50**		
Ne Bor Le	Maintenance Burn		36	Mod	
		1	**36**		

ALT 2: 2019 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
North Evans Block D HPB	Broadcast Burn		9	High	N
North Gorge Block C HPB	Broadcast Burn		18	High	N
River Way Block A HPB	Broadcast Burn		18	High	N
River Way Block B HPB	Broadcast Burn		24	High	N
Kettle river Arm Block B HPB	Broadcast Burn		66	High	N
		5	**135**		
PW Def Space HPB 2019	Hand Pile Burn		50	High	N/S
Copa Burn Old Slash	Hand Pile Burn		12	High	N
River Way Block A HP	Hand Pile Burn		18	High	N
River Way Block B HP	Hand Pile Burn		24	High	N
Clark Lake 5 Handpile	Hand Pile Burn		32	High	N
River Way Block D HPB	Hand Pile Burn		34	High	N
River Way Block E HPB	Hand Pile Burn		31	High	N
Clark Lake 4 HPB	Hand Pile Burn		79	High	N

ALT 2: 2019 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
South Evans Block A HPB	Hand Pile Burn		15	High	N
		9	**295**		
PW Def Space HP	Handpile		25	High	N/S
Log Yard Block A HP Handpile	Handpile		24	High	N
Log Yard Block B HP Handpile	Handpile		20	High	N
Barstow Block C	Handpile		75	Low	N
Kettle River Arm Block A	Handpile - ONLY		54	High	N
		5	**200**		
PW Def Space Thin	Thin		25	High	N/S
Log Yard Block A HP Thin	Thin		24	High	N
Log Yard Block B HP Thin	Thin		20	High	N
Kettle River Arm Block A	Thin		54	High	N
Barstow Block C	Thin		75	Low	N
		5	**198**		
Ne Bor Le	Maintenance Burn		36	Mod	N
		1	**36**		

Fiscal Year 2020

ALT 1: 2020 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
PW Def Space HPB 2020	Hand Pile Burn		75	High	N/S
PW Def Space HP	Handpile		50	High	N/S
PW Def Space Thin	Thin		50	High	N/S
Kettle River Arm	Maintenance Burn		20	Mod	N/S

ALT 2: 2020 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
River Way Block A HP	Broadcast Burn		18	High	N
River Way Block B HP	Broadcast Burn		24	High	N
Clark Lake 5 Handpile	Broadcast Burn		32	High	N
River Way Block D HPB	Broadcast Burn		34	High	N
River Way Block E HPB	Broadcast Burn		31	High	N
Clark Lake 4 HPB	Broadcast Burn		79	High	N
South Evans Block A HPB	Broadcast Burn		15	High	N
		7	**233**		
PW Def Space HPB 2020	Hand Pile Burn		50	High	N/S
River Way Block D HPB	Hand Pile Burn		34	High	N

ALT 2: 2020 TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Clark Lake 4 HPB	Hand Pile Burn		79	High	N
South Evans Block A HPB	Hand Pile Burn		15	High	N
Log Yard Block A HPB	Hand Pile Burn		24	High	N
Log Yard Block B HPB	Hand Pile Burn		20	High	N
Barstow Block C HPB	Hand Pile Burn		75	Low	N
Kettle River Arm Block A HPB	Hand Pile Burn - ONLY		54	High	N
		8	**351**		
PW Def Space HP	Handpile		25	High	N/S
Bissel Road Block A & B HP	Hand Pile		13	High	N
North Marcus Handpile	Handpile		47	High	N
		3	**85**		
Ricky Point South Block B & C Lop	Lop and Scatter		127	High	N
Bradbury Beach Edge Lop	Lop and Scatter		75	Low	N
PW Def Space Thin	Thin		25	High	N/S
North Marcus Thin	Thin		47	High	N
Ricky Point South Block B & C Thin	Thin		127	High	N
Bissel Road Block A & B Thin	Thin		13	High	N
Bradbury Beach Edge Thin	Thin		75	Low	N
		5	**489**		
Kettle River Arm	Maintenance Burn		20	Mod	N
		1	**20**		

Fiscal Year 2021+

ALT 1: 2021 and beyond TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
PW Def Space HPB 2021+	Hand Pile Burn		75	High	N/S
PW Def Space HP	Handpile		50	High	N/S
PW Def Space Thin	Thin		50	High	N/S
North Evans	Maintenance		37	Mod	N
Enterprise	Maintenance		20	Mod	N
Kettle Falls Admin	Maintenance		21	Mod	N
Napolean	Maintenance		30	Mod	N
North Gorge	Maintenance		50	Mod	N
		5	**158**		

ALT 2: 2021 and beyond TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Ricky Point South Block B & C BB	Broadcast Burn		127	High	N
Bradbury Beach Edge BB	Broadcast Burn		75	Low	N
River Way Block D HPB	Broadcast Burn		34	High	
Clark Lake 4 HPB	Broadcast Burn		79	High	
South Evans Block A HPB	Broadcast Burn		15	High	
Barstow Block C HPB	Broadcast Burn		75	Low	
		6	**405**		
PW Def Space HPB	Hand Pile Burn		50	High	N/S
Log Yard Block A HPB	Hand Pile Burn		24	High	N
Log Yard Block B HPB	Hand Pile Burn		20	High	N
Barstow Block C HPB	Hand Pile Burn		75	Low	N
North Marcus HPB	Hand Pile Burn		47	High	N
Bissel Road Block A & B HPB	Hand Pile Burn		13	High	
Hunter Block D HPB	Hand Pile Burn		86	High	N
North Orchard HPB	Hand Pile Burn		152	High	N
Summer Island	Hand Pile Burn		135	Low	N
Marcus South	Hand Pile Burn		33	Low	N
South Pingston Creek	Hand Pile Burn		48	Low	N
Old E	Hand Pile Burn		25	Low	N
North Gifford	Hand Pile Burn		178	Low	N
Hunters Block E	Hand Pile Burn		108	Low	N
Napolean East Block A	Hand Pile Burn		17	Low	N
Napolean East Block B	Hand Pile Burn		10	Low	N
Carson Block A	Hand Pile Burn		17	Low	N
Carson Block A	Hand Pile Burn		12	Low	N
Harker Canyon West	Hand Pile Burn		122	Low	N
Barstow Block B	Hand Pile Burn		46	Low	N
Snag Cove A	Hand Pile Burn		8	Low	N
Cedonia Block A	Hand Pile Burn		322	Low	N
French Rocks	Hand Pile Burn		23	Low	N
Mollenburg Road	Hand Pile Burn		25	Low	
Kettle River Arm Block A HPB	Hand Pile Burn - ONLY		54	High	N
		25	**1650**		
PW Def Space HP	Handpile		50	High	N/S
Hunter Block D Handpile	Handpile		86	High	N
North Orchard Handpile	Handpile		152	High	N
Summer Island	Handpile		135	Low	N
Marcus South	Handpile		33	Low	N

ALT 2: 2021 and beyond TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
South Pingston Creek	Handpile		48	Low	N
Old E	Handpile		25	Low	N
North Gifford	Handpile		178	Low	N
Hunters Block E	Handpile		108	Low	N
Napolean East Block A	Handpile		17	Low	N
Napolean East Block B	Handpile		10	Low	N
Carson Block A	Handpile		17	Low	N
Carson Block A	Handpile		12	Low	N
Harker Canyon West	Handpile		122	Low	N
Barstow Block B	Handpile		46	Low	N
Snag Cove A	Handpile		8	Low	N
Cedonia Block A	Handpile		322	Low	N
French Rocks	Handpile		23	Low	N
Mollenburg Road	Handpile		25	Low	
		19	**1417**		
2021 and beyond TREATMENT Alt 2 (Cont)	**TYPE**	**UNITS**	**ACRES**	**PRIORITY**	**Location**
PW Def Space Thin	Thin		50	High	N/S
Hunter Block D Thin	Thin		86	High	N
North Orchard Thin	Thin		152	High	N
Summer Island	Thin		135	Low	N
Marcus South	Thin		33	Low	N
South Pingston Creek	Thin		48	Low	N
Old E	Thin		25	Low	N
North Gifford	Thin		178	Low	N
Hunters Block E	Thin		108	Low	N
Napolean East Block A	Thin		17	Low	N
Napolean East Block B	Thin		10	Low	N
Carson Block A	Thin		17	Low	N
Carson Block B	Thin		12	Low	N
Harker Canyon West	Thin		122	Low	N
Barstow Block B	Thin		46	Low	N
Snag Cove A	Thin		8	Low	N
Cedonia Block A	Thin		322	Low	N
French Rocks	Thin		23	Low	N
Mollenburg Road	Thin		25	Low	
		19	**1417**		
North Evans	Maintenance		37	Mod	N
Enterprise	Maintenance		20	Mod	N
Kettle Falls Admin	Maintenance		21	Mod	N

ALT 2: 2021 and beyond TREATMENT	TYPE	UNITS	ACRES	PRIORITY	Location
Napolean	Maintenance		30	Mod	N
North Gorge	Maintenance		50	Mod	N
		5	**158**		

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Table 17: Alternative 1: Acres Per Fire Treatment 2014 – 2020

ALT 1 UNITS 2014 - 2020	UNDERBURN	MAINT RX	PILE RX	THIN	HANDPILE	TOTAL
Bradbury Beach 1 & 2 UB	67					
Ricky Point	65					
Gifford Cloverleaf	62					
Haag Cove	56					
Mission Point Underburn	45					
Fort Spokane	40					
Ricky North	25					
Ricky 3 Underburn	12					
Ponderosa	10					
Gifford		58				
Na-Bor-Lee		46				
Marcus		40				
Jones Bay		37				
Evans		30				
Seasonal Circle Underburn		30				
Whispering Pines		30				
Kettle River CG		27				
Kettle River Arm		20				
ND Gifford North Contract MP			100	100	100*	
PW Def Space HPB 2016			75	50	50	
PW Def Space HPB 2017			75	50	50	
PW Def Space HPB 2018			75	50	50	
PW Def Space HPB 2019			75	50	50	
PW Def Space HPB 2020			75	50	50	
Gifford-Cloverleaf HPB			62	62	62	
PW Def Space HPB 2014			50	25	25	
PW Def Space HPB 2015			50	25	25	
Enterprise			40	25	25	
ND Kettle Falls #4			14	14	14	
Copa Burn Old Slash			12		12	
Ponderosa Hand Pile Burn			10	10	10	
TOTAL	**382**	**318**	**713**	**511**	**423**	
**Gifford Machine Pile*					**100***	**2447**

Table 18. Alternative 2: Acres Per Fire Treatment 2014 - 2020

ALT II UNITS 2014 - 2020	UNDERBURN	MAINT RX	PILE RX	THIN	HANDPILE	TOTAL
Clark Lake 4 HPB	79					
Bradbury Beach 1 & 2 UB	67					
Kettle river Arm Block B HPB	66					
Ricky Point	65					
Gifford Cloverleaf	62					
Haag Cove	56					
Haag Sherman Block I	50					
Mission Point Underburn	45					
Fort Spokane	40					
Ricky Point South Block A HPB	37					
River Way Block D HPB	34					
Clark Lake 5 Handpile	32					
River Way Block E HPB	31					
Ricky North	25					
River Way Block B HPB	24					
North Gorge Block C HPB	18					
Ricky Point Block F HPB	18					
River Way Block A HPB	18					
South Evans Block A HPB	15					
ND Kettle Falls #4	14					
Haag Sherman Block III	12					
Ricky 3 Underburn	12					
River Way Block C HPB	12					
Ponderosa	10					
North Evans Block D HPB	9					
Haag Sherman Block II	8					
Gifford		58				
Na-Bor-Lee Underburn		46				
Marcus		40				
Jones Bay		37				
Evans		30				
Seasonal Circle Underburn		30				
Whispering Pines		30				
Kettle River CG		27				
Kettle River Arm		20				
TOTAL ACRES	**859**	**318**				

ALT II UNITS 2014 - 2020 Cont.	RX	Maint. RX	PILE RX	THIN	HANDPILE	TOTAL
ND Gifford North Contract MP			100	100	100*	
Clark Lake 4 HPB			79	79	79	
Kettle River Arm Block B HP Burn			66	66	66	
Gifford-Cloverleaf HPB			62	62	62	
PW Def Space HPB 2014			50	25	25	
PW Def Space HPB 2015			50	25	25	
PW Def Space HPB 2016			50	25	25	
PW Def Space HPB 2017			50	25	25	
PW Def Space HPB 2018			50	25	25	
PW Def Space HPB 2019			50	25	25	
PW Def Space HPB 2020			50	25	25	
Enterprise Handpile Burn			40	25	25	
Ricky Point South Block A HPB			37	37	37	
River Way Block D HPB			34	34	34	
Clark Lake 5 HPB			32	32	32	
River Way Block E HPB			31			
River Way Block B HPB			24			
Ricky Point Block F HPB			18	18	18	
North Gorge Block C HPB			18	18	18	
River Way Block A HPB			18	18	18	
South Evans Block A HPB			15	15	15	
ND Kettle Falls #4			14	14	14	
Log Yard Block C HPB			14	14	14	
Copa Burn Old Slash			12		12	
River Way Block C HPB			12	12	12	
Ponderosa HPB			10	10	10	
North Evans Block D HPB			9	9	9	
Ricky Point South Block B & C Thin				127		
Barstow Block C				75	75	
Bradbury Beach Edge Thin				75		
Kettle River Arm Block A				54	54	
North Marcus Thin				47	47	
Log Yard Block A				24	24	
Log Yard Block B				20	20	
TOTAL ACRES	**859**	**318**	**995**	**1160**	**870**	**4202**
**Gifford Machine Pile*					100*	**4302**

Table 19. Alternative 1: Acres Per Fire Treatment 2021 +

ALT I UNITS 2021+	UNDERBURN	MAINT RX	PILE RX	THIN	HANDPILE	TOTAL
North Evans		37				
Enterprise		20				
Kettle Falls Admin		21				
Napolean		30				
North Gorge		50				
PW Def Space 2021			75	50	50	
PW Def Space 2022			75	50	50	
PW Def Space 2023			75	50	50	
PW Def Space 2024			75	50	50	
PW Def Space 2025			75	50	50	
PW Def Space 2026			75	50	50	
TOTAL ACRES	**0**	**158**	**450**	**300**	**300**	**1208**

Table 20. Alternative 2: Acres Per Fire Treatment 2021 +

ALT II UNITS 2021+	UNDERBURN	MAINT RX	PILE RX	THIN	HANDPILE	TOTAL
Ricky Point South Block B & C BB	127					
Bradbury Beach Edge BB	75					
Barstow Block C HPB	75					
North Gorge		50				
North Evans		37				
Napolean		30				
Kettle Falls Admin		21				
Enterprise		20				
Barstow Block B			46	46	46	
Barstow Block C HPB			75			
Bissel Road Block A & B HPB			13			
Carson Block A			17	17	17	
Carson Block B			12	12	12	
Cedonia Block A			322	322	322	
French Rocks			23	23	23	
Harker Canyon West			122	122	122	
Hunter Block D HPB			86	86	86	
Hunters Block E			108	108	108	
Kettle River Arm Block A HPB			54			
Log Yard Block A HPB			24			
Log Yard Block B HPB			20			

ALT II UNITS 2021+	UNDERBURN	MAINT RX	PILE RX	THIN	HANDPILE	TOTAL
Marcus South			33	33	33	
Mollenburg Road			25	25	25	
Napolean East Block A			17	17	17	
Napolean East Block B			10	10	10	
North Gifford			178	178	178	
North Marcus HPB			47			
North Orchard HPB			152	152	152	
Old E			25	25	25	
PW Def Space 2021			50	25	25	
PW Def Space 2022			50	25	25	
PW Def Space 2023			50	25	25	
PW Def Space 2024			50	25	25	
PW Def Space 2025			50	25	25	
PW Def Space 2026			50	25	25	
Snag Cove A			8	8	8	
South Pingston Creek			48	48	48	
Summer Island			135	135	135	
TOTAL ACRES	**277**	**158**	**1900**	**1517**	**1517**	**5369**

In Year 2020 and beyond, additional maintenance phase burning will be scheduled based on information gained from the monitoring plots at LRNRA. Prescribed fires will be used on an as needed basis to maintain basal area goals and reduce ladder fuels. The fuel load data gathered will help determine appropriate timing for prescribed burns. Most often in the maintenance phase burning will be sufficient to achieve desirable stand conditions.

Additional thinning treatments may be needed if the unit was not thinned to desired stand densities (40-60 basal feet per acre) during the initial treatment. Reasons for lighter thinning treatments include management constraints due to:

1. Aesthetic, visual screening or shade concerns from park staff or neighbors.
2. Compliance actions for species protected by the Endangered Species Act.
3. Wind stability and blow-down concerns.
4. Change in management zone designation or LRNRA policy.
5. Management of overstocked, large diameter stands that may have material removed through a follow-up salvage logging or by a series of thinnings to keep 1000 hour fuels on the ground to a minimum.

Maps of Treatment Areas

Figure 12: Barstow Block Project Area

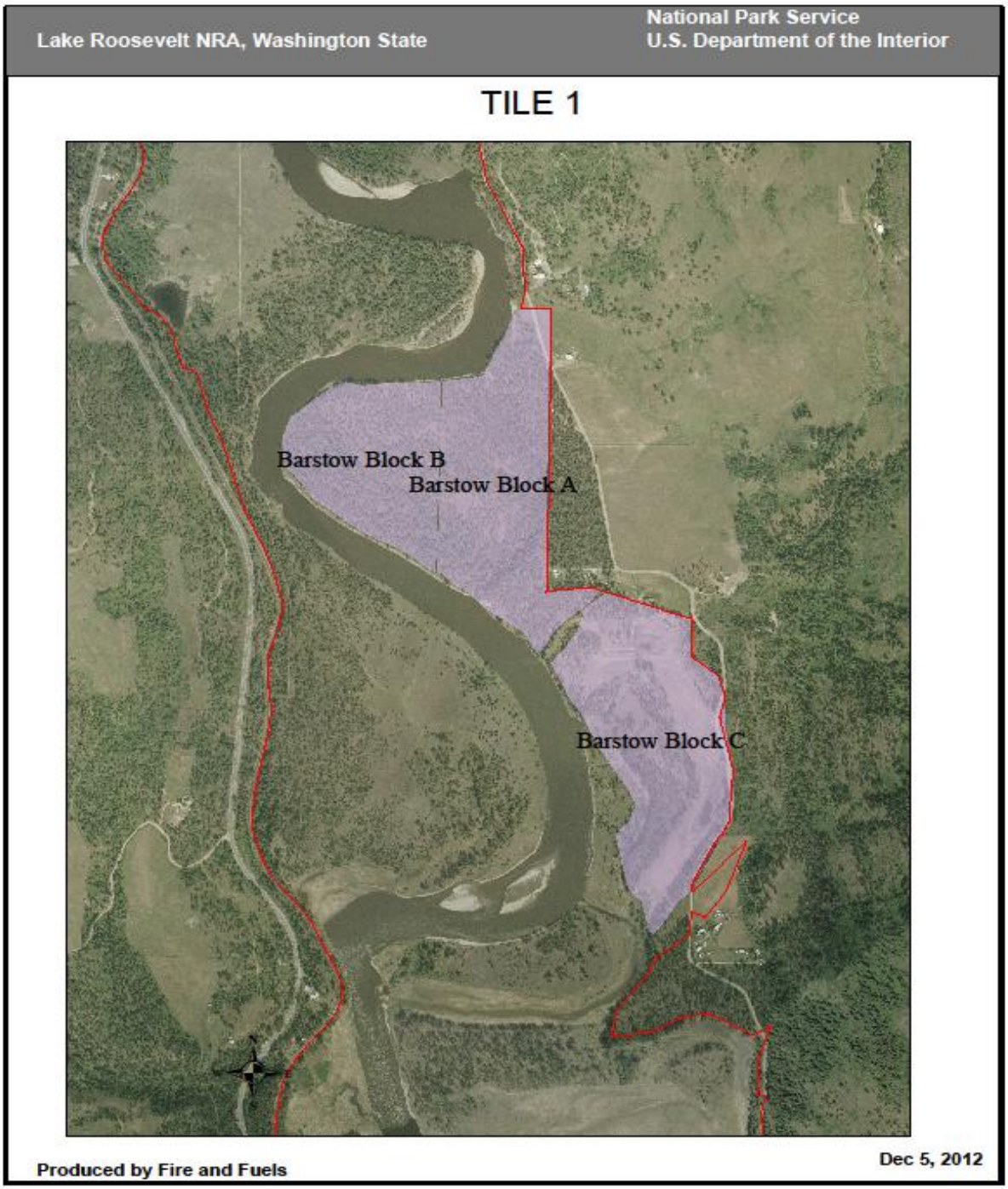

Figure 13: Kettle River Arm and Napolean East Project Areas

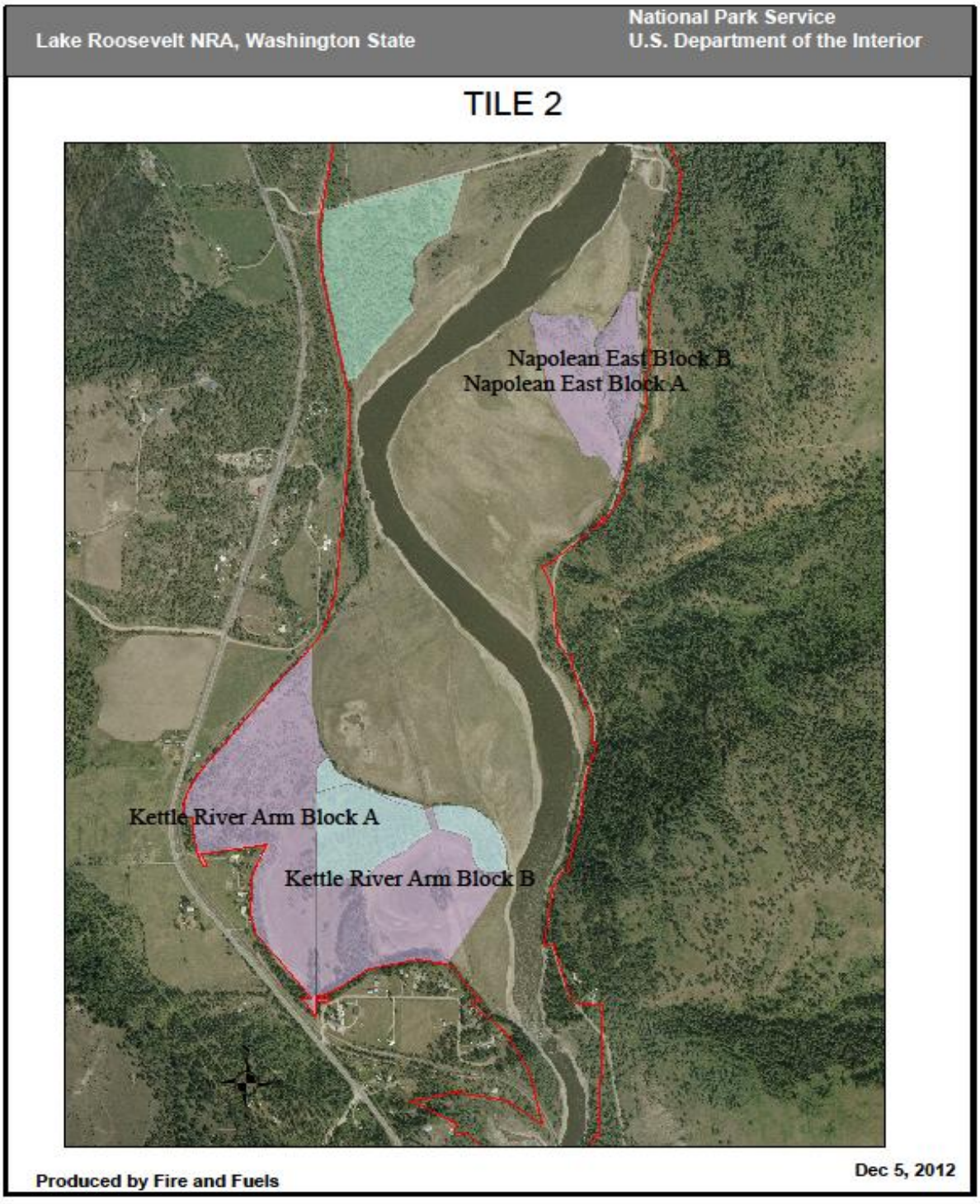

Figure 14: Carson Block and Defensible Space “A” Project Areas

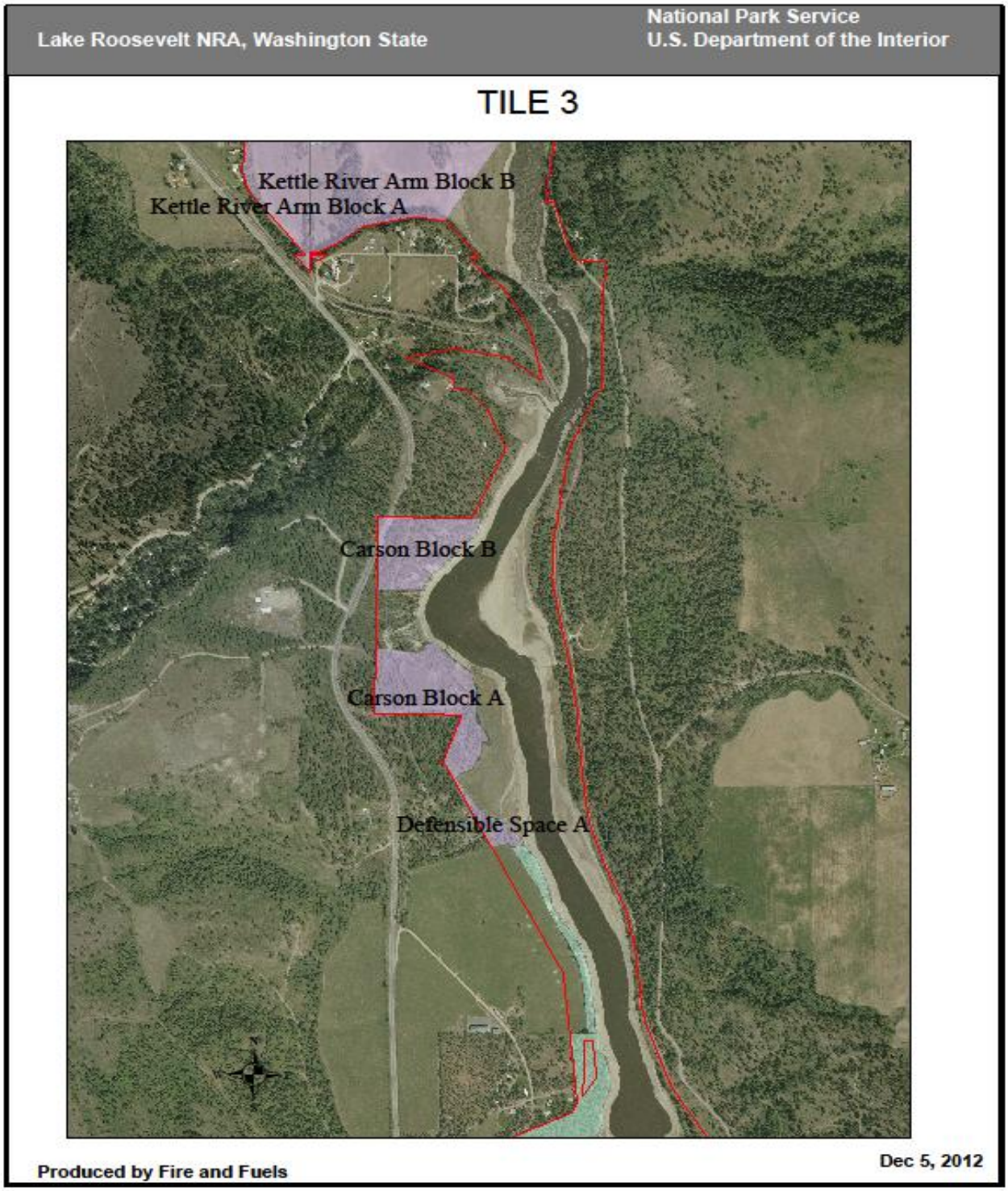

Figure 15: North Gorge Project Area

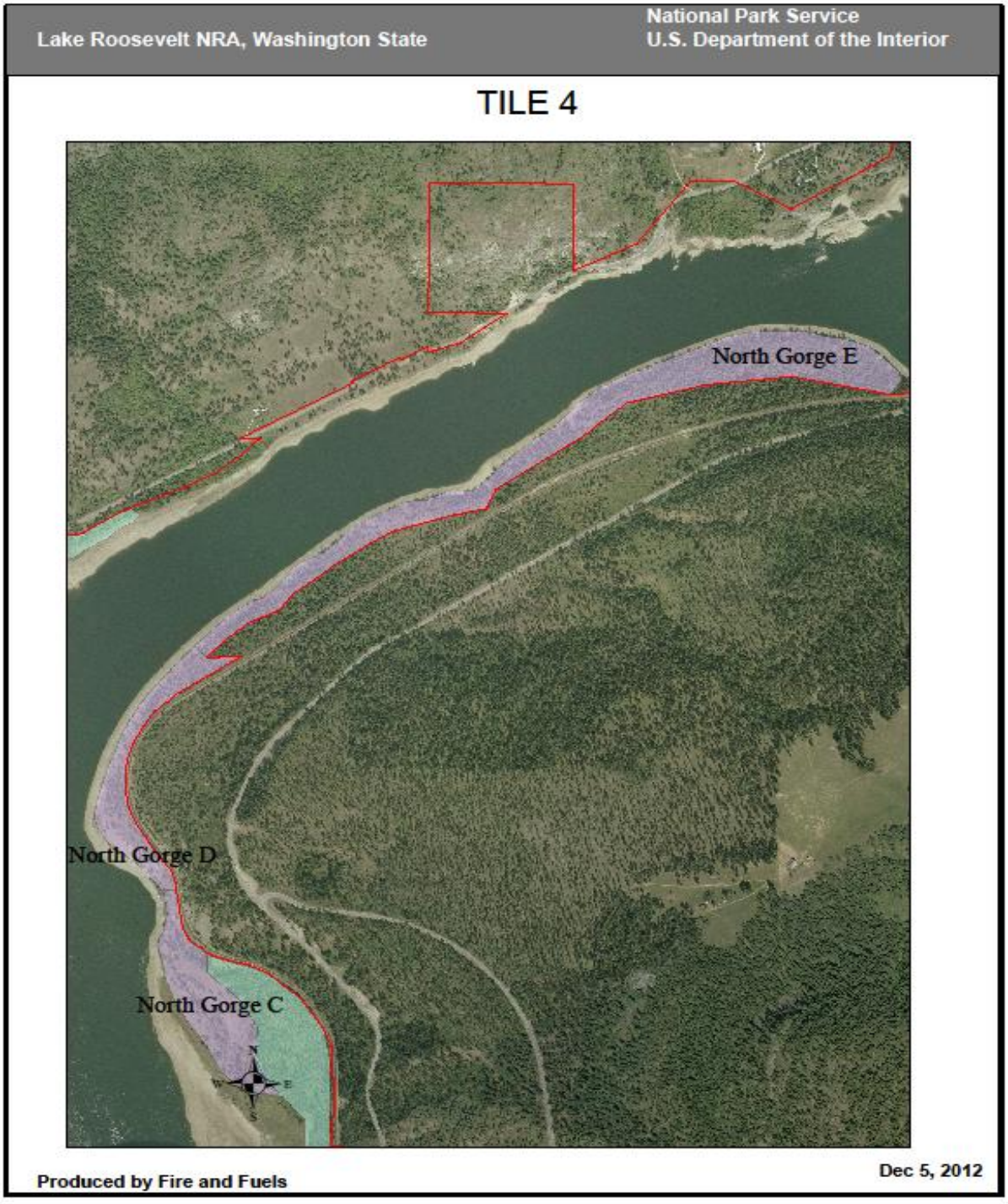

Figure 16: Snag Cove Project Area

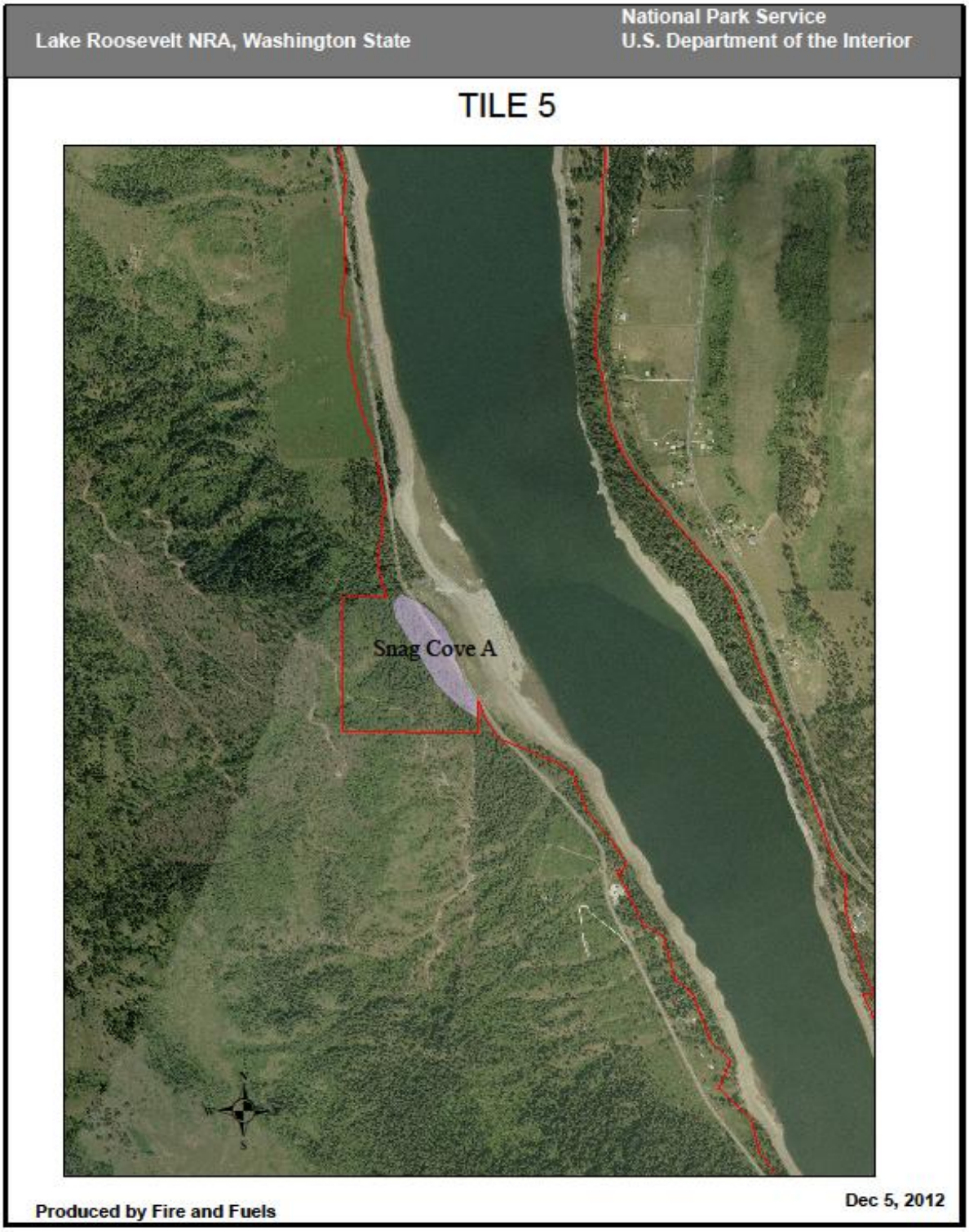

Figure 17: Evans Project Area

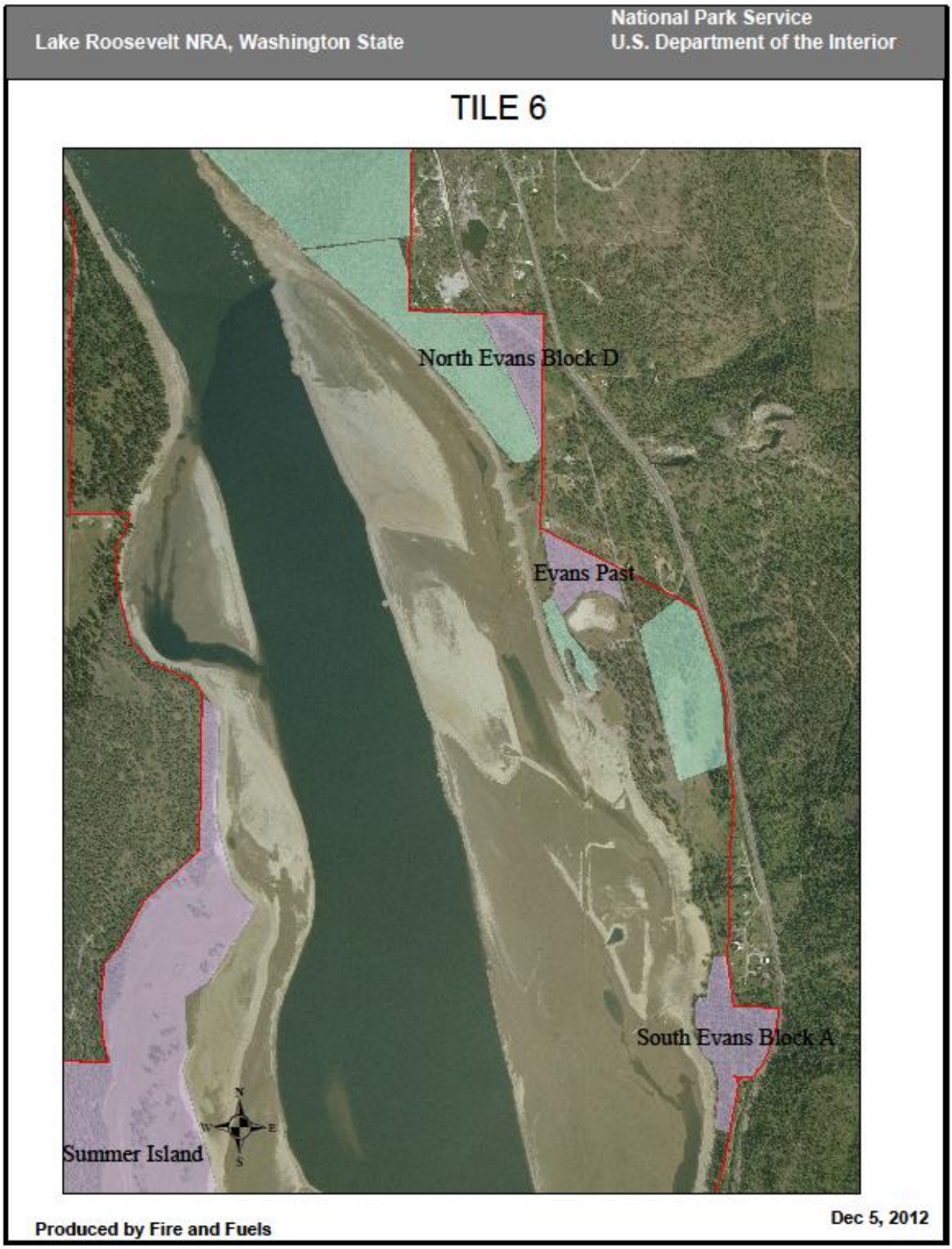

Figure 18: Summer Island Project Area

Figure 19: North Marcus Project Area

Figure 20: Marcus South and South Pingston Creek Project Areas

Figure 21: Welty Bay Project Area

Figure 22: Log Yard Project Area

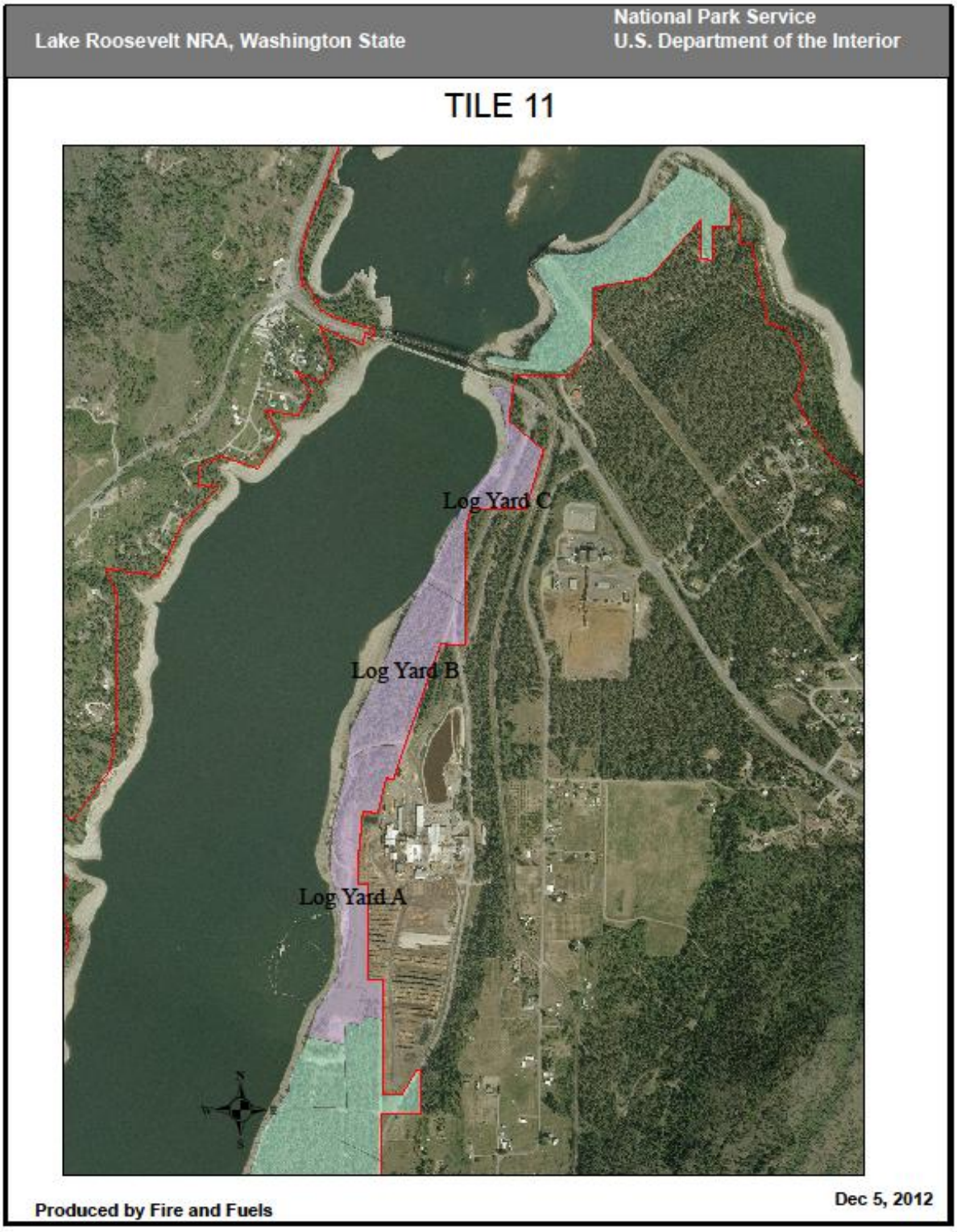

Figure 23: Haag Sherman Project Areas

Figure 24: Ricky Point (north) Project Area

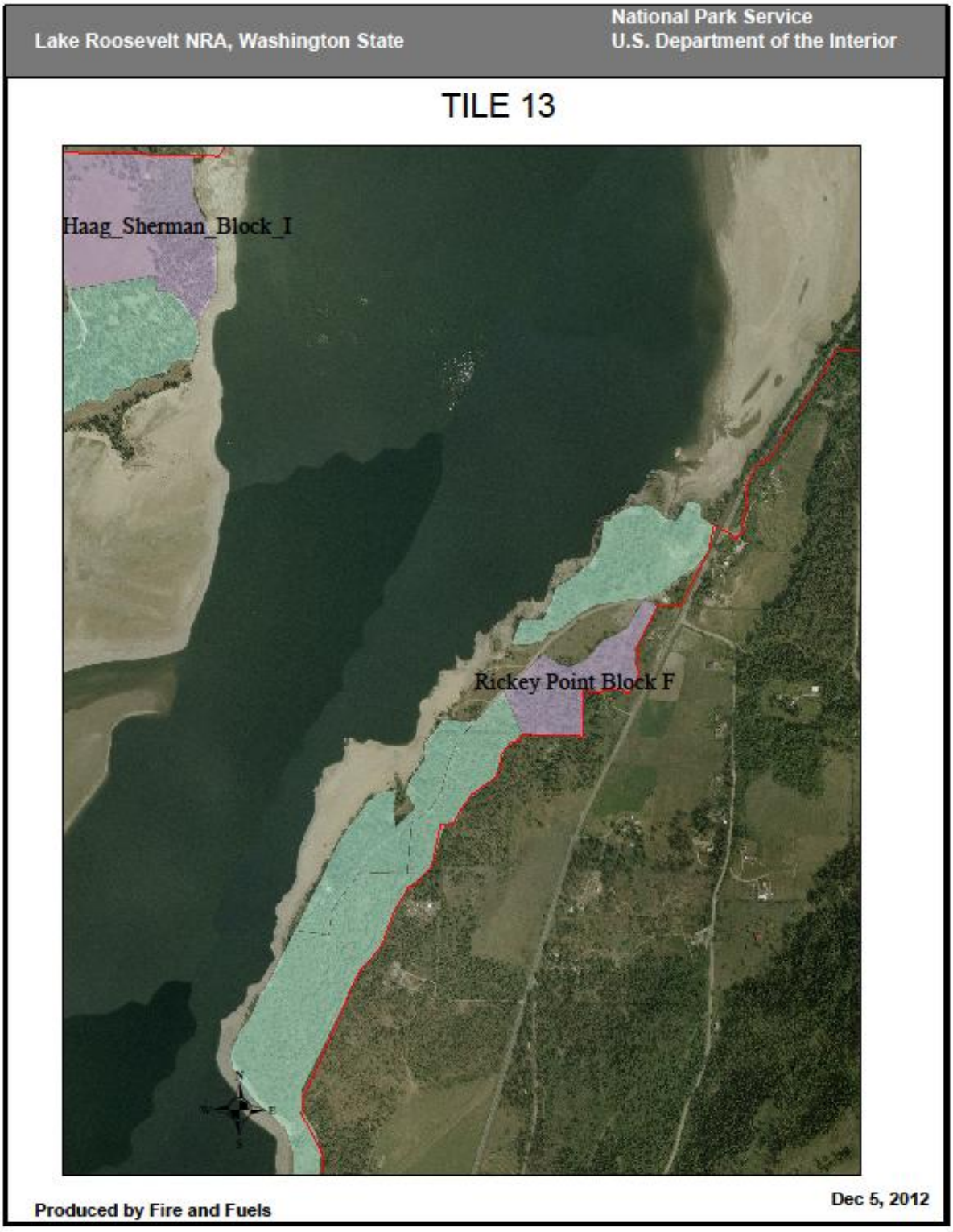

Figure 25: Ricky Point (south) Project Areas

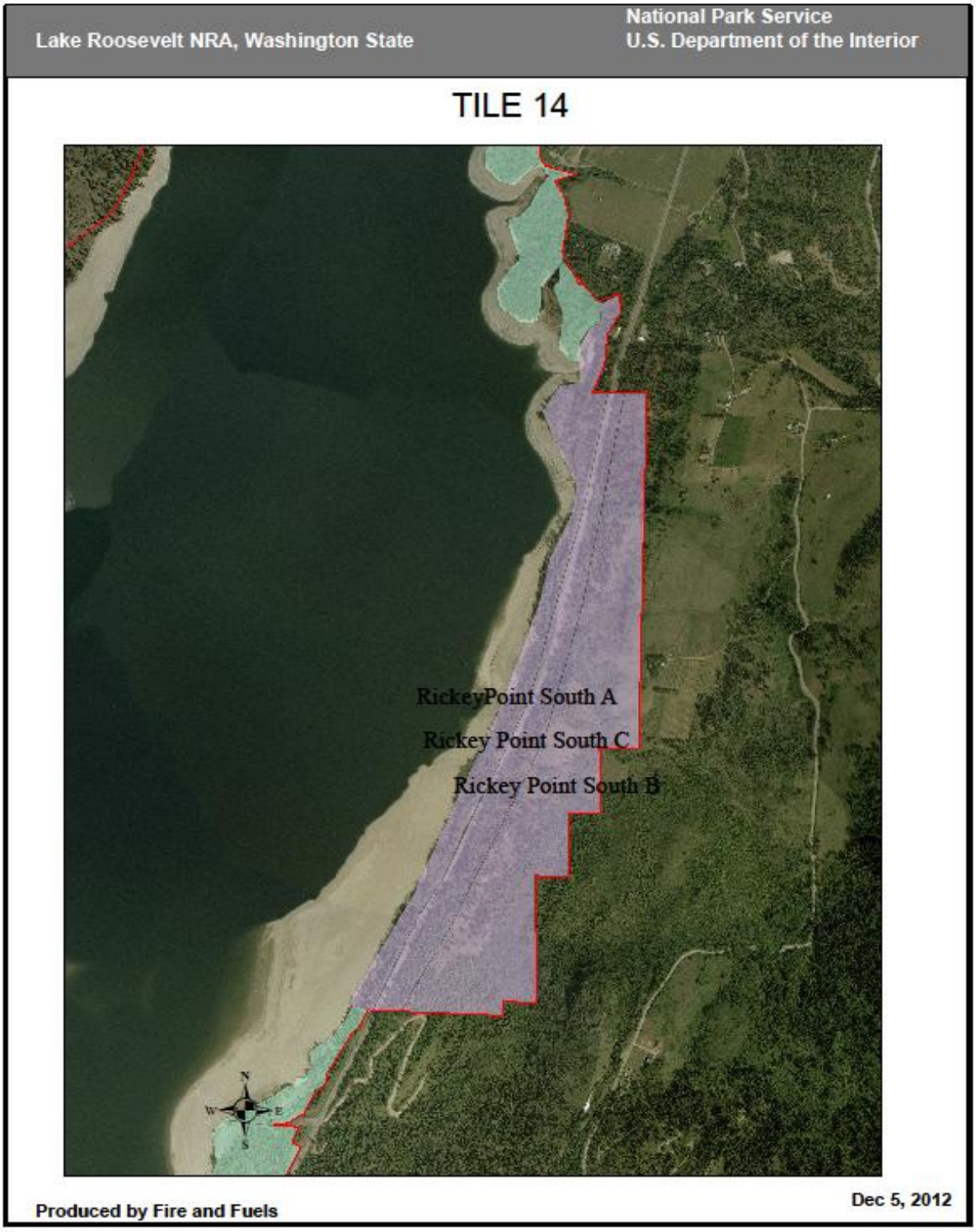

Figure 26: Bradbury Beach Edge Project Area

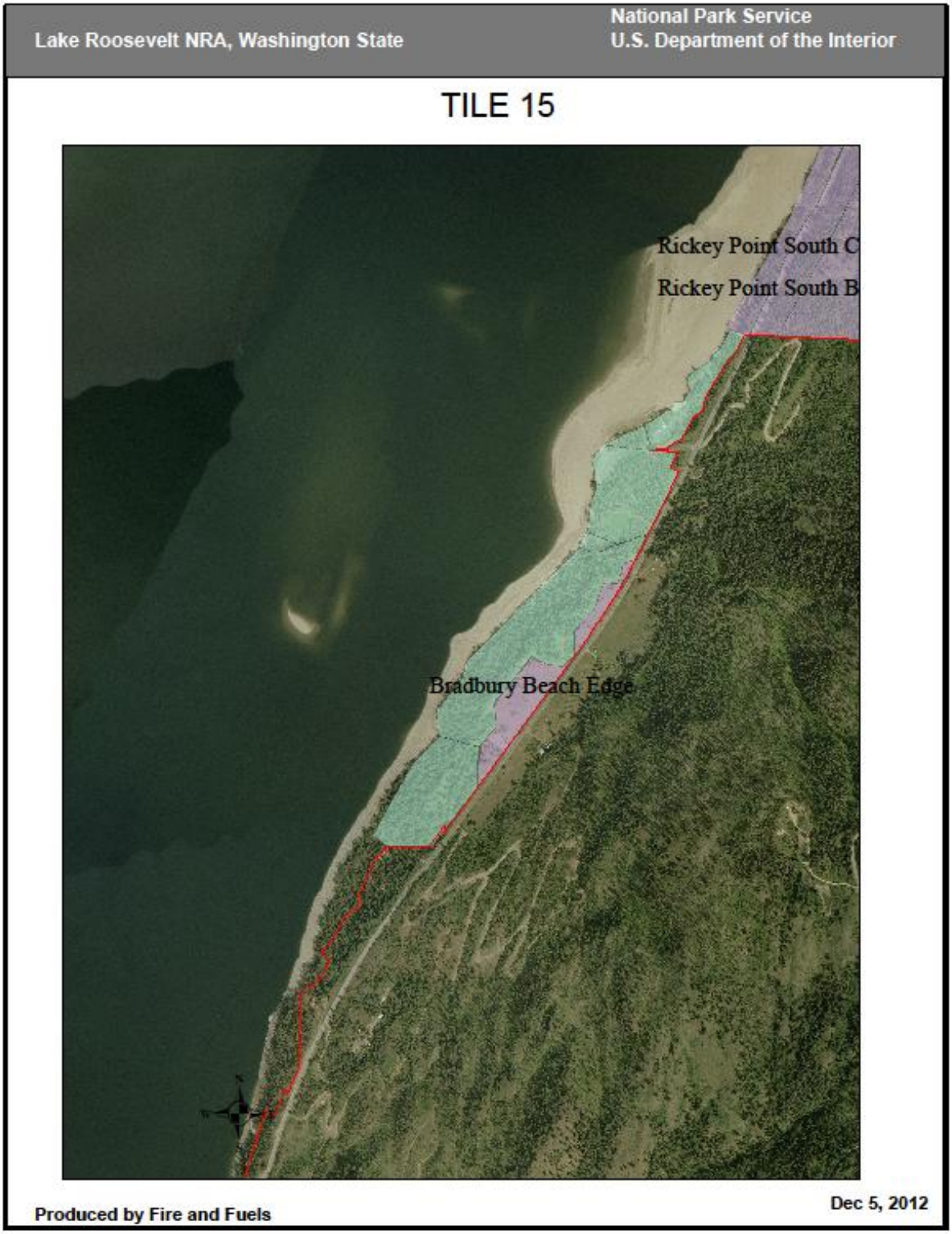

Figure 27: French Rocks and Mollenburg Road Project Areas

Figure 28: Old B Project Area

Figure 29: Copa Project Area

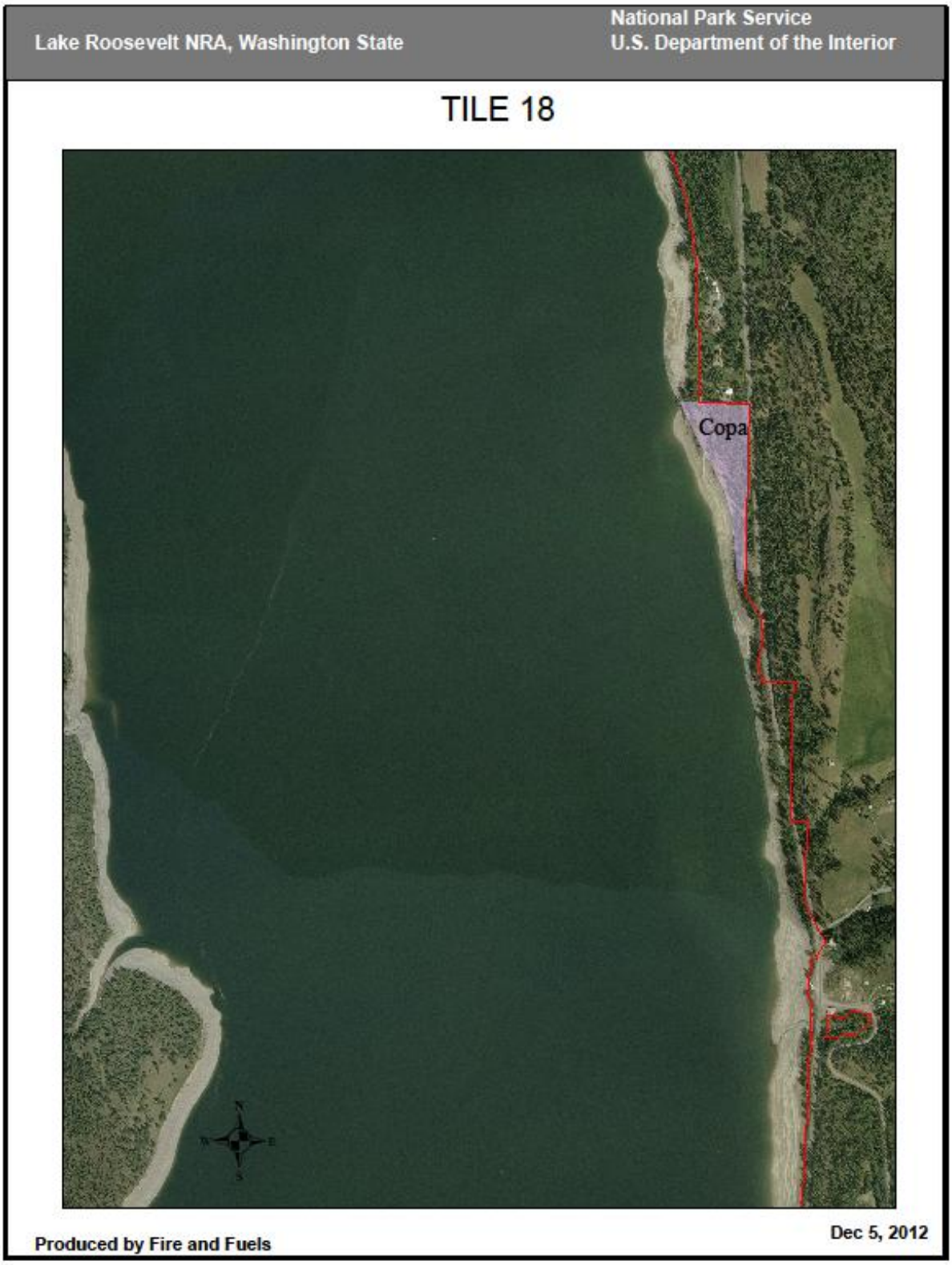

Figure 30: North Gifford (north) Project Area

Figure 31: North Gifford (south) Project Area

Figure 35: Cedonia Block A (south) Project Area

Figure 36: Hunters Block E Project Area

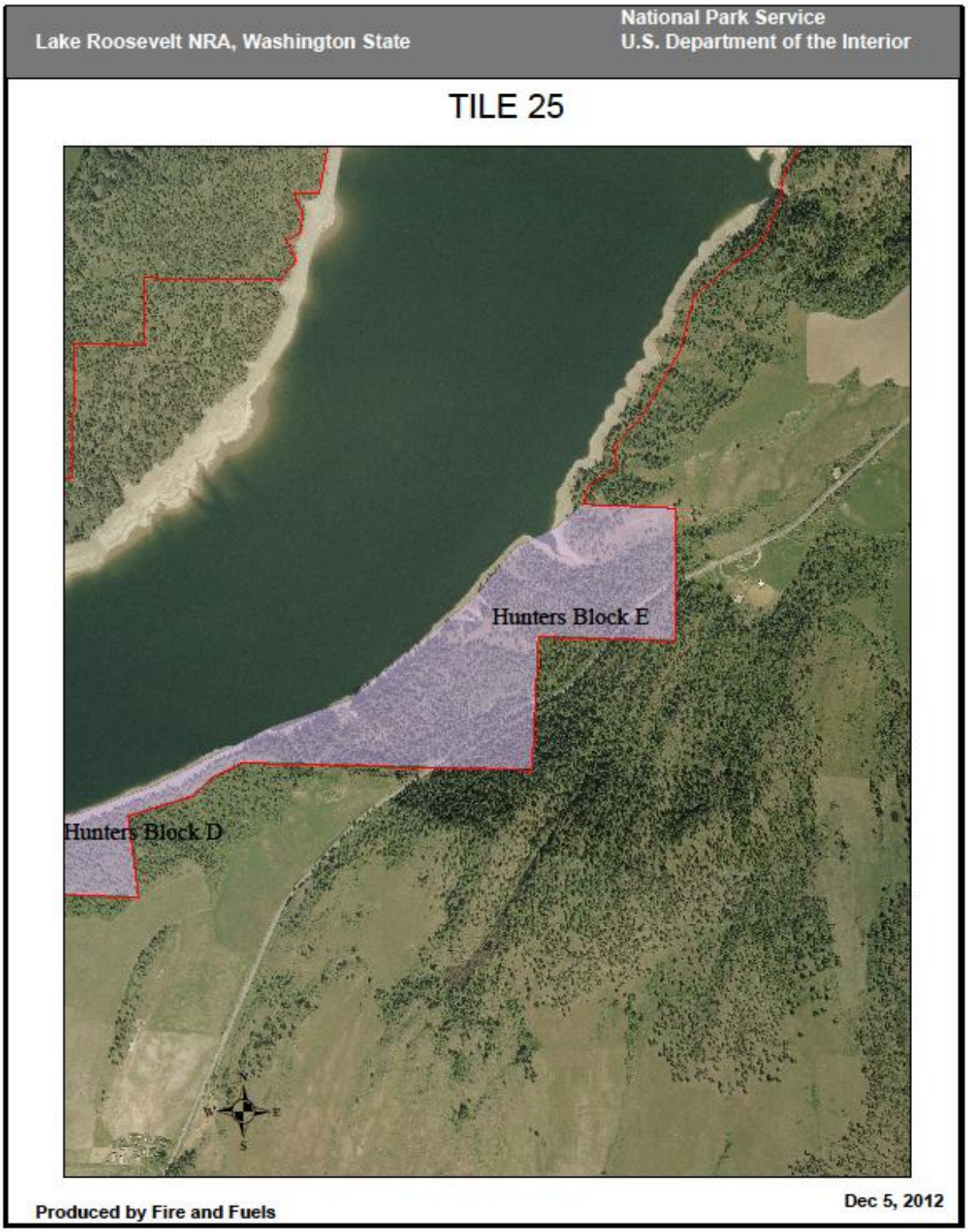

Figure 37: Hunters Block E and D Project Areas

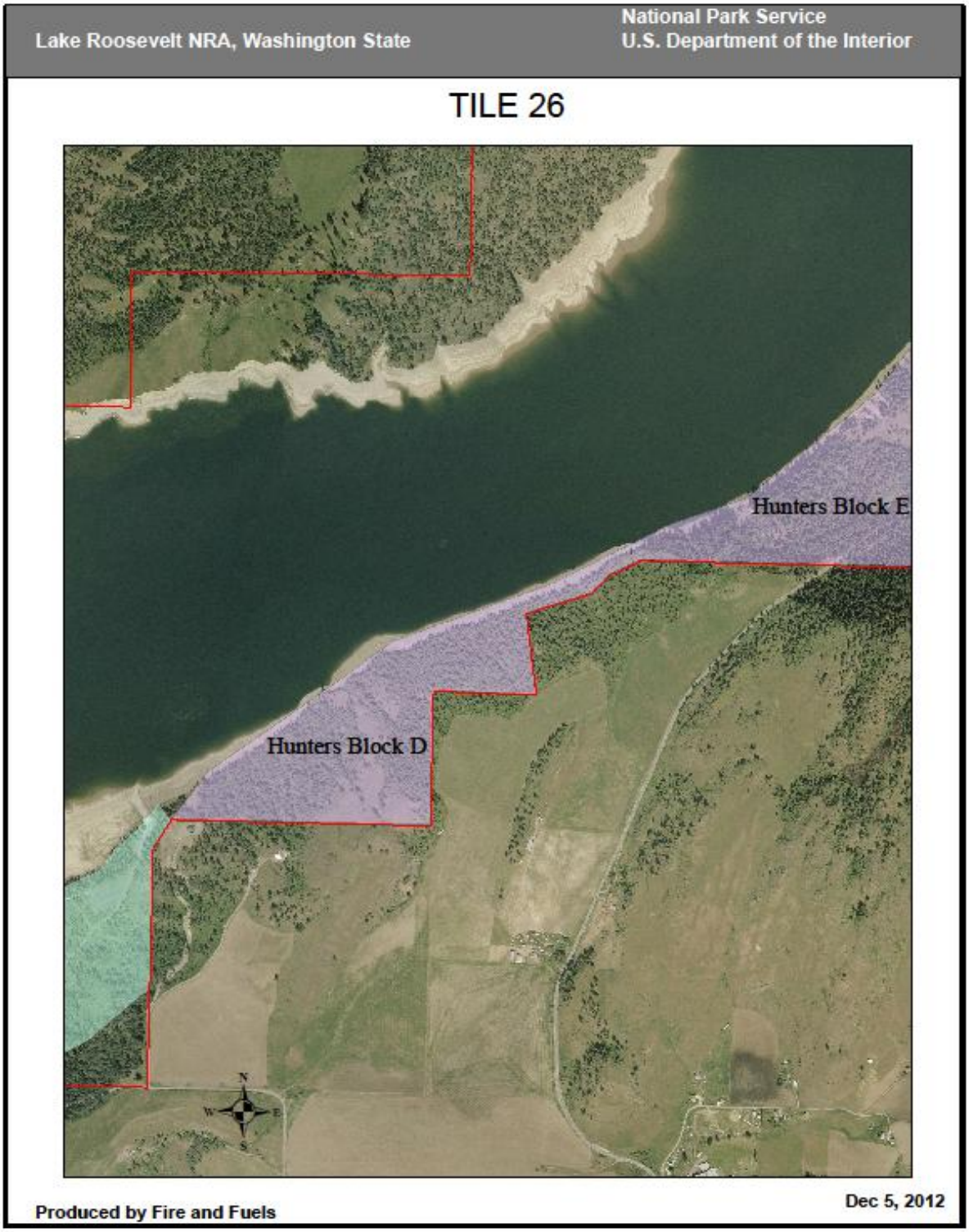

Figure 38: Riverway Project Areas