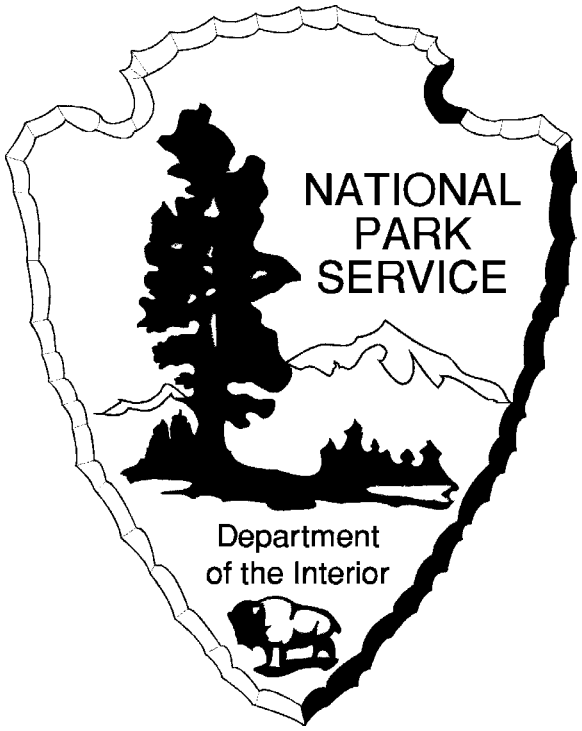
Lewis and Clark National Historical Park

Draft Forest Restoration Plan
Environmental Assessment



Proposed by
National Park Service
August 2007

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Purpose and Need

The National Park Service (NPS) proposes a Forest Restoration and Management Plan that seeks to manage for late-successional forest characteristics in the Fort Clatsop Unit (FOCL) of Lewis and Clark National Historic Park (LEWI). The proposed plan would guide management aimed at restoring natural processes and accelerating forest development in accordance with the goals and objectives put forth in the Park's 1995 General Management Plan (GMP)[1]. This forest plan builds on the GMP's mandate to create vegetation management guidelines for the Developed, Historic and Natural zones identified in the GMP.

The need for a forest management plan arises from the 2002 Fort Clatsop boundary expansion which added approximately 1000 acres of second and third growth forest to the Park. While the increased area brought on by the expansion has greatly increased the Park's potential to meet its recreation and wildlife habitat goals, the condition of newly acquired lands poses a number of challenges to the Park's core mission. Prior to acquisition by the National Park Service (NPS) these forest lands were owned by private timber companies, have been logged at least once, and have been managed as forest plantations for the production of timber for well over 100 years. This legacy has resulted in forests simplified in both structure and composition that, while good for producing quality timber, are not ideally suited to the NPS broader mandate to

"… promote and regulate the use of the...national parks...[whose] purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.[2]*"*

Because of this dramatic shift in management objectives, LEWI is in need of a plan to move these former forest plantations toward the late successional, complex stands that were once common along the Oregon Coast.

The need for this restoration plan is further enhanced by the fact that the lands around LEWI continue to be utilized for timber harvest and development. These land uses have resulted in a landscape where old, complex forest habitat is becoming increasingly rare. Because of this, there is a pressing need to provide quality forest habitat in the area.

Park Purpose and Significance

Enabling Legislation

Fort Clatsop National Memorial was created on May 29, 1958 when President Dwight D. Eisenhower signed into law the Act 72 Stat.153. The Memorial was established "for the

[1] Fort Clatsop National Memorial: General Management Plan Final Environmental Impact Statement. 1995. U.S. Dept. of the Interior. National Park Service. Astoria, OR.
[2] National Park Service Organic Act, 16 U.S.C.1.

purpose of commemorating the culmination, and the winter encampment, of the Lewis and Clark Expedition following its successful crossing of the North American Continent." The Act further stated that development was to include "... land and improvements thereon located in Clatsop County, Oregon, which are associated with the winter encampment of the Lewis and Clark Expedition, known as Fort Clatsop."

The Salt Works (Salt Cairn) addition was authorized for establishment by Act of Congress (92 Stat. 3467) and signed into law October 10, 1978, by President Jimmy Carter. This Act also amended the Act of May 29, 1958 to increase the acreage limitation from 125 acres to no more than 130 acres.

The Fort Clatsop Boundary Expansion Act of 2002 authorized the expansion of Fort Clatsop to a maximum of 1500 acres in order to re-establish the historic link between the Fort site and the coast. Currently, acquisitions and donations have brought the Fort Clatsop Unit up to 1,219.31 acres.

Another round of boundary expansion took place in 2004 when legislation was passed to consolidate Fort Clatsop, Cape Disappointment, Dismal Nitch, and other Lewis and Clark historic sites all under the banner of Lewis and Clark National Historic Park (LEWI). The overall Park now represents 12 locations encompassing just over 3,200 acres and stretching from Long Beach, WA to Cannon Beach, OR.

National Park Service Legislation

The Organic Act of 1916 states that the fundamental purpose of the National Park System "is to conserve the scenery and the natural and historic objects and the wildlife therein." The 1978 Amendments to the Organic Act known as the "Redwoods Act" states "... the protection, management and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established...". The statements in these two Acts provide a clear direction for park management to allow only those activities, or level of use, that leaves park resources unimpaired.

Other Legislation

The National Environmental Policy Act (NEPA) requires the consideration of the environmental effects of proposed Federal actions, and provides the legal framework for this document. NEPA was approved by Congress in 1969 and went into effect January 1st 1970. NEPA also created the Counsel on Environmental Quality (CEQ), an office of the President that is tasked with being the "caretaker of NEPA[3]." The CEQ subsequently published NEPA regulations in 1978 ((40 CFR 1500-1508)) with additional clarification in 1981 with the document titled "Forty Most Asked Questions Concerning CEQ's NEPA Regulations" (40 Most Asked Questions). All federal agencies are required to adhere to these regulations. The CEQ also requires that each federal agency "implement

[3] NPS DO-12 Handbook and Director's Orders

procedures to make the NEPA process more useful to agency decision-makers and the public" (40 CFR 1500.2). In adhering to this requirement the NPS has produced several NEPA handbooks, the latest being NPS-12 in 1982. The 2001 Director's Order 12 (DO-12) updates and expands upon NPS-12 and is the current standard for NPS conservation planning, environmental impact analysis, and decision making. This EA was prepared according to the recommendations and standards put forward in DO-12.

The National Historic Preservation Act of 1966, as amended in 1980, requires the consideration and review of any federal action that has the potential to affect cultural resources, and establishes a partnership between federal and state governments to administer a national preservation program that also recognizes and supports state and local cultural resources and preservation efforts. The National Park Service is charged with administering this partnership.

Executive Orders 11990 and 11988, both dated May 24, 1977, control impacts on wetlands and floodplains.

The Endangered Species Act of 1973 requires the formal consultation with the Fish and Wildlife Service when a proposed project or action has the potential to impact a known endangered plant or animal species.

Other relevant Acts and legislation include the 1972 Clean Water Act, particularly Section 404, and the 1977 Clean Air Act amendments (the Fort Clatsop Unit lies within a Class II area).

Historical Setting

The Fort Clatsop Unit of LEWI is located near the extreme northwest corner of Oregon (Figure 1). Historically, the area was dominated by Sitka spruce and western hemlock forests of the Oregon Coast Range. The Memorial is located at the convergence of the Coast Range habitat and the wetlands of the Columbia River Estuary System.

In the early 1800s the U. S. Government knew little about the North American continent between the present day Dakotas and the mouth of the Columbia River. President Jefferson dispatched the Lewis and Clark Expedition to this area to produce a map and locate a suitable water route to the Northwest, document and record Native American cultures and scientifically describe and inventory the plants and animals, especially those of economic and cultural importance. The primary purpose was to establish a claim to this region for the United States and to discover economic opportunities and transportation routes.

The Expedition reached the mouth of the Columbia River and the Pacific Ocean in early winter 1805. Because of fresh water supplies, sheltered terrain and an abundance of elk, they built their winter encampment adjacent to Clatsop Ridge along what is now referred to as the Lewis and Clark River. They constructed a temporary structure and named it Fort Clatsop after the Clatsop Tribe, the local Native Americans who assisted the

Expedition throughout the wet winter. In the spring of 1806 the Expedition began their return trip to St. Louis, abandoning the fort after giving it to the Clatsop Tribe.

Fur trappers, fishermen, farmers and loggers used the Fort Clatsop area after the Lewis and Clark Expedition left. Forest and farm lands were quickly claimed and transferred to private ownership. Changes were made to the landscape as the region was developed. In the early 1850s, the deteriorated remains of Fort Clatsop were burned and the land partially cleared for farming. In 1852, a sawmill was constructed at the Canoe Landing site and for two to three years employed 35 to 40 people. Lumber from this sawmill was loaded on ships bound for San Francisco. In 1872, a house was constructed near the site of the fort.

During the 1870s, steam-powered passenger ships traveled from Astoria up the Lewis and Clark River and deposited visitors at the Canoe Landing. From there, stagecoaches took them over Clatsop Ridge to the ocean beaches on a road which mostly followed the route of the present Fort Clatsop/Perkin's Road. Rail lines built near the turn of the 20th century made the Canoe Landing obsolete. Wetlands were drained and extensive dikes placed along the Lewis and Clark River to facilitate farming, dairies and house construction.

In preparation for the Centennial celebration of the Lewis and Clark Expedition, the Oregon Historical Society acquired three acres along the Lewis and Clark River they believed contained the Expedition's site. Local civic groups constructed a replica of Fort Clatsop in 1955 using Clark's floor plan sketch and the descriptions from the Lewis and Clark Journals. The site was permanently protected in 1958 with the establishment of Fort Clatsop National Memorial. The park was created to "... commemorate the culmination, and winter encampment, of the Lewis and Clark Expedition ..." and further added that development was to include "... adjacent portions of the old trail which led overland from the fort to the coast...". The Salt Works site was added in 1978 and the Fort Clatsop Boundary Expansion Act of 2002 authorized the addition of a trail linking the fort site to the ocean. [4]

[4] From Fire Plan EA

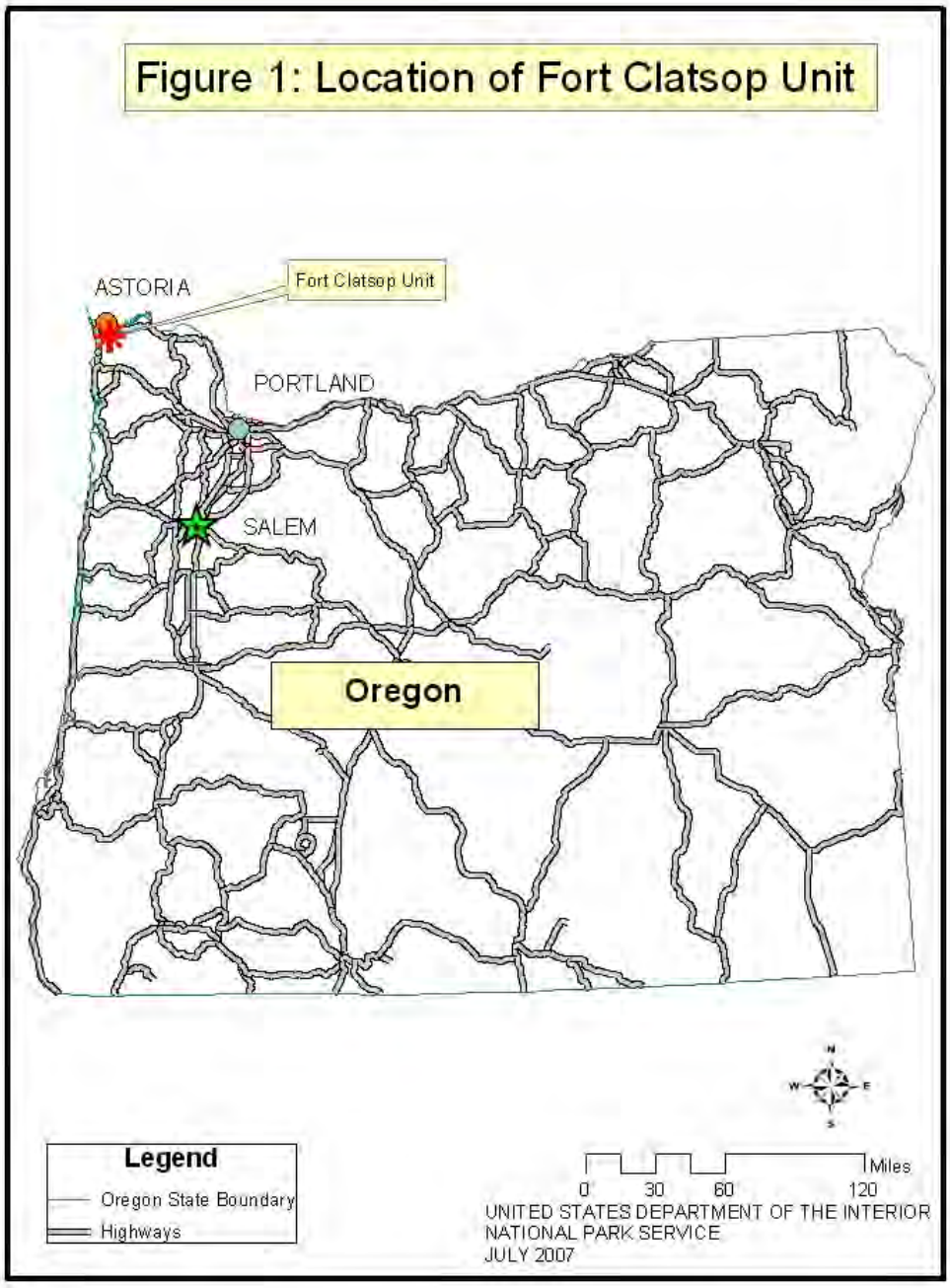


Figure 1: Location of Fort Clatsop Unit
ASTORIA
Fort Clatsop Unit
PORTLAND
SALEM
Oregon
Legend
Oregon State Boundary
Highways
Miles
0 30 60 120
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
JULY 2007

Project Background

The Fort Clatsop Unit of LEWI is set in the Oregon Coast Range, on the banks of the Lewis and Clark River near Astoria, OR (Figure 2). It commemorates the location where the Lewis and Clark expedition spent the winter of 1805-6 in preparation for their return trek back across the continent. The Fort Clatsop National Memorial Expansion Act of 2002 authorized the expansion of the Fort Clatsop Unit up to 1,500 acres. Since then it has grown from the original 125 acres to approximately 1200 acres in size. Much of this increase came as a result of the purchase of roughly 1000 acres of production forest land from the Weyerhaeuser Corporation. In addition to the 1000+ acres of forest, park resources include a replica of the fort constructed by the Lewis and Clark expedition, the historic canoe landing along the Lewis and Clark River, a visitor center, and park operations facilities.

Part of the central mission of LEWI is to recreate the atmosphere of the 1805-6 expedition. One of the key components of that atmosphere is a forested setting that insulates visitors from noise and other intrusions of the modern world. While the boundary expansion has added to this buffer, the forests at the Fort Clatsop Unit are still in the process of growing back and are much younger than the forests that were present when Lewis and Clark arrived. While the Park Service recognizes that it is not possible to totally recreate the forests present during the time of Lewis and Clark, it does acknowledge that management of these young forests can improve the visitor experience and the quality of forest habitats at LEWI.

In addition to the overall general need for a plan to clarify the Park's direction in managing these forests, there are a number of specific forest composition and habitat quality issues that further stress the need for action. This management plan and EA will address a number of options targeted at addressing the following needs for these newly acquired forests:

- Lack of structural complexity
- Simplified age distribution
- Young stands without large trees
- Few large snags and downed logs
- Lack of several common forest species
- Limited understory development
- Poor habitat quality
- Potential for current stands to stagnate and remain in the same developmental stage for an extended period of time
- The potential of stagnated stands to become highly susceptible to windthrow
- Incompletely decommissioned roads

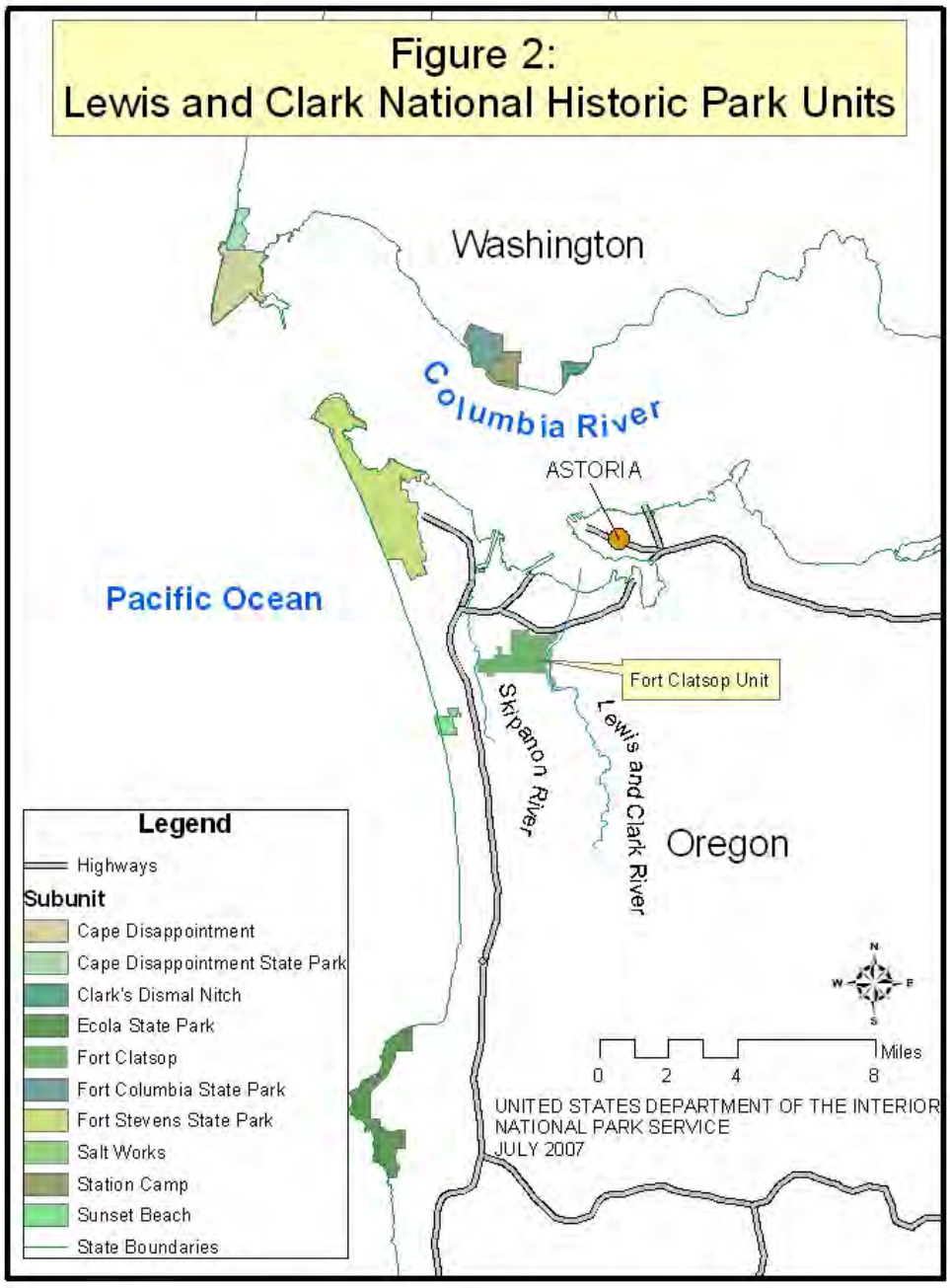
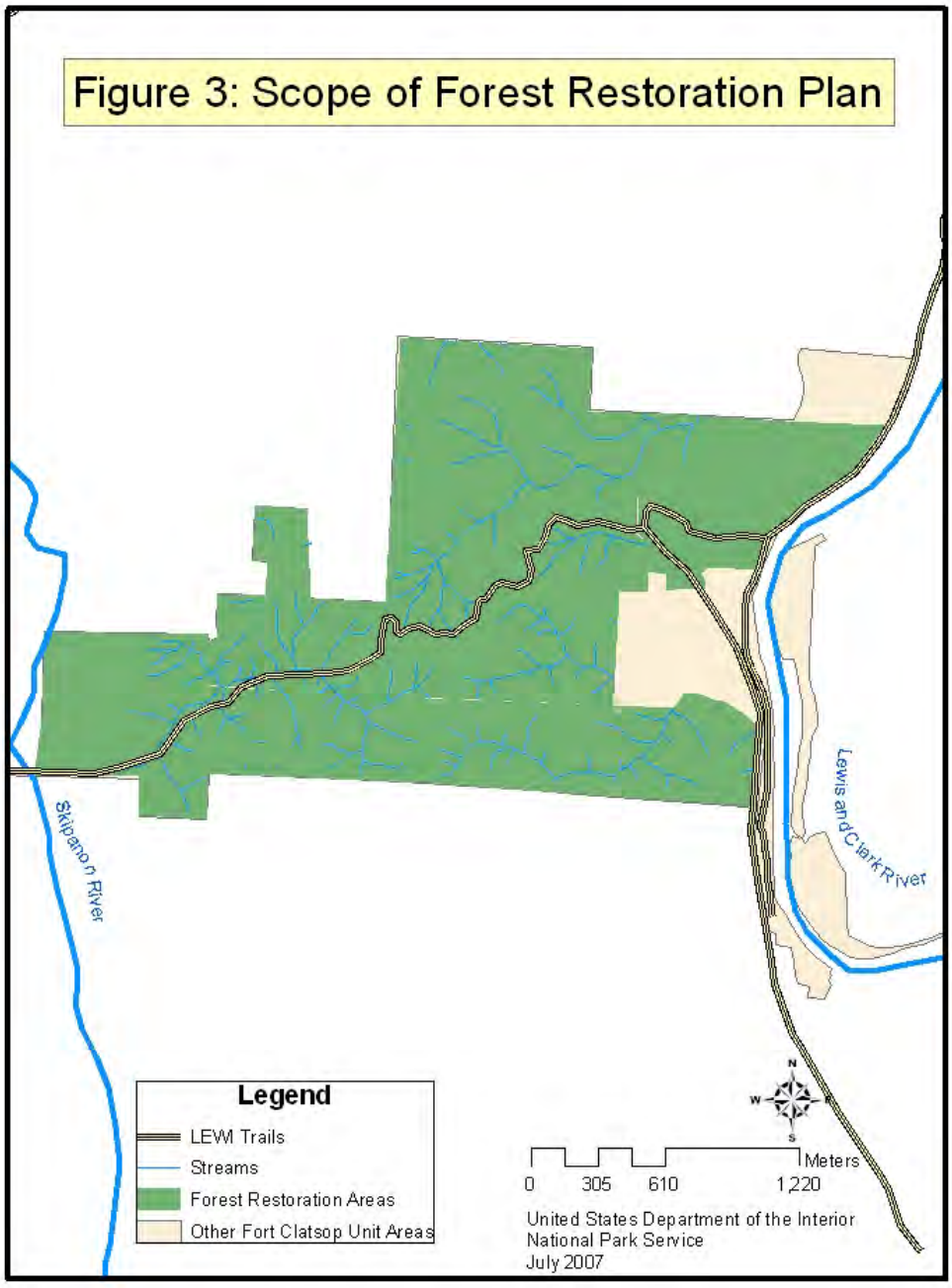


Figure 2:
Lewis and Clark National Historic Park Units
Washington
Columbia River
ASTORIA
Pacific Ocean
Fort Clatsop Unit
Skipanon River
Lewis and Clark River
Oregon
Legend
Highways
Subunit
Cape Disappointment
Cape Disappointment State Park
Clark's Dismal Nitch
Ecola State Park
Fort Clatsop
Fort Columbia State Park
Fort Stevens State Park
Salt Works
Station Camp
Sunset Beach
State Boundaries
N
W
E
S
0 2 4 8
Miles
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
JULY 2007

Project Scope

The proposed Forest Restoration Plan would cover the forested portions of the Fort Clatsop Unit of Lewis and Clark National Historic Park. This includes the original memorial and the adjacent forests acquired from Weyerhaeuser (Figure 3). Estuaries and floodplain areas with trees near Netul Landing are beyond the scope of this plan and will be the focus of other planning efforts by the NPS. The Sunset Beach site is managed by the Oregon Parks and Recreation Department and is also not covered in this plan. This Forest Restoration Plan is primarily intended to guide forest vegetation management for the next 20 years.



Goals and Objectives

In taking action, the Park will rely on the broader goals set forth in both the General Management Plan (1995) and the Resource Management Plan (1994). These plans identify the following Goals and Objectives:

Goals

- Perpetuate the park's cultural and natural resources to maintain the historic scene
- Allow natural processes to prevail
- Reduce evidence of non-historic, human-related intrusions and impacts upon the park's cultural and natural environment or visitor experience
- Reclaim impacted areas
- Promote visitor understanding of park resources
- At all times place the primary focus on safety of visitors, staff, and the park's resources

Objectives

- Restore terrestrial, wetland and aquatic resource ecosystem and processes so they may operate essentially unimpaired
- Protect threatened and endangered plant and animal species and reintroduce, where practical, those species eliminated or seriously reduced from the natural ecosystem
- Permit only those types and levels of use or development that do not significantly impair park resources or values and provide only those types and levels of programs and activities that enhance visitor understanding and enjoyment of park resources
- Manage vegetation, through mechanical manipulation, to replicate a natural ecosystem

In addition, there are a number of goals and objectives specific to the current proposal. These are:

Goals:

Goal 1. Manage forests for the development of late-successional characteristics (large trees, snags, CWD, diversity of trees sizes and species, multiple canopy layers etc.)

Goal 2. Improve wildlife habitat characteristics of forest stands (understory development, hiding cover, forage vegetation, etc.)

Goal 3. Adaptively manage the resources in order to respond to new challenges and improve management practices as experience is gained and knowledge evolves

Objectives specific to the three goals:

Goal 1: Forest Characteristics	**Objective 1-1:** Enhance forest structural complexity through application of variable density thinning and other techniques designed to accelerate stand development by truncating the competitive exclusion stage of forest development
	Objective 1-2: Reintroduce the range of plant species made rare under previous management
	Objective 1-3: Increase diameter growth rates to speed development of large trees and to reduce windthrow risk by decreasing the ratio between tree height and trunk diameter (H:D ratio)
	Objective 1-4: Encourage the development of multiple canopy layers
	Objective 1-5: Increase the number and size of snags and downed logs
Goal 2: Wildlife Habitat	**Objective 2-1:** Stimulate the re-initiation of understory plants through overstory thinning
	Objective 2-2: Retain existing snags and down wood where possible to preserve existing habitat structures
	Objective 2-3: Create additional snags and downed wood to recruit these structures where they are lacking or under represented
Goal 3: Adaptive Management	**Objective 3-1:** Develop a monitoring plan to assess effectiveness of treatments at directing stands toward the desired future condition
	Objective 3-2: Incorporate monitoring findings into management practices
	Objective 3-3: Continue to incorporate the best available science and practices by collaborating with other groups conducting forest restoration, and staying abreast of the latest scientific literature on ecology and silviculture

Relationship to Other Planning Documents

The development and implementation of the Forest Restoration Plan for Fort Clatsop stems from recommendations and goals put forward in two of LEWI's main

planning documents: The 1995 GMP and the 1994 Resource Management Plan (RMP). The GMP not only defined the overall objectives for LEWI but also laid the groundwork for the boundary expansion that is now the major focus of forest restoration. This Forest Restoration Plan will also meet GMP guidelines for a plan to address vegetation management in both the original park and the expansion.

Issues and Concerns

Throughout the scoping and development phases of this management plan, a number of key issues and concerns been identified as being particularly important with regard to the forests at the Fort Clatsop Unit. Meetings with public and government agencies; and comments from the general public led to this list of key issues and concerns:

- A well thought-out plan to manage the forests in the Fort Clatsop Unit
- Scarcity of late-successional forest in the current landscape has led to a decrease in biodiversity and habitat availability for species that historically were abundant in the area
- The restoration of the natural landscape including vegetation and wildlife habitat degraded by past management activities.
- Protection of natural resources including air, water, soil, plants and animals.
- Fires, including prescribed fires, and their potential spread onto adjacent private land.
- Protection of cultural resources, and inclusion of Native American tribes in archaeological and conservation activities
- Safety of visitors, staff, and adjacent property owners.
- Effects on visitor use.
- Preservation of the wilderness qualities found within the park.
- The cumulative effects of actions proposed in management with respect to potential watershed and landscape level impacts
- Maintenance of wildlife habitat in both the short and long term within the context of proposed actions
- Loss of elk habitat in the region as human development encroaches on areas used by elk

Impact Topics Selected for Detailed Analysis

Issues and concerns identified through project scoping and alternative development indicate resources of concern that could potentially be affected by actions within the range of proposed alternatives. Specific impact topics were selected to ensure that alternatives were thoroughly evaluated as to their impact on these park resources. The following impact topics were selected so as to comply with federal laws, regulations, orders, and NPS Management Policies 2007:

Geology, Soils, and Topography
Water Quality
Floodplains and Wetlands
Ecological Resources (including Threatened and Endangered Species)
Visitor Use and Experience
Socioeconomic Factors
Visual Resources
Infrastructure
Air Quality
Cultural Resources

Topics Dismissed from Further Analysis

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources in the Fort Clatsop Unit of LEWI. The lands comprising the monument are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, Indian trust resources were dismissed as an impact topic.

Coastal Zone Management

The Oregon Coastal Management Program (OCMP) only applies to aquatic areas and shorelines up to the height of maximum tidal influence. Since all actions being proposed in this forest plan would take place outside of estuaries and tributary streams with tidal influence, this impact topic was dismissed from further consideration.

Land Use and Zoning

The land use and zoning impact topic omitted because all areas within the proposed plan are zoned as either natural or forest.

Soundscape Management

Proposed actions under this management plan would not have permanent changes to the soundscape surrounding the Fort Clatsop Unit. Temporary sound intrusions resulting from possible management activities are addressed in the impacts to visitor use and experience and further discussion of sound impacts was determined to be unnecessary.

Lightscape Management

Lightscape management was determined to not be relevant because proposed actions would not involve installation of additional light fixtures and there would be no foreseeable changes to the Park lightscape.

Solid and Hazardous Wastes

No know solid or hazardous wastes exist within the Park boundaries. In addition, proposed actions would not generate solid or hazardous waste.

Transportation

The Transportation Impact topic was determined to not be relevant to this plan because no changes would be made to the publicly accessible transportation network around Fort Clatsop.

Applicable Regulatory Requirements and Coordination

This EA was prepared to evaluate the impacts of the reasonable alternatives described in Section 3.0. The EA is formatted in accordance with NPS-Director's Order 12, National Environmental Policy Act Guidelines and the provisions of the NEPA of 1969 (PL 91-190, 42 USC 4321-4247). Detailed procedures for developing this document comply with the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508). Regulatory requirements, which may be applicable to the activities addressed in this EA, include:

- Section 106 of the National Historic Preservation Act, which addresses any activity that directly, indirectly, or cumulatively with other actions may impact cultural resources listed on or eligible for listing on the National Register of Historic Places
- Section 404 of the Clean Water Act, state water quality certification through Section 401 of the Act

- Section 7 of the Endangered Species Act, consultation with the U.S. Fish and Wildlife Service, on any issues impacting federally listed threatened or endangered species
- Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands);however, actions that are functionally dependent on water are exempted from compliance with these orders under NPS final procedures
- NPS-Director's Order 12, which provides guidelines for NPS conservation planning, environmental impact analysis, and decision making

ALTERNATIVES

A number of alternative approaches to the restoration of forests at Fort Clatsop were identified through the project scoping process. The four alternatives (no-action and three action alternatives) selected for further analysis are described here along with a summary of the differences between these alternatives and their potential environmental impacts. The four main alternatives being considered are:

- Alternative 1: No-Action
- Alternative 2: Perkins Access
- Alternative 3: Preferred Alternative- Perkins Access and temporary use of roads in need of decommissioning
- Alternative 4: Use of all forest roads

In addition to these four options, several other alternatives were analyzed and dismissed from further consideration. A more detailed discussion of dismissed alternatives and the reasoning behind their elimination from consideration can be found at the end of this section.

Elements Common to All Alternatives

Late Successional Forests

A common focus of all action alternatives is managing for the desired future condition of late successional or old-growth forests. Late successional forests are fundamentally different from younger forest types and research has shown that they play a number of key ecological roles (Franklin and Spies 1991). What sets these forests apart is not simply their age but rather the structural complexity that arises due to the presence of large trees, large snags, large volume of downed wood, and a wide diversity of tree sizes (Franklin et al. 2005). This complexity results in the ability of these forests to support high levels of biodiversity and fill a number of key ecological functions such as nutrient retention, erosion control, and water purification (Franklin and Spies 1991). Late successional forests also will help achieve LEWI's goal of recreating the atmosphere surrounding the Lewis and Clark expedition.

Scope

All action alternatives propose strategies that apply only to the forested portions of the Fort Clatsop Unit (Figure 3). Other parts of the park are addressed in separate planning documents. As all alternatives address the same area, they also are subject to the same opportunities and obstacles present in the landscape. Forested areas at LEWI are found across the Developed, Historical, and Natural Zones identified in the Park's GMP.

Implementation Timeline

While this management plan is intended to guide forest restoration at LEWI for the next 20 years, thinning treatments are more effective early in the life of a stand before growth is dramatically slowed by competition. Restoration treatments during the first 10 years of the plan will focus more on thinning to maximize the effectiveness of treatments. Thinning may still be implemented through the duration of the plan but the emphasis will be on treating stands as soon as possible then following up as needed.

Thinning

All action alternatives would focus on working with the existing forest stands, not replacing them outright. This would be accomplished by thinning some of the trees within a stand. Thinning works because only a limited amount of resources (primarily light, water, nutrients) are available within a given area, removing some trees reduces competition and increases the relative abundance of resources to remaining trees and understory vegetation. Thinning also re-distributes resource availability, particularly light, within a stand allowing the remaining trees to grown more vigorously and understory plants to develop (Smith et al. 1997).

Thinning has also been shown to facilitate the development of the late successional characteristics that have been identified as the desired future condition of forests under this plan (Zenner 2005, Chan et al. 2006). The primary reason that thinning is able to speed the development of diverse understories, multi-layered canopies, and larger trees is that thinning works to shorten the competitive exclusion stage of forest development (DeBell et al. 1997). Competitive exclusion occurs when densely growing trees effectively capture all the available light and the ensuing competition for resources causes trees to stagnate in growth and die back slowly. This stage of forest development is characterized by few or no understory plants, reduced tree growth, increased suppression mortality, and these characteristics may persist for long periods of time (Franklin et al. 2002). Development of understory plants and multiple canopy layers is particularly slow in stands with a large western hemlock component (Stewart 1988). As most stands in the Fort Clatsop Unit feature hemlock as a major stand component, there is considerable potential for thinning to favorably improve understory growing conditions. Studies have shown that conventional thinning is effective in increasing understory diversity and that understory composition in thinned stands is closer to old-growth understory composition compared to un-thinned stands (Tappeiner 1997, Muir et al. 2002). Thinning conducted with specific ecological objectives, instead of only conventional timber production objectives, has the potential to be even more effective in

promoting biodiversity and the development of late successional characteristics. This is because thinning treatments can be designed to favor ecological elements such as wildlife trees, gaps, and snags that are ordinarily selected against in production forests because they do not maximize the commercial value of the trees remaining in the stand. While evidence supporting forest restoration in the Sitka spruce zone is limited, the growing consensus on forest restoration is that thinning does have a beneficial impact in young over dense stands across the region (Churchill 2003).

Due to the range of forest condition present in the Fort Clatsop Unit, a number of different thinning techniques will be necessary for restoration under the action alternatives. One of the main techniques being used in forest restoration in the Pacific Northwest is Variable Density Thinning (VDT) (Carey et al. 1999). Variable density thinning applies a variety of thinning levels to simulate the structural complexity and spatial heterogeneity that are characteristic of old-growth forests. Later versions of VDT have been described as "thinning with skips and gaps" (Harrington 2005). Skips are areas of no treatment designed to limit treatment impacts while gaps are areas cleared to simulate canopy openings resulting from windthrow or other disturbance. Both skips and gaps are designed to further increase the variability present after treatment. Sizes as well as the proportion of a stand devoted to gaps/skips can be tailored to meet local conditions and objectives. Overall, ongoing research continues to stress the importance of variability in thinning intensities when trying to achieve ecological objectives (Carey et al. 1999, Garman 2003, Muir et al. 2002, Franklin et al. 2002, Harrington 2005).

The other main thinning technique will focus primarily on gap creation designed to simulate disturbance processes like wind and disease pockets. Small gaps would involve thinning individual trees to groups of several neighboring trees and would range in size up to about 0.05 acres. Small gaps would be used to both increase understory light levels and to release selected trees from competition in order to increase their growth rates. Larger gaps up to 3/4 acre in size would be used to simulate larger wind disturbance events. These larger gaps would focus on regenerating understory diversity as well as creating opportunities to re-establish cedar, hardwoods, and other tree species that are rare within these forest stands that were previously managed for timber production. Larger gaps could retain some standing live trees as well as groups of snags to maintain important habitat elements within stands. Stand prescriptions will differ in the exact proportion of gaps to be placed in each stand depending on stand specific conditions and ecological needs. Prescriptions will generally range from 10% to 20% of the stand area in gaps with the area divided between 1-3 larger gaps and numerous small gaps.

Because of the present condition of many of the stands, thinning may need to be conducted over several intervals in order to achieve restoration objectives while minimizing the risk of windthrow. Periodic treatment would be particularly important in the dense stands with greater wind exposure as these areas are most prone to wind damage. Multiple rounds of restoration treatments would also be necessary to create larger snags and downed logs as trees large enough to create these structures are currently too rare within the Fort Clatsop Unit to meet desired abundance or size criteria.

Under action alternatives, thinning would mainly be directed at removing western hemlock and Sitka spruce as these two species are the most common in stands at the Fort Clatsop Unit. Douglas-fir will also be thinned in the few stands where it is a major component. Generally hardwoods and minor species such as red alder, bigleaf maple, black cottonwood, and western redcedar will be retained. Red alder may be thinned in stands where it is very abundant in order to create a diversity of snag and dead wood types. However, thinning of alder will generally be unnecessary due to its relatively short life span and its importance from a biodiversity standpoint. Maintaining minor forest species is important not only for plant biodiversity, hardwoods in particular are hosts to a great range of insects, arthropods, and epiphytic mosses and lichens (Neitlich and McCune 1997, Muir et al. 2002).

Treatment Intensities

Action alternatives also share common intensities of treatment, though they differ in their reliance on each intensity level. Treatment intensities include: thinning with biomass removal, thinning only, and light thinning focused solely on creating specific habitat characteristics.

Thinning with biomass removal would represent the more intensive form of restoration treatment under the action alternatives. Here thinned trees could be removed as long as targets for snag abundance and CWD are met. Removal of trees will generally be limited to the small size classes of trees within a stand, though occasionally some moderate sized trees will be removed. While larger trees may be thinned as part of a restoration treatment these larger stems will be retained as downed woody debris or snags. A diameter cap of 20 inches DBH will be used in order to ensure that these larger stems remain in treated stands.

Evidence from commercial operations in the Sitka spruce/western hemlock forests of southeast Alaska show that partially cut stands where timber was removed, still developed into complex stands with late successional characteristics (Deal and Tappeiner 2004). Deal (2002) also found that understory composition in partially cut stands recovered from logging related disturbance and was more similar to uncut old-growth stands compared to unthinned stands of the same age. Removal of small hemlock logs should have a minimal impact due to the speed at which these logs, if left, would decompose (Grier 1978, Graham unpublished report, Hennon and Loopstra 1991; Edmonds 2000). Overall, there is still uncertainty about the long term impacts of biomass removal though evidence suggests that it can be accomplished without considerable disruption to forest development (Chan et al. 2006). Monitoring will be a key element of tracking the long term impacts of restoration treatments.

Thinning without removal would be another intensity level of restoration treatment. Thinned trees would simply be felled or girdled and left as standing snags. Thinning targets would be similar to when trees were being removed but the lack of ground disturbance would lessen the potential impact if this treatment on the site. Leaving all thinned trees may also necessitate lighter initial prescriptions, especially in

the densest stands, in order to prevent high downed log concentrations from posing a hindrance to wildlife use.

The third level of treatment intensity would involve lighter thinning directed at sensitive areas or areas where forest development is already more advanced. Lighter treatments would not involve biomass removal and would be focused solely on habitat improvements such as snags, CWD, and small gaps. Under all three action alternatives, any treatment in riparian areas and older age classes of forest would only be this lighter intensity of restoration treatment.

Uses for Removed Biomass

Biomass removed during restoration treatments would be used in a number of different ways. Small branches and foliage from removed trees would be left in stands to maintain nutrients in the system. Large branches and small tree boles would either be piled on roads as part of the decommissioning process or chipped and spread to control erosion from road beds. Removed tree boles large enough to have a commercial value would be used as part of a material for service contract to offset the costs of forest restoration and road decommissioning. While the National Park Service does not have a mandate to produce timber revenue, there are previous examples in other NPS units such as Yosemite National Park and the Big Thicket National Preserve where removed woody material was exchanged for fuels reduction or other forest restoration treatments (Yosemite *Final Fire Management Plan/EIS* 2004). Another example outside of the NPS is the City of Seattle's Cedar River Municipal Watershed where commercial harvest is prohibited under the watershed's Habitat Conservation Plan (HCP). However, material removed as part of ecological thinnings is allowed to be used to cover restoration costs (Boeckstiegel et al. 2005). Another local example is The Nature Conservancy's proposal for Ellsworth Creek and Long Island in Washington state, where trees removed while thinning for ecological objectives will be sold to help pay for the costs of their restoration program. Trees removed during forest restoration treatments could also be used locally within the park as large woody debris in ongoing estuary and stream restoration projects.

Snags and CWD

Dead wood in the form of both standing snags and downed logs is another feature common to all action alternatives. Large pieces of dead wood are one of the defining characteristic of old-growth forests and provide a number of ecological functions ranging from water retention to nitrogen fixation to aiding tree establishment (Franklin and Spies 1991). While dead wood of all sizes play some role in forest ecosystems, larger pieces above 20 inches in diameter are particularly important due to their longevity (Nelson 1988). Many species such as woodpeckers and other cavity nesters require larger snags in order to construct their nests (Aubry & Raley 2002). Because of the importance of large dead wood, creating effective snags and logs will necessitate cutting larger trees once they are available. Specific targets for snag and CWD abundance vary considerable in the published literature for the Oregon Coast but could be greater than 36 snags over 10 inches DBH per acre and 10% cover of CWD (Mellen et al. 2006). Spies (1988) and Nonaka (2003) both documented even higher densities of snags in the forests of the Oregon Coast Range.

Planting

Planting of tree species and other vegetation normally found in the area is another feature common to all action alternatives. Reintroduction of some plant species is necessary since many areas have very few plant species and slow natural rates of dispersal would not accomplish reintroduction within realistic timetables. Planting will be particularly important for species like western redcedar in the Fort Clatsop Unit expansion where there are too few remaining to provide an adequate seed source. The main tree species to be planted include western redcedar, Sitka spruce, vine maple, and bigleaf maple. Planting activities may require some initial clearing of ground vegetation to establish desired species. Herbivory mitigation measures like mesh tree shelters may also be necessary to establish some species.

Safety

Another common feature among action alternatives will be to limit management where there is a potential risk to the safety of park resources, staff, and visitors. This would include taking extra care near streams, riparian areas, and trails. Biomass removal would not take place in riparian areas though some thinning may take place in order to promote the development of large conifers for in-stream wood recruitment. Snag creation would also be limited to provide a buffer of two current tree heights away from facilities and trails.

Invasive Species

Implementation of the Park's Integrated Pest Management (IPM) program would continue under all alternatives (including no action). This would be necessary to control and limit the spread of invasive species.

Monitoring and Adaptive Management

Another element common to all alternatives is the monitoring of forests and any implemented projects. Monitoring is necessary to not only assess success of treatments but also to keep track of potential problems like invasive species or maintenance needs. Knowledge gained by monitoring past projects will also be used to adapt future restoration timing and methodology to respond to changing conditions and new knowledge. Monitoring will also add to the base of scientific knowledge on applications of silviculture to promote late successional characteristics.

Natural Disturbance

All alternatives would also recognize the importance of natural disturbance and generally allow areas affected by wind or other natural processes to develop with minimal intervention. This would include not salvaging trees after blowdown or fire. However, fire suppression would continue as part of the Fire Management Plan. Opportunities created by natural disturbance could be used to meet management objectives through actions such as planting to reintroduce rare species. Under extreme circumstances actions may be necessary to respond to levels of disturbance that threaten the Park's core mission. Events like large scale insect or disease outbreak or widespread

blowdown that threaten the ability of the Park to meet its core mission will require an appropriate management response.

No Treatment Areas

In addition to skips called for in stand prescriptions, action alternatives would also incorporate areas of contiguous no treatment within each age class of forest. No treatment areas would occupy approximately 20% of the area in each timber type/age class. These areas would function as quiet areas for wildlife during restoration activities and would also serve as refugia for ground mosses and fungi that could be disturbed during active treatment. No action areas would also serve as the basis for comparison during ongoing forest monitoring.

Alternative 1: No-Action Alternative

The No-Action Alternative is mandated under the National Environmental Policy Act and is designed to serve as the basis for comparison of proposed actions. Under this alternative the forests at LEWI would largely be left to develop without intervention. Some vegetation management would still take place within the Park's developed and historical zones in accordance with the existing Fire Management Plan. Existing guidelines for hazard tree treatment, viewshed maintenance, and trail maintenance would likely be the only forest activities extending into the Park's natural zone.

If this alternative is selected, the opportunity to meet objectives to improve habitat, biodiversity, and other forest characteristics would be limited. Forest stands at the Fort Clatsop Unit are predominantly in the competitive exclusion stage of forest development with little to no understory development and slow growth of existing trees. Without management, stand development would be extremely slow as trees continue to aggressively compete for light and suppression mortality gradually thins the stands. This process can last between 80 and 100 years depending on site productivity and natural rates of disturbance (Franklin et al. 2002). Stands could potentially show an ever slower rate of understory development due to the levels of hemlock present in forest stands (Stewart 1988).

Under the No-Action Alternative, windthrown risk could potentially increase over time as densely grown trees are unable to commit the resources required to develop larger stems necessary to resist toppling (Oliver and Larson 1996). The predominance of even ages hemlock make these stands particularly susceptible to wind damage since hemlock is considerably less windfirm compared to Sitka spruce, Douglas-fir, or western redcedar (Edmonds et al. 2000, Beese 2001, Holmberg et al. 2006). While the Sitka spruce forest zone is characterized by frequent windthrow events, the variability across a particular forest typically results in a pattern of smaller, frequent pockets of windthrow (Frankling and Dryness 1973). Large windthrow events do occur but these are typically less frequent (Edmonds et al. 2000). Given the predominance of western hemlock dominated stands at the Fort Clatsop Unit, a no management approach could transition the present

pattern of chronic patchy windthrow to one where larger catastrophic windthrow is more frequent (Churchill 2003, Wilson 1998). This is due to large areas of dense young stands with high height to diameter ratio's (Oliver and Larson 1996) all reaching a period of peak wind susceptibility within a similar time frame.

Overall, under the No-Action Alternative, stands at the Fort Clatsop Unit would continue to resemble commercial timber production forests with limited biodiversity, uniform tree sizes, and lack of snags and CWD. Stand development would take place but would be considerably slower than even modest restoration activities and current forest conditions with limited biodiversity and habitat value will continue to persist. The No-Action Alternative would not meet the Park's overall goals to manage for the development of late successional characteristics and improve wildlife habitat characteristics. In addition, this alternative would not provide the management tools necessary to adaptively respond to future challenges to the altered forest conditions resulting from the legacy of industrial management.

Alternative 2: Perkins Access

Restoration of LEWI forests with the use of existing forest roads from Perkins Road on the western edge of the Fort Clatsop expansion.

In addition to the management around the developed and historic areas of the park, this alternative would expand treatment to the natural zone. The two existing drivable roads leading into the park from Perkins Rd. would be used to allow access to a limited area of some stands (Figure 4).

Under Alternative 2 the park would receive three main categories of forest treatment through the course of 20 year time lifespan of this forest plan. The first category of treatment would be biomass removal where some trees are cut and removed. While all thinning would be primarily focused on achieving ecological objectives, removal of tree biomass would be possible to offset the cost of treatment. Trees being removed would primarily come from the lower size classes and no trees larger than 20 inches DBH would be removed. Trees over 20 inches may still be thinned but will be retained as snags or downed logs since these larger pieces are particularly important for wildlife habitat.

Thinning with some biomass removal would be possible but limited to the stands immediately adjacent to the two existing drivable forest roads entering the western portion of the Park from Perkins Road (Figure 4). The two roads used in this alternative will be kept after treatment as they are used in maintenance activities. Because these roads will be kept, the option for biomass removal in these stands is necessary to prevent unauthorized access from accidentally igniting the buildup of downed trees that would result from thinning with no removal. The Perkins access points would enable access to approximately 160 acres of forest stands where biomass removal would be a management option. Remaining forest stands away from roads and other access points will still be eligible for the other main treatment categories, thinning only and habitat improvement,

but all thinned trees would remain on site. In stands without access, thinning will be accomplished through a combination of cut/leave and girdle/top to produce downed logs and standing snags.

In order to achieve the desired forest conditions, multiple restoration treatments will be applied to stands where needed. Initial treatments will be focused on the more intensive biomass removal and thinning only strategies in order to apply these treatments earlier in the life of a stand where they will be most effective. Follow up treatments may also include additional thinning especially in areas prone to windthrow where thinning targets cannot be met in a single treatment due to wind risk. Additional treatments will also include lower intensity activities focused on creating snags, CWD, and planting to increase the biodiversity of both overstory and understory species. Additional habitat oriented activities, such as inoculating trees with fungi and carving out tree cavities, will also be possible once trees larger than 20 inches DBH can be grown.

Like the other action alternatives, forest restoration activities under Alternative 2 are anticipated to take place throughout the 20 year life of this plan. However, given the limited acreage of biomass removal, it is anticipated that any biomass removal operations will be completed within the first 5 years of the plan. As time progresses, forest restoration will focus more on lighter thinning to create specific habitat improvements such as large snags, downed logs, and to promote forest biodiversity.

Alternative 2 would begin to provide the management tools necessary to accomplish the Park's forest development and habitat improvement goals. Thinning options under this alternative may be limited by the option to only remove biomass on approximately 160 acres. The limited amount of removal means that management options for many other densely forested stands will be drastically reduced because some biomass removal may be necessary in order to prevent large accumulations of downed trees from limiting access for larger animals. Lighter forest treatments without biomass removal could be used to prevent large accumulations of downed trees from restricting wildlife movement, however these lighter forest treatments may delay reaching some forest and habitat objectives especially in some of the densest stands. The limited option for biomass removal will also place some restrictions on the adaptive management strategy by eliminating biomass removal as option for changing management techniques to respond to future disturbances such as insect or disease outbreaks. In spite of these drawbacks in meeting the objectives, this alternative would provide a minimum level of management options needed to accomplish most of the project goals.

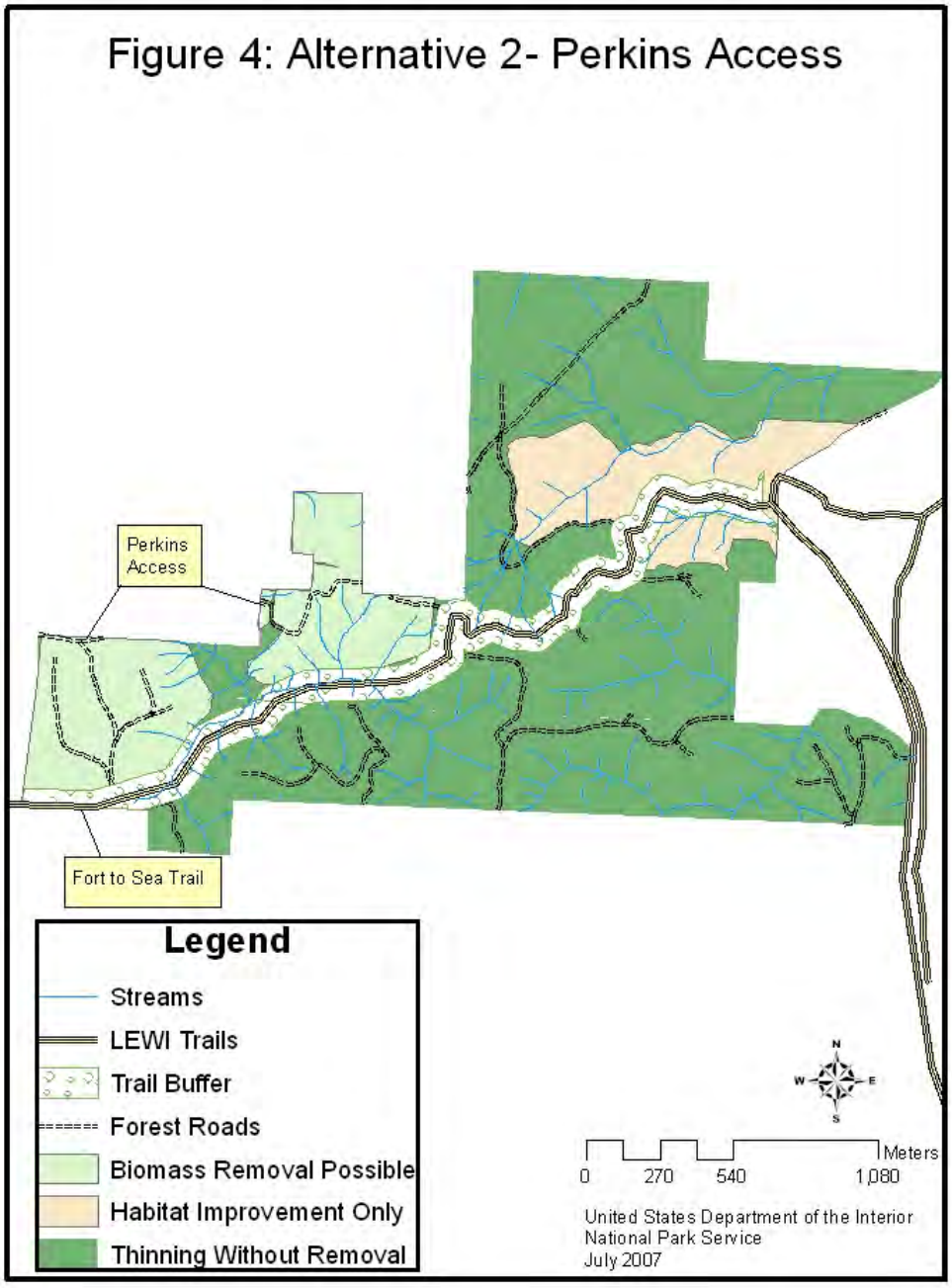


Figure 4: Alternative 2- Perkins Access
Perkins Access
Fort to Sea Trail
Legend
Streams
LEWI Trails
Trail Buffer
Forest Roads
Biomass Removal Possible
Habitat Improvement Only
Thinning Without Removal
N
W
E
S
Meters
0
270
540
1,080
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Alternative 3: Preferred Alternative

Perkins Access and temporary use of roads in need of decommissioning

Under this alternative road use could be expanded to include the Perkins access roads as well as two additional existing forest roads (roads A and B) (Figure 5). Thinning and other forest treatment options would be similar to Alternative 2 but would increase the area where biomass removal would be possible to approximately 410 acres. The two roads added in this alternative are still open but would require some maintenance to make them totally accessible.

Road A enters the Park at the NW Natural Gas right of way at the north central part of FOCL and winds through the central portion of the Park before intersecting the Fort to Sea Trail. Several high density stands are located along the road. One of the primary reasons for re-establishing access to this stretch of road is to address several stream crossings with undersized or blocked culverts that could eventually fail and release large amounts of sediment into the stream network.

Road B enters the center southern portion of the Park from Weyerhaeuser land. It runs primarily along the crest of Clatsop Ridge and is connected to one of the main road networks used by Weyerhaeuser in the management of their lands south of LEWI. The road itself does not cross any streams in the area; however, it does contribute to habitat fragmentation in a portion of LEWI that is otherwise without human presence.

In addition to expanding the area where biomass removal is possible, this alternative would call for the complete decommissioning of the reopened roads once forest treatments are completed. This would allow the opportunity to remove existing culverts and to re-vegetate the roadbed to prevent erosion and future road failures. Ideally, once they are no longer needed, roads could be obliterated and re-contoured to match adjacent slopes and restore natural water flow patterns. However the natural gas right of way would remain open due to the existing agreement with NW Natural Gas.

Like the previous alternative, restoration treatments under Alternative 3 would shift over the life of this plan. Earlier treatments would focus on biomass removal and heavier thinning in order to apply these techniques when they would be most effective. Road decommissioning proposed under Alternative 3 would further relegate biomass removal to the earlier stages of implementation because once roads are decommissioned access for biomass removal will no longer be practical. With approximately 410 acres accessible for biomass removal under Alternative 3, restoration treatments involving biomass removal will take place over a longer period of time than Alternative 2 but should still be completed within the first 10 years of implementation. Other forest restoration techniques focused on habitat improvement and biodiversity will take place concurrently during the first 10 years of the plan but will continue as needed through the life of the forest restoration plan.

Alternative 3 greatly expands the management option available to meet Park goals. Thinning activities under this alternative will have more adaptability to meet stand needs without making compromises to accommodate wildlife access. This will allow the potential for greater success toward meeting forest development objectives. Thinning combined with road removal will also allow an increased potential to meet wildlife habitat improvement goals. Temporary utilization of useable roads will also enable a wider range of management options available to adapt to future conditions and respond to monitoring findings.

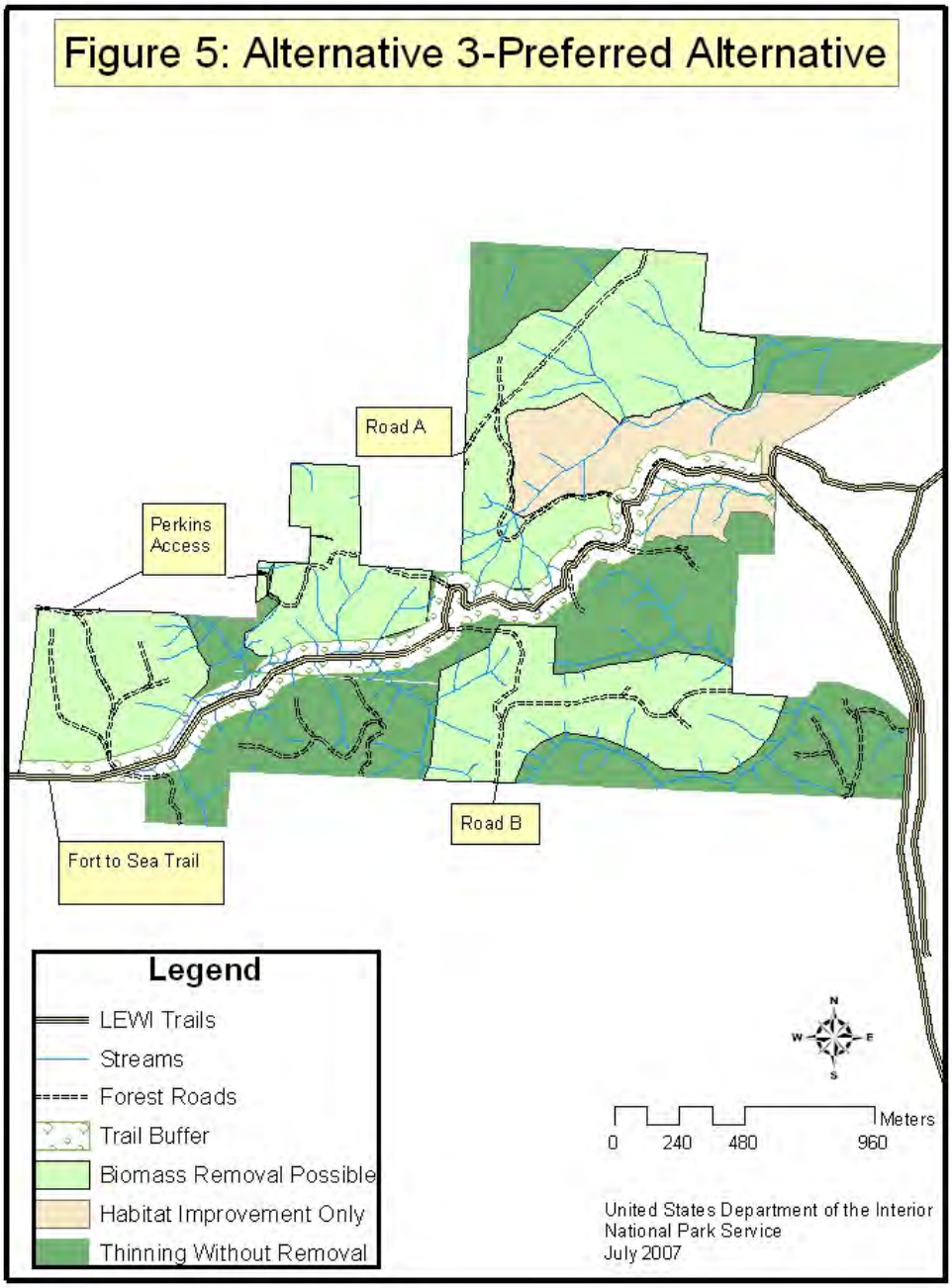
Figure 5: Alternative 3-Preferred Alternative
Road A
Perkins Access
Road B
Fort to Sea Trail
Legend
LEWI Trails
Streams
Forest Roads
Trail Buffer
Biomass Removal Possible
Habitat Improvement Only
Thinning Without Removal
N
W
E
S
Meters
0
240
480
960
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Alternative 4: Use of all forest roads

Restoration of LEWI forests using all available forest roads

This alternative would involve the use of all existing forest roads within LEWI to allow access for forest restoration and road decommissioning. Like the Alternative 3, Alternative 4 would involve the use of the Perkins access points, and Roads A and B. In addition, two more forest roads entering the SW and SE portions of the Park would be added (Roads C and D) (Figure 6). Roads C and D are partially grown over and would require additional maintenance to make them accessible. Both C and D are on ridges above headwater streams and do not have problematic stream crossings. To prevent long term habitat fragmentation, both of these roads would be decommissioned when management activities are complete.

Road use proposed under Alternative 4 would allow access to a total of approximately 515 acres where biomass removal would be a restoration option. Like the previous action alternatives forest areas without road access could still receive restoration treatments but management would be limited to methods that did not involve tree removal. Road C is located above Netul Landing and the ongoing estuary restoration being undertaken at LEWI. This road network would provide access to about 40 acres of young (15-20yrs) forest characterized by dense regeneration of western hemlock and significant patches of invasive species, particularly Himalayan blackberry. Road D enters LEWI from Weyerhaeuser land at the SW portion of the Park (Figure 4). This road is almost completely grown over and would require more work to resurface compared to others in the park. Utilizing this road would allow access to an additional 90 acres of forest.

Like previous action alternatives, restoration methodology would shift over the course of the 20 year life of this forest plan. Earlier treatments would focus on biomass removal and heavier thinning in order to apply these techniques when they would be most effective. Road decommissioning proposed under Alternative 4 would further relegate biomass removal to the earlier stages of implementation because once roads are decommissioned access for biomass removal will no longer be practical. While Alternative 4 does again increase the acreage where biomass removal is possible, the timeframe for restoration is similar to Alternative 3. If biomass removal in to be used in a restoration framework it will take place within the first 10 years. Other forest restoration treatments will occur concurrently during the first 10 years but will continue as needed through the life of this plan.

Overall this alternative would again expand the area of the park where removal of excess trees would be possible. Like previous alternatives, areas without access would still receive lighter treatments. Alternative 4 would provide the greatest flexibility in forest management options and would provide the greatest potential to meet the Park's forest development goals. Wildlife habitat goals would also be accomplished under this alternative. However, the temporary use of all forest roads within the Park will have a greater temporary impact on wildlife. The Park's potential to adapt management

practices will also be increased under this alternative as the improved access via road use will greatly increase the available forest treatment options.

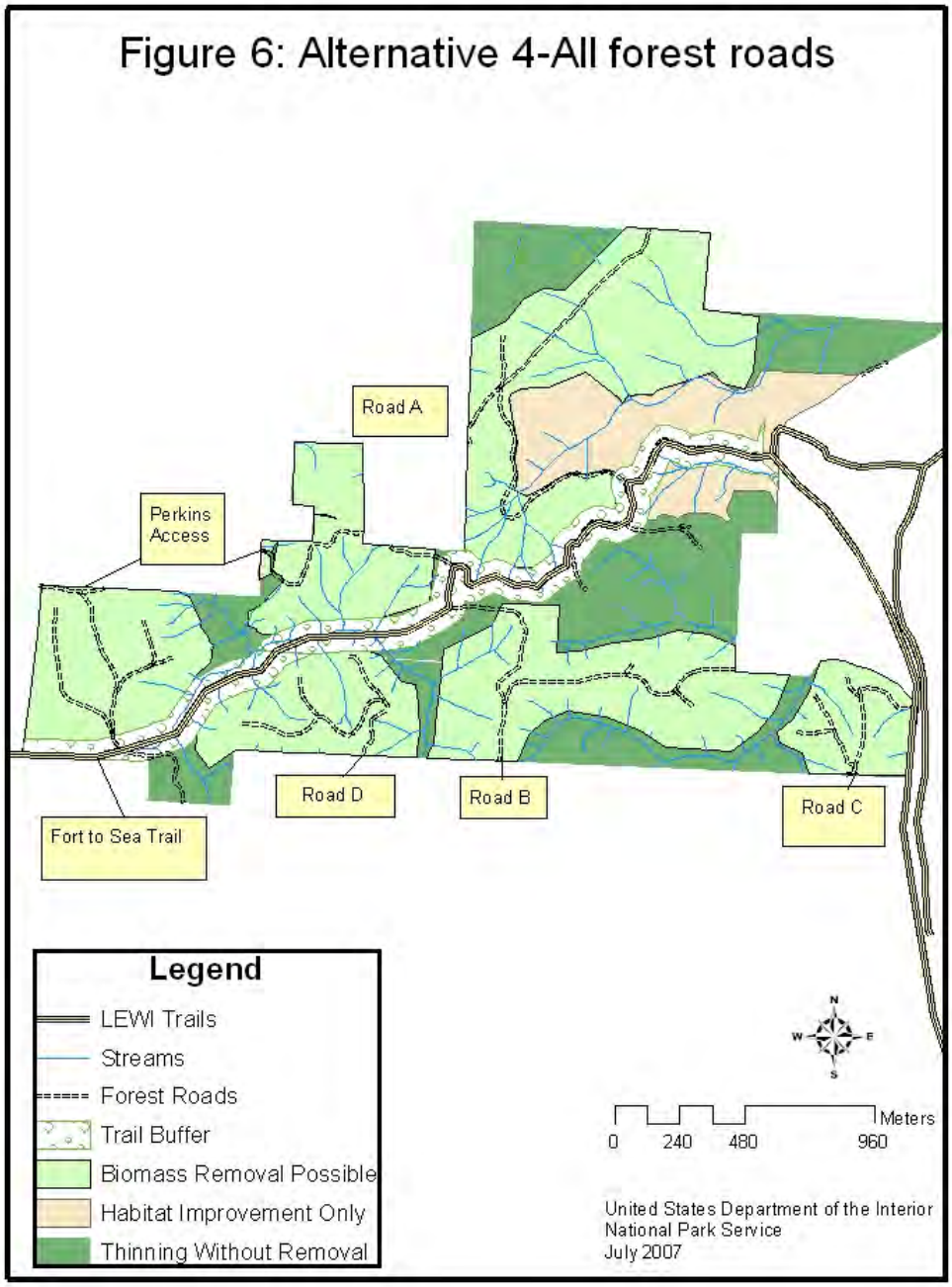
Figure 6: Alternative 4-All forest roads
Road A
Perkins Access
Road D
Road B
Road C
Fort to Sea Trail
Legend
LEWI Trails
Streams
Forest Roads
Trail Buffer
Biomass Removal Possible
Habitat Improvement Only
Thinning Without Removal
N
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960
Meters
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Mitigation Measures

Geology, Soils, Topography

Potential impacts to soils by all action alternatives would be mitigated by limiting the amount of ground disturbance. This would involve minimizing ground harvesting and where possible re-using skidder trails and landings left from previous forest operations. Where material is to be removed, uphill cable yarding would be used where possible as it has been shown to have less impact than ground operations or downhill yarding (Kellogg 2002). Logs would not be yarded through streams or wetland areas to limit erosion. If logs must cross steams or sensitive areas all logs will be fully suspended through the entire buffer area consistent with local forest regulations and best management practices. Roads used during any management alternative would be maintained to current standards for limiting erosion. Slash from biomass removal activities will be spread over disturbed areas to minimize further compaction. Slash will also be chipped and spread to minimize erosion and speed re-establishment of vegetation. To further limit impacts to soils, restoration activities that could cause soil compaction would be suspended from October 1st to May 1st as well as any time soils are waterlogged and particularly prone to compaction (Dan Goody, ODF personal communication).

Water Quality

Water quality impacts under action alternatives could result from road related sediment and erosion. Maintaining roads to current standards will be essential to mitigate the potential for roads to impact water resources. Mitigation measures would include the establishment of stream buffers to limit actions near steams, as well as sediment control measures and adequate road drainage. Action alternatives that include removal of stream crossings and old roads would lead to a long term improvement in downstream water quality by restoring historic stream channels and decreasing the potential for a mass release of road fill.

Ecological Resources

Impacts to Park ecological resources could occur under action alternatives but would primarily be short-term and there is considerable opportunity to minimize any potential impacts. Restoration activities involving machinery will be curtailed during sensitive times of the year to eliminate the potential to adversely impact wildlife. In addition, surveys conducted prior to project implementation would be used to identify sensitive areas or species of concern. Skips and areas of no treatment will then be targeted to most effectively keep management activities away from areas where they may have an adverse impact. No treatment areas will also function as an additional mitigation measure against impacts to ecological resources by providing larger areas for wildlife to temporarily avoid human caused disturbance. In addition, careful project planning can be used to group active projects together to limit disturbance to large areas of the Park simultaneously.

Disturbance and damage to vegetation will result from thinning and biomass removal activities. Skips within thinned areas will act as one mitigation measure that will maintain areas without disturbance to vegetation. Damage to leave trees can also be minimized by effective project planning that allows for felling and yarding corridors that minimize maneuvering of cut stems.

While fungal diseases are a natural cause of tree mortality, damage to trees and cut stump surfaces may increase the potential for fungal pathogens to infect remaining trees (Thies and Goheen 2002). To prevent the spread of annosum root rot stumps can either be treated with a borax solution or cut so that at least 12" of stump remains (Edmonds 2000). Thinning during wet seasons has also been shown to limit the infection of cut spruce stumps in coastal forests (Morrison and Johnson 1999). Fungal disease risk is further reduced when thinning small diameter trees since the residual stumps are not large enough to sustain fungal infections (Edmonds 2000).

Although LEWI lies in an area known for its high rainfall, periodic summer drought conditions may occasionally raise fire risk levels sufficiently to warrant temporary fire closures. Management will also increase the amount of downed woody material closer to natural levels.

Floodplains and Wetlands

Potential impacts to floodplains and wetlands would primarily be avoided under action alternatives by drastically limiting the types of activities allowed in these sensitive areas. No machinery will be used within wetlands, floodplains, or riparian buffers. Biomass removal will also not take place and no trees will be yarded across these areas. Restoration actions will be limited to meeting dead wood targets and planting in these areas.

Visitor Use and Experience

Active management proposed under the action alternatives does have the potential to temporarily adversely impact visitor use and experience. Areas surrounding active projects may need to be closed to visitors; however project planning can help to minimize the frequency of closures. Buffers of two tree heights around trails will be necessary to ensure the continued safety of park visitors. Lower intensity vegetation management will still be possible in buffer areas but standing snags will not be created within the two tree height zone to prevent the creation of hazardous conditions. Buffers will also be expanded in areas where visual or noise impacts from active projects could be detrimental to visitor use and experience. Lower intensity treatment options, such as girdling and topping trees without using power saws, will be used in areas where sound impacts are a concern. Temporary disruptions to visitor experience will be an educational opportunity to inform the public about forest restoration as well as the uniqueness and importance of old-growth forests.

Visual Resources

Forest restoration activities could have temporary impacts to the visual surroundings primarily resulting from disturbance to vegetation. Impacts will likely be short term and mitigation measures such as planting and leaving buffer areas around visually sensitive areas will likely eliminate most impacts to visual resources. Additional visual impacts could arise from excessive windthrow. Potential windthrow impacts will be minimized by using several lighter thinning treatments as opposed to a single heavy application.

Air Quality

Action alternatives should have minimal impacts to air quality. There may be some short term localized impacts resulting from machinery used during biomass removal or road decommissioning. Mitigation of potential impacts would primarily be focused on using machinery only when necessary and preventing unnecessary idling.

Slash burning is included in the Fort Clatsop Fire Plan but is currently limited to the area within the original 125 acres around the visitor center and fort replica. If burning were to occur, it would comply with existing Fire Plan guidelines and follow all local regulations to limit smoke impacts to air quality. Additional slash burning is not called for under this plan and any fuels concerns associated with slash would be mitigated by chipping small material for use in erosion control and road rehabilitation.

Cultural Resources

Action alternatives could have adverse impacts to undocumented cultural resources. However impact would most likely be minimal since areas where proposed actions would occur have previously been disturbed. Potential impacts to cultural resources would be mitigated by surveying previously undisturbed areas if additional ground disturbance is anticipated. Cultural resources identified during surveys will be documented and removed or alternative actions considered in order to avoid impacts entirely.

Environmentally Preferred Alternative

The environmentally preferred alternative is determined by applying the criteria suggested in NEPA, which is guided by the Council on Environmental Quality (CEQ). The CEQ provides direction that "…the environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA's Section 101." Using the six criteria from Section 101 detailed below, it was determined that Alternative 3 provides the greatest level of achieving restoration objectives of the alternatives evaluated in this discussion.

- Criteria 1- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Criteria 2- Assure for all generations safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Criteria 3- Attain the widest range of beneficial uses of the environment without degradation, risk of heath or safety, or other undesirable and unintended consequences.
- Criteria 4- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Criteria 5- Achieve a balance between population and resource use that will permit high standards of living and wide sharing of life's amenities.
- Criteria 6- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Among the options considered, Alternative 3 best fulfills the NEPA criteria. Proposed actions under Alternative 3 best satisfy criteria 1, 2, and 6 by working to restore natural forest conditions while addressing the potential for road failures to impact water resources in the future. Alternative 3 also best meets criteria 3 by including a moderate about of biomass removal and limiting the use of this technique to the areas where it would be most effective thus attaining the widest range of benefits without compromising environmental responsibilities. While all alternatives would preserve historic, cultural and natural aspects of our heritage, Alternative 3 would best preserve future choices by not committing the entire park to a single management strategy. Instead, Alternative 3 focuses on areas which the greatest potential for benefits under existing knowledge, and leaves options open for future generations. Lastly, the preferred alternative meets criteria 5 and 6 by allowing a moderate amount of temporary resource use in a way that benefits the local community, all while working to improve the quality of natural resources within the Park.

Preferred Alternative Designation

After comparing the range of management options available under all four Alternatives, Alternative 3 was selected as the Preferred Alternative because it provided the greatest ability to meet Park goals and objectives while minimizing the potential impact to the Park environment. While Alternative 3 and Alternative 4 are quite similar in their overall approach, Alternative 4 relies on considerable road maintenance for a small increase in the amount of area where biomass removal could be possible. In addition, the grown over roads to be utilized under Alternative 4 have shown signs of heavy elk use. Thus it was felt that Alternative 4 would have a greater impact to elk populations especially with all the other projects possible under Alternative 4. Alternative 3 also has a greater potential to meet park goals and objectives compared to No-Action and Alternative 2.

Alternatives Considered But Rejected

In addition to the options selected for analysis, several other alternatives were considered but ultimately rejected from further consideration. The first of these was the option to conduct forest restoration treatments without the use of the existing forest roads and without the removal of any thinned trees. While appropriate in the more developed forest area at Ft. Clatsop and areas with limited access, some of the densest stands have a need for some removal after thinning in order to maintain wildlife access. Refraining from utilizing the existing road system also would limit opportunities to combine forest treatment with road decommissioning thus greatly increasing the cost of treating roads in the future.

Another rejected alternative would have focused restoration activities only along the visible corridor accessible to visitors. In the long run this option would have maximized the visitor perception of being in an old-growth forest but would have caused considerable disruptions to the visitor experience in the short term. This alternative would have resulted in only a small portion of the park being treated and many areas that would have benefited from thinning would have been overlooked. Restoration options would further be limited due to the fact that there is little access to the visual corridor aside from the existing trail network. This lack of assess would have eliminated options such as removing some thinned trees and using equipment to lower costs. Overall, this alternative would only have achieved restoration objectives over a small portion of the park.

Consideration was also given for an alternative that limited treatment to sheltered areas most likely to mature into old-growth. This alternative would have mimicked one pattern seen in coastal areas where the oldest forests are found in areas protected from wind and other disturbances. However, limiting treatment to only a small portion of the landscape would have left much of the park still more closely resembling a production forest and would not have met a number of key restoration objectives.

One last alternative was similar to the preferred alternative but involved the selection of different roads for use. This alternative was rejected because it made more sense to use the four roads selected in the preferred alternative because they would involve less maintenance to make them useable. In addition, we felt the full range of road use options was captured between the selected alternatives.

Table 1: Alternatives 1-4 Restoration Comparison

	Untreated Areas (% of Park)	Thin Without Removal (Acres)	Biomass Removal (Acres)	Years where Biomass Removal Possible	Approx. Biomass Removal (Acres/year)
Alternative 1 (No Action)	100%	0	0	0	0
Alternative 2	20%	678	160	2-5	80-30
Alternative 3	20%	428	410	5-10	80-40
Alternative 4	20%	323	515	5-10	100-50

Table 2: Impact Comparison Matrix

Impact Topic	Alternative 1 (No-Action)	Alternative 2: Perkins Rd	Alternative 3: Preferred Alternative	Alternative 4: All Roads
Geology, Soils, and Topography	Minor, short-term, adverse impacts on soils; adverse long-term impacts dependant on severity of road failures, could be moderate adverse in small areas	Minor to moderate, short-term, adverse impacts. Adverse long-term impacts dependant on frequency and severity of road failures, could be moderate in small areas	Moderate, adverse, short-term impacts on soils localized on roadbeds. Beneficial long-term impacts from road decommissioning. Minor, short-term, adverse impacts to soils from thinning	Moderate, short-term, adverse impacts to soils localized on roadbeds. Long-term beneficial impacts from road decommissioning. Minor, short-term, adverse impacts to soils from thinning
Water Quality	Minor, short-term, adverse impacts on surface waters. Long-term impacts dependant on severity of future road failures; could be moderate, adverse	Minor to moderate, short-term, adverse impacts on surface waters. Long-term impacts dependent on severity of future road failures; could be moderate, adverse. Negligible to minor, short-term, adverse impacts from restoration activities; long-term beneficial impacts	Moderate, short-term, adverse impacts to surface waters from road decommissioning. Long-term beneficial impacts as decommissioned roads reduce erosion. Negligible to minor, short-term, adverse impacts from restoration activities; long-term beneficial impacts	Moderate, short-term, adverse impacts to surface waters from road decommissioning. Long-term beneficial impacts as decommissioned roads reduce erosion. Negligible to minor, short-term, adverse impacts from restoration activities; long-term beneficial impacts
Floodplains and Wetlands	Negligible direct impacts. Moderate, adverse, short-term impacts if road failures occur. Long-term impacts minor to moderate depending on how roads deteriorate	Negligible to minor, adverse, direct impacts in the short-term. Beneficial long-term impacts of restoration to wetland function. Moderate, adverse, short-term impacts if road failures occur. Long-term impacts minor to moderate depending on how roads deteriorate	Minor, short-term, adverse impacts to wetland resources. Moderate, short-term, adverse impacts from road decommissioning. Long-term impacts beneficial as risk of road failure is reduced	Minor, short-term, adverse impacts to wetland resources. Moderate, short-term, adverse impacts from road decommissioning. Long-term impacts beneficial as risk of road failure is reduced

Impact Topic	Alternative 1 (No-Action)	Alternative 2: Perkins Rd	Alternative 3: Preferred	Alternative 4: All Roads
Ecological Resources	Negligible, short-term, direct impacts to ecological resources. Long-term impacts could be moderate, adverse due to current stand conditions and windthrow risk.	Minor, short-term, adverse impacts to ecological resources. Long-term impacts beneficial as forest development progresses	Minor, short-term, adverse impacts to ecological resources. Long-term impacts beneficial as forest development progresses	Moderate, short-term, adverse impacts due to increased disturbance and proximity of project area. Long- term impacts beneficial as forest development progresses
Visitor Experience & Sound	Negligible, short-term, direct impacts to visitor experience. Long-term impacts could be moderate, adverse depending on severity and location of windthrow	Minor to moderate, short-term, adverse impacts to the visitor experience. Long-term impacts beneficial as stands develop more windfirmness after treatment	Minor to moderate, short-term, adverse impacts to the visitor experience. Long-term impacts beneficial as stands develop more windfirmness after treatment reducing the potential for windthrow disruptions to visitor use	Minor to moderate, short-term, adverse impacts to the visitor experience. Long-term impacts beneficial as stands develop more windfirmness after treatment reducing the potential for windthrow disruptions to visitor use
Visual and Scenic Resources	Negligible short-term impacts. Long-term impacts could be moderate, adverse depending on the severity of wind damage	Minor to moderate, short-term, adverse impacts. Long-term impacts beneficial as vegetation reinitiates and windthrow risk is reduced	Minor to moderate, short-term, adverse impacts. Long-term impacts beneficial as vegetation reinitiates and windthrow risk is reduced	Minor to moderate, short-term, adverse impacts. Long-term impacts beneficial as vegetation reinitiates and windthrow risk is reduced
Socioeconomics	Negligible, short-term impacts to socioeconomic resources. Minor, long-term, adverse impacts	Minor, short-term and long-term beneficial impacts	Minor, short-term and long-term beneficial impacts	Minor, short-term and long-term beneficial impacts
Infrastructure	Negligible	Negligible short-term impacts to Park infrastructure. Long-term impacts minor, adverse resulting from wear on roads	Minor, short-term, adverse impacts to Park infrastructure. Long-term impacts would be a reduction in the number of Park forest roads	Minor, short-term, adverse impacts to Park infrastructure. Long-term impacts would be a reduction in the number of Park forest roads
Air Quality	Negligible	Minor, short-term, adverse impacts to air quality. Negligible long-term impacts	Minor, short-term, adverse impacts to air quality. Negligible long-term impacts	Minor, short-term, adverse impacts to air quality. Negligible long-term impacts
Cultural Resources	Negligible	Negligible	Negligible	Negligible

Affected Environment

Topics addressed in this section, and subsequently analyzed in the Environmental Consequences section, were selected based on their relevance as indicated by on-site visits, secondary sources documents, regulatory agency input, and information from NPS personnel.

Geology, Soils, and Topography

The project vicinity is within the Astoria Basin, which includes Clatsop County and northernmost Tillamook County. Elevation ranges from sea level to approximately 360 ft at the Fort to Sea Trail overlook. Topography is varied with lower elevation areas having moderate slopes (0-30%) and areas along Clatsop ridge generally having much steeper slopes (30-70%).

Geology of LEWI generally consists of a stratum of older Cenozoic marine and estuarine sedimentary rocks with minor volcanic rocks covered by a layer of post-early Miocene marine sedimentary and minor volcanic rocks. The Astoria Formation of sandstone and siltstone intertwines with basalt flows and submarine breccias. The western edge of the Columbia River Basalt Flow is also located in the area.

According to Natural Resource Conservation Service data, soils in the project area primarily belong to the Templeton, Ecola, and Walluski soil types. All soils are characterized by low strength and are prone to rutting.

Water Resources

Aquatic systems within the area surrounding the park have been greatly altered. The Lewis and Clark River has been extensively diked, reducing or eliminating fertile floodplains. These past floodplains are now used for agriculture, dairy and rural and industrial development. Other potential impacts consist of pesticide and fertilizer use, illegal dumping of household and industrial rubbish and toxic waste, and soil erosion from forest management activities.

Infrequent sampling by the Oregon DEQ indicates that the Lewis and Clark River and Young's Bay has aluminum, dissolved oxygen and fecal coliform levels that do not meet state water quality level standards.[5] The park has developed a water quality inventory and monitoring program in conjunction with the Water Resources Division, United States Geological Survey (USGS), and Oregon Department of Environmental Quality to develop a water quality inventory and monitoring program.

[5] Resource Management Plan, Fort Clatsop National Memorial, 1994, Page 18.

A historic spring flows for approximately nine months of the year and is the source for a small stream which flows to the Lewis and Clark River. It is believed to be the water source for the Lewis and Clark party while they wintered at the Memorial site.

Additional water resources in the project area include three fish bearing tributaries to the Lewis and Clark River, one fish bearing tributary to the Skipanon River, and numerous small headwater streams and springs.

Floodplains and Wetlands

The proposed Forest Restoration Plan does not involve actions in the100-year tidally influenced floodplain. However according to the National Wetlands Inventory several wetlands occur within the forested areas of the park. Additional emergent marsh and marsh/scrub-shrub wetlands are found along the Lewis and Clark River.

Ecological Resources

A. Vegetation

LEWI is located within the "Sitka Spruce Zone" as defined by Franklin and Dyrness (1973).[6] This vegetation zone is found along the west coast from northern California to southeastern Alaska. Sitka spruce is the most common tree species but western hemlock, western redcedar, red alder and Douglas-fir are major components in this zone. Minor species include Pacific silver fir, grand fir, shore pine, western white pine, and big leaf maple.

Wind, mainly from the south and southwest, is the major disturbance factor affecting vegetation. While most of the Park is somewhat sheltered by Clatsop ridge, wind is still believed to be responsible for the historic vegetative pattern as result of frequent wind disturbances which opened small openings suitable for the establishment of Sitka spruce. Fire also plays a role but intervals between major fires are thought to be very long with intervals of 200 or more years between fires (Agee 1993). Although infrequent, wildland fires can be severe and serve as a stand replacement event.

LEWI maintains a vegetative species list that is approximately 80% complete. Presently there are no known vegetative or fungal species listed as Threatened or Endangered, but a comprehensive inventory survey for rare plants has not been completed. Two estuarine intertidal vascular plant species, *Lilaea scilloides* and *Samolus valerandi* ssp *parviflorus,* are listed as rare by the Oregon Natural Heritage Program. Neither species occurs in forested wetlands. A January 2006 Park vegetation report identified 74 native bryophyte and 163 native vascular plant species within the Fort Clatsop Unit. An additional 92 species of exotic or invasive species were identified within the Park. LEWI maintains a herbarium

[6] Franklin, J.F., and C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. USDA For. Serv. Gen. Tech. Rpt. PNW-8.

collection of Park flora and currently has collections from 304 of the 329 species found at LEWI. [7]

B. Fungi and Lichens[8]

The Fort Clatsop Unit of LEWI features a rich diversity of fungi and lichen species. Park surveys, while not comprehensive, have identified 88 fungi and 57 lichen species within the park. Hardwood and riparian areas in the park have particularly high lichen diversity. Forest areas in the Park with old remnant spruce trees are also hotspots of lichen diversity. Two lichen species found during lichen surveys, *Usnea longissima* and *Cetrelia cetraroides*, are listed as rare by the Oregon Natural Heritage Program. One fungi species observed within the Park, *Tylopolis pseudoscaber*, was formerly listed as an Oregon State Survey and Manage species. No other fungi species known to occur at Fort Clatsop are identified as species with an elevated conservation status.

C. Wildlife

LEWI contains a diverse collection of wildlife habitat and wildlife species. Inventories of the park's birds, insectivores, rodents, fish, reptiles and amphibians have been initiated. Little is known of the park's invertebrate species.

MAMMALS

Roosevelt elk played a key role in the survival of the Lewis and Clark Expedition by providing an important food source.[9] The elk population was severely depleted by 1900 but conservation efforts have been successful in re-establishing their numbers in the Memorial area. The Oregon Department of Fish and Wildlife reports their numbers are now stable in Clatsop County. Other mammals recorded at LEWI include black-tail deer, opossum, raccoon, chipmunks, squirrels, beaver, mink, river otter, coyote, bobcat, weasel, skunk, rabbit, muskrats, and seven bat species. The white-footed vole, a federal Species of Concern, was documented within the Fort Clatsop Unit in 1940, but has not been found in more recent park small mammal surveys. Five bat species documented in the park are Species of Concern: the Townsend's big-eared bat and long-eared, fringed, long-legged and Yuma myotis. Introduced mammals include the Norwegian rat, black rat, and nutria.

BIRDS

A high percentage of bird species found at LEWI prefer mature to old-growth forests. These species may be remnant or isolated populations, since most of the region's old-growth had been cut by the early 1980's.

[7] LEWI plant checklist
[8] Park Reports on Lichen and Fungi
[9] General Management Plan, Fort Clatsop National Memorial, 1995, Page 73

Bird species commonly observed at Fort Clatsop include woodpeckers, flycatchers, wrens, kinglets, thrushes, vireos, owls, kingfishers, swallows, sandpipers, rails, hawks, eagles, mergansers, mallards, herons, cormorants and grebes. The purple martin, band-tailed pigeon and olive-sided flycatcher are federal Species of Concern. Peregrine falcons, an Oregon Endangered species, are observed within the Fort Clatsop Unit. Oregon sensitive species include the bufflehead and willow flycatcher. Bald eagles, regularly pass through and there is a nest site located about one-half mile from the Netul landing.

FISH[10]

An initial fish survey of LEWI was conducted in the spring of 2005 and a total of ten fish species were observed within the Fort Clatsop Unit. Additional species were added after additional surveys in 2006. Despite the limited timeframe and scope of these surveys, species identified during these efforts provide a baseline for tracking fish assemblages at LEWI.

Species found during the 2005 and 2006 surveys include:

Chinook Salmon	*Oncorhynchus tshawytcha*
Coho salmon	*Oncorhynchus kisutch*
Chum Salmon	*Oncorhynchus keta*
Steelhead Trout	*Oncorhynchus mykiss*
Cutthroat Trout	*Oncorhynchus clarkii clarkii*
Threespine stickleback	*Gasterosteus aculeatus*
Riffle Sculpin	*Cottus gulosus*
Reticulate sculpin	*Cottus perplexus*
Coastrange sculpin	*Cottus aleuticus*
Prickly Sculpin	*Cottus asper*
Pacific Staghorn sculpin	*Leptocottus armatus*
Western brook lamprey	*Lampetra richardsoni*
Banded Killifish	*Fundulus diaphanus*
Peamouth	*Mylocheilus caurinus*

The following evolutionary significant units listed under the Endangered Species Act may inhabit or are known to inhabit LEWI:

Chinook salmon (*Oncorhynchus tschawytcha*), Lower Columbia River ESU
Chum salmon (*Oncorhynchus keta*), Columbia River ESU
Steelhead (*Oncorhynchus mykiss*), Lower Columbia River ESU

The following species are listed under the Oregon Endangered Species Act and may inhabit or are known to inhabit LEWI:

Critical Status:

[10] LEWI Fish report

Coho salmon (*Oncorhynchus kisutch*)
Chum salmon (*Oncorhynchus keta*)
Coastal Steelhead (*Oncorhynchus mykiss*) Lower Columbia River
Coastal Cutthroat trout (*Oncorhynchus clarki clarki*)

Vulnerable status:
Pacific lamprey (*Lampetra tridentata*)

AMPHIBIANS

Amphibian surveys conducted in 2005 confirmed the presence of 9 native amphibian species and 1 invasive. Amphibian species known to occur in the Fort Clatsop Unit of LEWI include :

Pacific Chorus Frog	*Pseudacris regilla*
Northern Red-legged Frog	*Rana aurora aurora*
Northwestern Salamander	*Ambystoma gracile*
Pacific Giant Salamander	*Dicamptodon tenebrosus*
Ensatina	*Ensatina eschscholtzii*
Dunn's Salamander	*Plethodon dunni*
Western Red-backed Salamander	*Plethodon vehiculum*
Columbia Torrent Salamander	*Rhyacotriton kezeri*
Rough-skinned Newt	*Taricha granulosa*
Bullfrog (Invasive)	*Rana catesbeiana*

The red-legged frog is listed by the US FWS as a species of concern in Oregon[11]. No other state or federally listed species of reptiles are known to occur. However, the long-toed salamander, Copes's giant salamander (sensitive) and tailed frog (sensitive) have been confirmed near or adjacent to the Park. Furthermore, LEWI is within the range of the Olympic clouded salamander which is classified as a sensitive species. The Columbia torrent salamander is also an ODF&W species of concern.

REPTILES
The January 2007 update to LEWI's list of confirmed reptile species includes three species none of which are protected or listed as having an elevated conservation status. Reptiles at LEWI include:

Northern Alligator Lizard	*Elgaria coerulea*
Northwestern Garter Snake	*Thamnophis ordinoides*
Common Garter Snake	*Thamnophis sirtalis*

[11]Species of Concern US Fish and Wildlife Service, Oregon Fish and Wildlife Office Updated November 7, 2005

INVERTEBRATES

No information is available concerning invertebrates at LEWI.

MARBLED MURRELET: Federally listed as Threatened, marbled murrelets have not been surveyed for or confirmed to occur within the Fort Clatsop Unit, although suitable mature Sitka spruce-western hemlock maritime forest nest habitat may exist in limited patches within the park. They have been noted within the vicinity of the park in other units within LEWI. Marbled murrelets are found year-round in late-successional and old-growth forests near the western Oregon coast. They are not common at the mouth of the Columbia River.[12]

BROWN PELICAN: The brown pelican feeds in near-shore waters along the entire Oregon coast and into the Columbia River estuary during the late summer-fall seasons. .

NORTHERN SPOTTED OWL: Historically, the area around LEWI may have served as spotted owl habitat. Historic land practices and current presence of Barred owls have precluded potential presence of spotted owls. Spotted owls are not known to be in or near the LEWI area and would not be expected to occur there.

CHUM SALMON (Lower Columbia River): Federally listed as Threatened, chum salmon have been confirmed downriver and north of the LEWI in Youngs Bay (1990) and in the Youngs River near Wireless Road (2002). The Netul Landing and riverside trail within the park are directly adjacent to habitat for anadromous species. Chum salmon, if present, would be expected to migrate past the site as juveniles during their out-migration from mid-March through May and, upstream as adults from early October through mid-November.

CHINOOK SALMON (Lower Columbia River): Chinook salmon are a Federally listed Threatened species. Their presence in the Lewis and Clark River was confirmed in Oregon Department of Fish and Wildlife survey data from 1948-1996, but none have been recorded since that time.[13] On 4/11/2002 one Chinook smolt was seined in RM1of Hansen Creek (north of the park) during a fish presence survey by salmonid biology students at Astoria High School.

[12] Oregon Breeding Bird Atlas, 1995-1999.
[13]Oregon Department of Fish and Wildlife. Peak Spawning Ground Counts of Fall Chinook in Tributaries of Youngs Bay, 1948-97.

In the Lewis and Clark River, juvenile Chinook salmon out-migration occurs from mid-March through mid-June. Adult Chinook salmon upstream migration occurs from late August through October/November.

OREGON SILVERSPOT BUTTERFLY: This Federally listed as Threatened, the Oregon silverspot butterfly occupied early successional coastal grasslands in Clatsop County containing its host plant, nectar sources and adult courtship areas. Its historic population center on the plains is approximately five miles long and one mile wide, extending from Camp Rilea on the north to the Gearhart Golf Course on the south. Sunset Beach is within the butterfly's historic range (Gearhart Beach to Clatsop Spit). The last documented sighting of this butterfly was in 1998 near Camp Rilea, previously the population stronghold in the county.[14] LEWI does not contain suitable habitat for the butterfly but expansion lands on the Clatsop Plains will include potential habitat areas.

Proposed Species

COASTAL CUTTHROAT (Columbia River): A Federally proposed Threatened Species, cutthroat trout were documented in two of the slough's tributary streams during electrofishing surveys at the project site in April 2005.[15]

Candidate Species

COHO SALMON (Lower Columbia River): Coho salmon have been found in tributary streams of the Lewis and Clark River in recent Oregon Department of Fish and Wildlife fish count data. Coho were documented in two of the park's tributary streams during electrofishing surveys at the project site in April 2005.[15]

Species of Concern

VOLES: The white-footed vole was historically documented within Fort Clatsop NM in 1940[16], but has not been found in more recent park small mammal surveys (1993, 2001). This species is most frequently found in riparian (especially alder) habitat within coniferous forests. Small clearings with forb growth may also provide important habitat. Red tree voles are found along the coast in Sitka spruce forests that contain some Douglas fir. Its diet consists almost exclusively

[14]VanBuskirk, R. 1998. Survey for the presence of the Oregon Silverspot Butterfly, *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae) on the Clatsop Plains in 1998. University of California. The Nature Conservancy, Portland, Oregon.

[15] Brenkman, S. J., S. C. Corbett, and P. Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park.

[16] Csuti, Blair [et al.] *Atlas of Oregon Wildlife: distribution, habitat and natural history*. Corvallis: Oregon State University Press, 1997.

of Douglas fir needles, and to a lesser extent those of western hemlock, spruce and fir.

BATS: Fringed, long-legged and Yuma myotis were mist-netted in coniferous forest habitat near the Fort Clatsop replica during 1995 surveys. Vouchers of these three species were obtained during an earlier 1940 mammal survey of the site. A park mammal survey in 2001 netted a single long-eared myotis at Clay Pit Pond.

Pacific big-eared bats have not been found within the Fort Clatsop Unit. A 1958 Clatsop County record reports a Cannon Beach collection location for the species. West of the Oregon Cascades, the bats are associated with moderate to older coniferous forests. They are reported to be very intolerant of human disturbance.

Silver-haired bats have not been found within the park. These bats occur throughout Oregon except most areas of the Columbia Basin. Their primary habitat is older Douglas fir/western hemlock forests with riparian forage areas. The Netul landing and proposed trail area in the park have the high quality feeding habitat as well as suitable roosting trees.

BAND-TAILED PIGEON: Band-tailed pigeons are present throughout the Columbia River estuary. Their preferred habitats are closed-canopy forest for nesting, open-canopy forests for foraging and mineral sites. They are highly mobile and may travel 32 miles from nest locations to food or mineral sites. Band-tailed pigeons have been documented during linear transect surveys at the project site and elsewhere in the park.[17]

OLIVE-SIDED FLYCATCHER: Olive-sided flycatchers are summer residents in coniferous forests of the Columbia River estuary. They are most frequently found in open coniferous forests with tall snags for perching. The birds have been documented during linear transect surveys at the project site and elsewhere in the park.[17]

PURPLE MARTIN: Purple martins are summer residents in the Columbia River estuary, nesting and feeding primarily in riparian habitats. The birds were documented on the Lewis and Clark River within the park during a 2006 survey and more recently have been noted to be nesting in piling near the park's Netul Landing site.

NORTHERN RED-LEGGED FROG: Numerous observation and voucher records document the occurrence of northern red-legged frogs in the Fort Clatsop

[17] Patterson, Mike. 2007. Migrant and Wintering Bird Inventory Analysis for Properties in Lewis and Clark National Historic Park. NPS: LEWI.

Unit's forest and riparian habitats.[18] LEWI has portions of wetland habitat and it is probable that it contains populations of red-legged frogs.

GREEN STURGEON: Green sturgeons occur in brackish and seawater salinity zones within the Columbia River estuary, but no records document them in the Lewis and Clark River.[19]

RIVER LAMPREY, PACIFIC LAMPREY: River and Pacific lamprey have not been confirmed to exist in streams within Fort Clatsop, although a 2/2002 fish survey of Hansen Creek netted a juvenile lamprey of unknown identity. Alder Creek within Fort Clatsop and the stream at the park's south boundary are potential habitat, as is the Lewis and Clark River.[20]

ADDITIONAL SPECIES: The following animal and plant species have not been documented to occur within the project area: Steller sea lion, western snowy plover, brown pelican, short-tailed albatross, Lewis' woodpecker, mountain quail, tailed frog, Oregon coast steelhead, pink sand verbena, Saddle Mountain bitter cress, Chamber's paintbrush, Willamette Valley larkspur, frigid shootingstar, queen-of-the-forest, Saddle Mountain saxifrage, Henderson sidalcea, bristly-stemmed sidalcea and the moss species Limbella fryei.

Visitor Use and Experience

Current annual visitation averages 200,000 to 275,000. This number of people concentrated in such a small area can have a dramatic impact on the resources of the park. Very little work to date has assessed the degree of this impact. A carrying capacity study is needed, but is outside the scope of this project.

A pulse survey to derive visitor numbers was conducted for Fort Clatsop in 1986.[21] The survey was repeated in 1987 and 1988 to identify trends and add to the information database. The survey provided park management a comprehensive look at who park visitors are, where they come from and why, and an evaluation of park services. Results showed that 60 percent visited the park because of their interest in Lewis and Clark Expedition history, 12 percent had heard about the park's programs, and another 11 percent expressed a passing interest. Approximately 70 percent were first time visitors and more than half lived outside of Oregon; 75 percent were family

[18]Ek, David. A Selection of Rare Wildlife Species, or Species of Concern, within Clatsop County, Oregon. NPS: FOCL, 2/1997.

[19]Bottom, Daniel L., Jones, Kim K., Herring, Margaret J. 1984. Fishes of the Columbia River Estuary: Final Report on the Fish Work Unit of the Columbia River Estuary Data Development Program. Dept. of Fish and Wildlife Research and Development, Corvallis, Oregon.

[20] Bottom, Daniel L., Jones, Kim K., Herring, Margaret J. 1984. Fishes of the Columbia River Estuary: Final Report on the Fish Work Unit of the Columbia River Estuary Data Development Program. Dept. of Fish and Wildlife Research and Development, Corvallis, Oregon.

[21] General Management Plan, Fort Clatsop National Memorial, 1995, Page 79

groups. A considerable portion of visitation is associated with commercial tours provided by charted buses and tour ships (21,300 visits in 2003-04). An informal survey in 1992 indicated that most visitors to the Salt Works had not visited the fort replica site.

Physical limitations on visitor numbers at the Fort Clatsop Unit involve the amount of space available for visitor use including: seating capacity of the auditorium and theater, parking spaces, and the number of picnic tables available. Limitations associated with the capacity of the Fort replica and Visitor Center also exist but are more related with the perception of crowded conditions and what would constitute a quality recreation experience. The potential of damage to park resources from excessive use is also a consideration.

Socioeconomic Factors

A. Socioeconomic Environment

Clatsop County, Oregon, has a population of about 35,600 people. The county population has grown slowly over the past three decades, and this trend is projected to continue. County population is projected to increase to 38,376 in 2010 and 40,018 by 2015 (Portland State University/Oregon Office of Economic Development). The per capita personal yearly income average for the County in 1999 was $23,800, compared to Oregon's at $26,958 and the United States at $28,546. In 1990, the largest employments by industry were retail, consisting of 22.6 percent of all jobs and then manufacturing-durable goods at 9.2 percent. The unemployment rate has gone down considerably from 7.0 percent in 1990 to 4.6 percent in 2000, lower than Oregon's rate of 4.9 percent in 2000 (U.S. Department of Labor, Bureau of Labor Statistics, 2002). The City of Astoria is located six miles east and slightly north of the Fort Clatsop Unit and has a population of around 9,800 people. The population significantly increases from tourists, especially during peak season times. The City of Warrenton, with a population around 4,100 people, is five miles from the Fort Clatsop Unit. The City of Seaside has a population of 5,900 people and is 16 miles south of the Fort Clatsop Unit. In the year 2000, there were 19,685 total housing units in Clatsop County—4,982 were vacant (25.3 percent vacancy rate). Oregon's vacancy rate is 8.2 percent and the U.S. rate is 9.0 percent. The vacancy rate is high in Clatsop County because 3,092 of the vacant housing units, or 15.7 percent of all housing units, are used for seasonal, recreational, or occasional use due to the area's large tourism draw.

The forest industry has long been an important part of the local economy along the Oregon coast. While the management goals associated with forests at the Fort Clatsop Unit have undergone a drastic change there still is significant potential for benefits to the local economy. In addition to being a source for a small number of trees, forest restoration at LEWI will likely rely heavily on the expertise of local forest management firms, thus creating the potential for local jobs.

B. Economic Resources

Located 100 miles west of Portland, Oregon, and 185 miles southwest of Seattle, Washington, this area is easily accessible for day and weekend trips. Peak travel season for the Fort Clatsop area is from June through August and the shoulder seasons are April to May and September to October. Total travel spending has increased over the years by an average annual percentage change of 5.9 percent from 1991 to 2000. In 2000, the total travel spending for Clatsop County was $285.2 million (including air transportation). Clatsop County had the highest number of travel-generated jobs per capita in the state for 1999, with 141 jobs per 1,000 residents, or a total of 4,890 jobs. In 2000, the number of travel-generated jobs increased to 5,260. Local taxes from travel spending generated $3.4 million in Clatsop County in 2000, and state tax revenues were $4.0 million (Dean Runyan Associates, 2002).

Forests at LEWI's Fort Clatsop Unit also represent a valuable economic resource due to their value as a tourist attraction. While it is not in the mission of the NPS to utilize this resource for profit, its inherent value does need to be considered in the impact of management alternatives.

Visual Resources

The LEWI region is characterized by a landscape of forested, hummocky ridges; steep ravines; and low-lying, long, narrow, sandy ridges with intervening streams, lakes, and marshes extending to the Pacific coast. This natural landscape is divided by U.S. 101. The natural landscape first experienced by the Lewis and Clark expedition is changing to an urbanized landscape, affecting local visual resources and regional viewsheds (NPS, 1995).

Visual resources within the project area include a variety of different views that help convey the cultural landscape of the Lewis and Clark expedition. The canoe landing features views of the Lewis and Clark River along with the associated tide flats and river bars. Views throughout much of the Park are limited by vegetation and topography, but the surrounding trees help recreate the atmosphere of being isolated in the forest. The Fort to Sea Trail overlook provides views of the Pacific Ocean and the surrounding forest, however development has begun to intrude on visual resources. Forest restoration activities would add an additional element to visual resources by allowing a greater variety of flora and fauna to thrive increasing the quality of visual resources in the surrounding forest and improve the overall visitor experience.

Infrastructure

Infrastructure pertinent to the project primarily consists of the existing network of forest roads. Currently only the two roads accessible from Perkins Rd. are drivable. Two additional roads leading to the center of LEWI are mostly open but would need some maintenance to allow access. The last two remaining forest roads lead from Weyerhaeuser land into the SE and SW corners of the park. These roads are currently grown over and would require clearing and resurfacing to provide access.

In addition to the existing forest roads, the Fort to Sea trail provides an additional piece of infrastructure that is a potential resource in the project. While the trail is closed to equipment and vehicles, it does provide walking access to many stands.

Air Quality

LEWI 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. It allows a moderate increase in certain air pollutants. The Clean Air Act requires that the National Park Service comply with all federal, state, and local air pollution control laws (Section 118). The state agency that manages air quality related concerns is the Oregon Department of Environmental Quality (DEQ). Clatsop County does not have county level ordinances regarding air pollution: they defer these concerns to the State DEQ.

Air quality monitoring at LEWI is not conducted by the DEQ because coastal winds generally maintain clean air conditions in the area.[22] Under certain conditions, air quality can be occasionally impacted by nearby forest slash burning and from living history fires within the fort replica. Odors from pulp mills in western Washington can infrequently be detected at LEWI, but such impacts are generally of short duration. Increasing industrial and urban development in the surrounding area may cause air quality problems in the future

Cultural Resources

The 120 acres originally designated for the Memorial is listed on the National Register of Historic Places: this listing is for both natural processes and cultural values and includes the Fort replica, wetlands, sloughs, estuary and the spruce/hemlock forests. The 120 acres is zoned "historical" which defines the landscape as a cultural landscape within the National Park Service's management policies.[23]

The Oregon Historical Society began acquiring land for the Memorial in 1901 (approximately 3 acres) and added another two acres in 1928; a bronze marker was then placed at the site. A replica of the Fort was constructed in 1955 by local organizations. This effort helped established the National Memorial. The Fort replica is the focal point for a variety of interpretative and living history programs

[22] General Management Plan, Fort Clatsop National Memorial, 1995, Page 67.
[23] General Management Plan, Fort Clatsop National Memorial, 1995, Page 4.

which are designed to help visitors understand the significance of the Lewis and Clark Expedition and to help them appreciate the role of local Indians in the success the journey.

Additional historical features include:

- A spring located about 50 yards north of the Fort replica; it is believed to have been used by the Expedition members.
- A canoe landing and storage area located about 250 yards south and east of the Fort replica.
- An approximately two and one-half mile trail to the coast used by the Lewis and Clark party for hunting purposes and to access the Salt Works site. There were 31 documented trips from the Fort to the coast by party members. The exact location of the trail has not been determined.
- The Salt Works site used by the Expedition for salt making; approximately three and one-half bushels were made. While the Salt Works site is unattended, it has an interpretive plaque explaining the relationship of the site to the Fort.
- Museum collections of rare books, natural and cultural specimens, and historical photos and prints.

Historically, the Memorial involves more than just the Lewis and Clark occupation. Previous and subsequent use of the site includes Indian occupation, farming, an orchard, home-sites, clay mining and brick firing, a saw mill, mid-19th century post office, dike construction, boat repair, ship landing and wharf, and a stage line. Some of these activities and cultures are included in existing interpretive programs, especially as they relate to describing the landscape changes that have occurred since the Expedition.

Archeological excavations conducted in 1948, 1956-57 and 1961 failed to recover materials connected with the Lewis and Clark or Clatsop occupation of the Fort Clatsop site. There have been no original artifacts found at the Fort site that can be substantiated to have been used by, or historically connected with, the Lewis and Clark Expedition. However, several mid-nineteenth Century artifacts were recovered from the park during these excavations. In 1990, an archaeological research-geophysical survey was conducted to provide an overall view of the immediate Fort area subsurface. While this geo-radar search detected seven possible sub-surface features, no definitive results were reported.

Items in the Memorial's collection consist of period tools, weapons and trade items from both western Native American (primarily Clatsop) and non-native pioneer cultures of the 1800's. Most are archeological objects and specimens. There are also original and replicated items that relate to the Memorial's history and objects portraying highlights of the Lewis and Clark Expedition.

The park’s museum collections consist of:

Biology (plant, bird, fish, and mammal specimens)	Total 750
Archeology (objects recovered from archeological excavations)	Total 3,607
History (period tools and weapons, trade objects, and objects from the 1904-1906 Lewis and Clark Centennial)	Total 1,088
Ethnology (Pacific Northwest tribal objects that include trade beads, baskets, mats, tools, canoes)	Total 974 objects
Archives (rare books, historic photographs, paintings, prints, reports, and other documents)	Total 7,500

While an ethnographic overview and assessment of the Memorial has not been conducted, there is ample ethnographic information available and funding has been requested to conduct the survey. There are many historic documents, early ethnographic studies, books, and other documents available. The survey will gather all of the ethnographic information and compile it into one document.

A 1993 Cultural Landscape Report consolidates landscape recommendations contained in nine separate planning documents, special studies, and technical reports for the Memorial from 1976 to 1993.[24] The report also developed recommendations to delineate an overall scheme for Memorial restoration. The report, along with General Management Plan and the Resource Management Plan, confirms management objectives and establishes a consistent strategy for preservation treatment at the Fort and Salt Works sites.

[24] Cultural Landscape Report, Landscape Recommendations. Fort Clatsop National Memorial. 1993.

Environmental Consequences

This section of the EA forms the scientific and analytic basis for the comparisons of alternatives as required by 40 CFR 1502.14. This discussion of impacts (effects) is organized in parallel with Section on Affected Environment and is organized by resource areas. The No-Action Alternative and each action alternative are discussed within each resource area. To the extent possible, the direct, indirect, short-term, long-term, beneficial, and adverse impacts of each alternative are described for each resource area.

Impairment Analysis- The *National Park Service Management Policies* (NPS, 2001a) requires analysis of potential effects to determine whether or not actions would impair park resources or values.

The fundamental purpose of NPS, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values; and, the park's enabling legislation, as amended, further mandates resource protection. NPS managers must always seek ways to avoid or minimize to the greatest degree practicable, actions that would adversely affect park resources and values.

These laws give NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, so long as the impact does not constitute impairment of the affected resources and values. Although Congress has given NPS the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

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, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute impairment. Impairment may result from NPS activities in managing the park, from visitor activities, or from activities undertaken by concessionaires, contractors, and others operating in the park. Impairment of park resources can also occur from activities occurring outside park boundaries. 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 to opportunities for enjoyment of the park.
- Identified as a goal in the park's GMP or other relevant NPS planning documents.

Cumulative Impacts—The CEQ regulations, which implement NEPA, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative

impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for both the no-action and proposed action alternatives.

Cumulative impacts were determined by combining the impacts of the proposed alternative with potential other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or foreseeable future projects within LEWI and, if necessary, the surrounding region. Reasonably foreseeable cumulative actions include:

- The immediate area of LEWI has been extensively logged in the past and logging operations continue in the region. Connectivity with other forests with late successional characteristics will continue to be a challenge as neighboring land uses intensify.

- Proposed natural resource management actions at LEWI include restoration of forests, wetlands and native species and eradication of invasive species.

- Future development at Astoria Airport is projected to include commercial and industrial activities. Airport officials are lobbying to regain commercial aviation service.

- The North Coast Business Park between U.S. 101 and U.S. Business Route 101 is 270-acres is size, however the only construction to date has been the North Coast Youth Correctional Facility and the Clatsop County animal shelter. The business park is located northwest of LEWI and it is anticipated that development of this site will continue.

- Tourism is becoming a larger segment of the regional economy of northwest Oregon. In addition to several sites associated with the Lewis and Clark expedition, numerous other events and recreational activities are drawing more visitors to the region each year. The increase in tourism results in a corresponding increase in the number of vehicles on regional roads.

Intensity, Duration, and Type of Impact

Evaluation of alternatives takes into account whether the impacts would be negligible, minor, moderate, or major (minor being barely detectable, moderate being clearly detectable, and major being a substantial alteration of historic conditions). Duration of impacts are evaluated based on the short-term or long-term nature of alternative-associated changes on existing conditions. Type of impact refers to the beneficial or adverse consequences of implementing a given alternative. More exact interpretations of intensity, duration, and type of impact are given for each resource area examined.

Professional judgment is used to reach reasonable conclusions as to the intensity and duration of potential impacts.

Methodology:

The environmental consequences of alternatives were estimated through a combination of the following:

Discussions with Park Service resource personnel and observations made onsite during site visits.

Phone and E-Mail communications with Park Service personnel.

Existing resource documents including the General Management Plan and the Resource Management Plan.

Research of existing literature pertinent to the Impact Topics.

Included in the analysis of environmental consequences is a conclusion statement for each alternative by impact area. This conclusion section contains a statement about whether an impairment of park values or resources is likely, or would occur. 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. Each impairment statement in the conclusion sections is based on the analysis discussion for the particular Impact Area.

Consequences by Impact Topic

Geology, Soils, and Topography

Alternative 1(No-Action)- Geology, Soils, and Topography

Analysis- Under the No-Action Alternative there would be no impact to soils from thinning or harvesting activities. However, the existing old forest roads would receive no attention and over time will remain with an increasing potential to fail and cause erosion. Road A is of particular concern as it has several stream crossings that do not meet current standards. Culverts conditions along this road are not visible and if they exist are buried or blocked. Over time roads will re-vegetate but it is unclear how effective this will be at preventing erosion in the long term.

Conclusion- This alternative would likely have minor-short term adverse impacts to soils along existing old forest roads at LEWI due to erosion of road beds.

Long-term impacts could vary depending on the ability of vegetation to re-colonize the road surfaces and stabilize the road prism. Impacts could be moderate, adverse depending on the size and frequency of road failures.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Geology, Soils, and Topography

Analysis- Alternative 2 would begin active forest management at Fort Clatsop. Management under this alternative would include thinning with biomass removal as well as thinning with all trees left on site.

Impacts to soils under this alternative would mainly arise from forest thinning with biomass removal along the two Perkins access roads. Soils in these areas are prone to rutting due to low strength but mitigation efforts should be effective in minimizing impacts. Soils along the northern Perkins access are poorly suited to ground based harvesting equipment and would necessitate uphill cable yarding to limit impacts. Under this alternative, the majority of impacts would be confined to the approximately 160 acres accessible from the two Perkins access roads. The main potential impact would be soil compaction along corridors used by harvesting equipment.

Impacts to soils, geology, and topography from forest restoration activities away from existing forest roads are also a possibility. Impacts from these activities would potentially be some compaction from trees being felled. No equipment will be used in areas away from roads and potential impacts should be minimal.

Additional impacts under this alternative could result from the existing old forest roads in the Park. Increased erosion could result from the use of the Perkins roads for restoration activities. Under this alternative roads would not be decommissioned and as a result would remain with a higher potential to fail and cause erosion. The Perkins access roads would be maintained but other roads would be abandoned. Road A is of particular concern as it has several stream crossings that do not meet current standards. Culverts conditions along this road are not visible and if they exist are buried or blocked. Over time roads will re-vegetate but it is unclear how effective this will be at preventing erosion in the long-term.

Conclusion- Impacts from thinning and biomass removal operations along the Perkins access roads would likely be minor to moderate in the short-term and confined to skid trails and yarding corridors. Additional biomass removal operations in the future would likely only slightly increase impacts as long as yarding is kept to old skid trails. Long-term impacts should be minor due to the speed at which coastal areas re-vegetate. Planting and other mitigation measures will help keep impacts from restoration activities to a minimum.

Impacts from forest thinning without biomass removal should be negligible in the short and long-term.

Short-term impacts of using the Perkins access roads should be minor as long as maintenance and mitigation requirements are followed. Long-term impacts of keeping all old existing forest roads could vary depending on the ability of vegetation to re-colonize the road surfaces and stabilize the road prism. Impacts could be moderate, adverse depending on the size and frequency of road failures.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Geology, Soils, and Topography

Analysis- In addition to the areas proposed in Alternative 2, this alternative would expand forest restoration activities with biomass removal to roads A and B. Under this alternative the primary impact to soils would be from compaction in areas where equipment is being used to fell and yard trees for biomass removal, approximately 410 acres. Potential impacts should be similar to those in Alternative 2. Compaction should be limited to skid trails and yarding corridors. Soils underlying areas with proposed biomass removal are characterized by low soil strength and are prone to rutting. Most of the stands have been thinned previously and old skidder paths can be re-used to limit additional impacts. Cable yarding along Road B will likely be necessary due to steep slopes in the area.

Impacts to soils, geology, and topography from forest restoration activities away from existing forest roads are also a possibility. Impacts from these activities would potentially be some compaction from trees being felled. No equipment will be used in areas away from roads and potential impacts should be minimal.

Alternative 3 also calls for decommissioning of Roads A and B. Decommissioning will involve removing culverts from stream crossings and re-contouring the road surface to match the surrounding slopes. In the short term this could result in moderate, adverse impacts along the old road bed (Luce 1997; Gucinski, Furniss et al. 2000; USFS 2003; Switalski, Bissonette et al. 2004). However, monitoring studies on Redwood National Park and several National Forests have shown that treated roads are less prone to failure, mass wasting, and produce less erosion (Bloom 1998, Madej et al. 2001, (Luce 1997; Gucinski, Furniss et al. 2000; USFS 2003; Switalski, Bissonette et al. 2004).

Conclusion - Impacts from thinning and biomass removal operations along the Perkins access roads, Road A, and Road B would likely be moderate in the short-term and confined to skid trails and yarding corridors. Additional biomass removal operations in the future would likely only slightly increase impacts as long as yarding is kept to old skid trails. Long term impacts should be minor due

to the speed at which coastal areas re-vegetate. Planting and other mitigation measures will help keep impacts from restoration activities to a minimum.

Impacts to soils from forest thinning without biomass removal should be negligible in the short and long-term.

Short-term impacts of using the roads in Alternative 3 should be minor as long as maintenance and mitigation requirements are followed. The Perkins roads are currently open and drivable. Roads A and B would require clearing of fallen trees but should otherwise be drivable without additional surface treatment.

Decommissioning of Roads A and B would likely have moderate, adverse, short-term impacts in the immediate area of old roadbeds due to the amount soil disturbance involved in re-contouring roads. Long-term impacts of decommissioning would likely be moderate and beneficial to geology, soils, and topography as erosion potential and likelihood of road failure is reduced.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Geology, Soils, and Topography

Analysis- In addition to the impacts discussed previously for Alternatives 2 and 3, this alternative would involve potential impacts to soils along Roads C and D. Potential impacts for biomass removal along Roads C and D would be similar to other alternatives. The main difference is the area where disturbance to soil may occur will increase to approximately 515 acres. Biomass removal along Roads C and D would rely on cable yarding due to the steep slopes. The lack of ground yarding operations would limit soil compaction to yarding corridors.

Additional impacts under this alternative would arise from clearing and maintenance of Roads C and D in order to make them accessible. Currently both roads are grown over and would likely need considerable work to resurface them if equipment is to access these areas. Both roads are along ridgelines and potential to impact side slopes during maintenance would be minimal. However, clearing would be a moderate, adverse, short-term disturbance in the area. Decommissioning of Roads C and D upon project completion would mitigate the long-term impacts of re-opening these two roads.

Conclusion- Impacts from thinning and biomass removal operations along the all roads would likely be moderate in the short-term and confined to skid trails and yarding corridors. Additional biomass removal operations in the future would likely only slightly increase impacts as long as yarding is kept to old skid trails. Long term impacts should be minor due to the speed at which coastal areas re-vegetate. Planting and other mitigation measures will help keep impacts from restoration activities to a minimum.

Impacts to soils from forest thinning without biomass removal should be negligible in the short and long-term.

The use and decommissioning of Roads A and B would likely have moderate, adverse, short-term impacts due to the amount soil disturbance involved in clearing, improving, and then decommissioning roads. Long-term impacts of decommissioning would likely be moderate and beneficial to geology, soils, and topography.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Water Quality

Alternative 1 (No-Action)- Water Quality

Analysis- The No-Action alternative would have little direct impact on water resources within the park. Potential indirect impacts to water quality could result from continued erosion along existing forest roads within LEWI. Erosion from logging roads is one of the primary source of sediment associated with forest management (Grace 2002). Erosion impacts on water quality could increase under the No-Action scenario if blocked culverts cause road failure along Road A. Erosion will largely depend on how well vegetation is able to stabilize road surfaces but studies suggest that un-treated roads are still more prone to failure due to disruption of subsurface water flow down slopes (Bloom 1998, Luce 1997).

Conclusion- Under this alternative, adverse short-term impacts from road erosoin will potentially be minor. Long-term impacts could be moderate adverse but would vary in intensity on the frequency, severity, and proximity of road failures to bodies of water.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Water Quality

Analysis- Alternative 2 would have similar impacts to water resources as the No-Action Alternative primarily because old forest roads remain in their current condition. Some minor increase to erosion associated with the Perkins access roads may occur due to increased use during restoration activities.

Direct impacts to water resources would be minimized by utilizing stream buffers that are consistent with or exceed State forest practices regulations. Trees would not be yarded across streams. Some thinning may be done by hand in riparian areas to encourage the development of conifers near streams. No trees would be

removed from buffers to ensure adequate wood available for in-stream habitat needs.

Conclusion- Impacts to water resources would primarily be indirect and would result from road related erosion. Adverse short-term impacts from increased road use will potentially be minor to moderate. Long-term impacts could be moderate adverse but would vary in intensity depending on the frequency, severity, and proximity of road failures to bodies of water.

Direct impacts of restoration activities should be negligible in the short term, and potentially beneficial in the long-term.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Water Quality

Analysis- Like the previous alternatives, indirect impacts to water resources would most likely result from erosion related to forest roads. Under this alternative, additional impacts resulting from utilizing Roads A and B would likely be minor since both are currently drivable and would not require extensive disturbance to re-open. Decommissioning of roads A and B could cause additional erosion in the short-term as stream crossings are removed and the roadbed re-contoured. Decommissioning, particularly Road A, in the long-term should help restore natural water flows down slopes and limit the potential for future road related landslides (Bloom 1998, Luce 1997).

Direct impacts from restoration activities are possible under this alternative. However, mitigation measures such as buffers, and preventing trees from being yarded across streams should keep impacts to a minimum.

Conclusion- Indirect adverse short-term impacts from using the Perkins access roads, and Roads A and B should be minor as all would require minimal additional maintenance to limit erosion. Decommissioning of Roads A and B could have moderate, adverse impacts in the short-term. Over the long-term impacts would be beneficial as erosion potential would be greatly reduced and historic flow in small channels is restored. Impacts from restoration activities should be minor to negligible as they would take place away from water resources.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Water Quality

Analysis- Impacts under this alternative would be similar to Alternative 3 but would include impacts associated with additional road use and biomass removal along Roads C and D. Direct impacts of biomass removal and other restoration

activities would likely be minimal as mitigation measures such as buffers, and preventing trees from being yarded across streams should keep impacts to a minimum.

Additional direct impacts under this alternative could occur from clearing Roads C and D. Impacts should be limited somewhat since both roads lack stream crossings and are located along broad ridge tops. However clearing and resurfacing these roads will involve more disturbance and the potential to produce sediment during heavy precipitation events. Decommissioning Roads C and D after project completion should prevent long term adverse impacts as natural water flows are restored and re-vegetation prevents further erosion potential.

Conclusion- Indirect adverse short-term impacts from using the all forest roads should be minor to moderate since all roads all would require minimal additional maintenance to limit erosion. Decommissioning of Roads A and B could have moderate to major adverse impacts in the short-term but over the long-term would be beneficial as erosion potential would be greatly reduced and historic flow in small channels is restored. Clearing and eventual decommissioning of Roads C and D would have minor to moderate adverse short term impacts due to increased run off and erosion. Long-term impacts of decommissioning would be moderately beneficial but would at best be marginally better than leaving both C and D un-used.

Impacts from restoration thinning activities should be minor to negligible in the short term as they would take place away from water resources. Thinning should have a beneficial impact in the long-term as downed wood and larger trees develop and increase the filtering capabilities of forest stands (source).

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Floodplains and Wetlands

Alternative 1 (No-Action)- Floodplains and Wetlands

Analysis- The No-Action Alternative would not involve management activities in or near wetlands and floodplains. Direct impacts of continuing to implement existing management would likely be minimal.

Indirect impacts under this alternative may result from road erosion and failures. The intensity of impacts would depend on the severity and proximity of road failures to wetlands. Most wetland and floodplain resources at LEWI are located away from forest roads and vegetated slopes should mitigated erosion impacts to wetlands. The one exception would be along Road A where road failures at stream crossings could wash into wetlands.

Conclusion- Overall impacts to floodplains and wetlands from the No-Action Alternative should be minor in the short and long-term. Impacts from stream crossing failures along Road A would have moderate, adverse impacts in the short-term. Long-term impacts should be minor to moderately adverse as local systems recover.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Floodplains and Wetlands

Analysis- Indirect impacts from roads would be similar to Alternative 1. Direct impacts from biomass removal and forest restoration treatments under this alternative would likely be negligible or minor. Biomass removal would not take place in or around wetlands and no logs would be yarded across wetlands. Other forest restoration activities would take place around wetlands but would mainly involve creating snags, CWD, and planting. These activities would have a negligible impact in the short-term, but in the long term will help increase the biodiversity and function of wetlands at LEWI.

Conclusion- Overall, adverse impacts to floodplains and wetlands from Alternative 2 should be minor in the short and long-term. Impacts from stream crossing failures along Road A could have moderate adverse impacts in the short-term. Long-term impacts should be minor to moderately adverse as local systems recover. Forest restoration and biomass removal should have negligible to minor short term adverse impacts but beneficial impacts in the long-term.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Floodplains and Wetlands

Analysis- Indirect impacts from roads would be similar to previous alternatives. However, under Alternative 3 Road A would be decommissioned after forest restoration activities are complete. Removal of stream crossings along Road A could have moderate adverse short-term impacts due to increase erosion during the removal process. However the controlled removal would allow some mitigation of erosion and would likely result in less sediment delivery to wetland resources compared to an uncontrolled failure in the future.

Increased biomass removal and other forest restoration actions under this alternative would likely have negligible impacts to wetland resources as these actions will take place away from wetland areas.

Conclusion- Impacts to wetlands at LEWI would primarily be minor and adverse in the short-term. Road A decommissioning could have moderate adverse short-term impacts. Long-term impacts under Alternative 3 should primarily be beneficial as the risk of road failure is reduced. Direct impacts from forest

restoration and biomass removal should be negligible to minor adverse in the short-term and beneficial in the long-term.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Floodplains and Wetlands

Analysis-Indirect impacts from roads would be similar to previous alternatives. However, under Alternative 4 Road A would be decommissioned after forest restoration activities are complete. Removal of stream crossings along Road A could have moderate adverse short-term impacts due to increase erosion during the removal process. However the controlled removal would allow some mitigation of erosion and would likely result in less sediment delivery to wetland resources compared to an uncontrolled failure in the future. Additional removal of roads B, C, and D would likely have negligible impacts to wetlands as all are located away from wetland resources.

Increased biomass removal and other forest restoration actions under this alternative would likely have negligible impacts to wetland resources as these actions will take place away from wetland areas.

Conclusion- Impacts to wetlands at LEWI would primarily be minor and adverse in the short-term. Road A decommissioning could have moderate adverse short-term impacts. Other road decommissioning activities would likely have negligible to minor adverse short term impacts. Long-term impacts under Alternative 4 should primarily be beneficial as the risk of road failure is reduced. Direct impacts from forest restoration and biomass removal should be negligible to minor adverse in the short-term and beneficial in the long-term.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Ecological Resources

Discussion of impacts to Threatened and Endangered Species follows in attached Biological Assessment

Alternative 1 (No-Action)- Ecological Resources

Analysis- Under the No-Action Alternative vegetation management activities would not take place and there would be no direct impacts to Park ecological resources. However, forgoing the opportunity to thin forests now will severely limit the development of a more diverse overstory and understory. Leaving crowded stands un-treated will also increase the risk of windthrow over time as trees continue to grow taller as they compete for light. Wildlife habitat quality will continue to be poor for a number of species due to the lack of large trees, snags, and downed logs.

Conclusion- While no direct impacts would result from this alternative, the overall impact would be moderate, adverse in the long-term as forests would remain in their current condition of poor habitat quality and increasing windthrow risk over time.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Ecological Resources

Analysis- Actions under Alternative 2 could impact park ecological resources. In the short-term, disturbance from active management could cause temporary flushing of wildlife from active project areas. Flushing would likely be most significant in areas where biomass removal is planned due to the noise associated with logging equipment. However, under this alternative biomass removal would only occur on approximately 160 acres and would leave much of the park with much less human intrusion. Other thinning activities would likely cause less disruption to wildlife because they would not involve machinery. In the long-term, thinning and other restoration treatments will have a beneficial impact as more diverse forests with a full complement of snags and downed logs provide high quality habitat for a range of species.

Damage to existing vegetation is another impact that could result from thinning and biomass removal activities. Impacts to shrubs and other understory vegetation would likely be moderately adverse in the short-term. Given the limited amount of existing understory vegetation and the productivity of the sites in the area, overall adverse long-term impacts to understory vegetation should be negligible. Long-term impacts will be beneficial as the increased light from thinning will encourage understory development. Damage to remaining trees during thinning will have a negative impact on damaged individuals but mitigation measures and project planning should limit impacts to minor adverse. Other vegetation such as mosses would be more sensitive to ground disturbance but impacts should still be minor as skips and reserve areas will provide areas where these resources will be protected.

Invasive vegetation could increase as a result of opening up growing space during thinning. This will be more likely in biomass removal areas as machinery can act as a vector for invasive species. However results from other thinning experiments suggest that invasive species decrease over time (Carey et al 1999).

Insects and forest diseases could potentially increase due to the tree damage and trees left on the ground after thinning operations. However, impacts from these disturbance agents have been minor in nearby forests managed by the Oregon Department of Forestry (Dan Goody, ODF personal communication).

Wind will continue to be the primary disturbance agent in these forest and adverse impacts to LEWI forests could result. In the short-term thinning will increase

wind damage susceptibility slightly as trees must adapt to more open growing conditions. However this can be mitigated by using lighter treatments spread over several years. Overall, impacts will be beneficial in the long-term as treated stands will be more windfirm than untreated stands as time progresses.

Conclusion- Overall, adverse impacts should be minor and limited to the short-term in the immediate area of active projects. Long-term impacts will be beneficial to park ecological resources as restoration treatments reintroduce essential habitat elements and encourage forest development.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Ecological Resources

Analysis- Impacts under Alternative 3 will be similar to those under Alternative 2. The main differences are that Alternative 3 increases the area where biomass removal is a management option and includes road decommissioning. An increase in the area treated with biomass removal will increase the area disturbed by machinery during removal activities resulting in slightly greater impacts compared to Alternative 2. However, projects should still be sufficiently separated both temporally and spatially to keep impacts to minor adverse. Long-term impacts would be beneficial as forest treatments would accelerate forest development and increase habitat quality.

Road decommissioning following restoration treatments will cause additional temporary disturbance in along roads. Adverse impacts should still be minor due to the limited duration of these activities and mitigation measures will increase the rate of vegetation recover. In the long-term, decommissioning will reduce habitat fragmentation and prevent future unauthorized access from disturbing wildlife in the interior of the Park.

Conclusion- Overall impacts would be minor adverse in the short-term in the immediate area of active projects. Long-term impacts would be beneficial as restoration treatments will increase windfirmness and increase habitat quality.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Ecological Resources

Analysis- Impacts under Alternative 4 would be similar to Alternatives 2 and 3. However, the use of roads C and D could increase the potential for some additional impacts. Both of these roads could involve considerably more maintenance to make them useable thus increasing the amount of traffic in these areas. In addition, the area around road D is utilized heavily by elk since it is one of the more isolated portions of the Park. Disturbance in this area may have additional impacts due to the presence of management activities in other areas of

the Park leaving less room for species to temporarily occupy to avoid human contact. As a result impacts to Park ecological resources under this alternative could potentially increase to moderate, adverse in the short-term. However, like the previous alternatives the long-term impacts will be beneficial as habitat quality is improved.

Conclusion- Moderate, adverse short-term impacts to ecological resources resulting from increased disturbance across the Park. Beneficial, long-term impacts as restoration improves habitat quality and reduces wind risk to forest stands.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Visitor Use and Experience + Sound impacts

Alternative 1 (No-Action)- Visitor Use and Experience + Sound impacts

Analysis- Under the No-Action Alternative short-term impacts to visitor use and experience would be negligible. Long-term impacts resulting from no forest restoration treatments could be an extended period of time where visitors would not be able to see forests with greater species diversity. Additional adverse impacts could arise if dense stands become increasingly prone to windthrow and large blowdown patches occur. Severity of blowdown impacts would depend on proximity to areas accessible to visitors but could be moderate to major if areas near trails are affected.

Conclusion- No-action would likely have negligible short term impacts to visitor use and experience. Long-term impacts would depend on location and severity of blowdown but could be moderate, adverse if trails or other visitor resources are affected.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Visitor Use and Experience + Sound impacts

Analysis- Impacts to visitor use and experience under Alternative 2 could arise from thinning operations and increased potential for windthrow in the short-term. Impacts from thinning and biomass removal operations would primarily take place away from areas accessible to visitors. However, noise from restoration activities could adversely impact visitor use and experience. Quieter alternatives, such as girdling trees with hand tools, could be used in areas near trails. Due to the small size of the Park, nearby activities such as logging, construction, and highway traffic already intrude on the visitor experience. Proposed actions would only be a temporary incremental addition to this background noise.

Another potential disruption to the visitor experience could result from temporary closures around project areas for safety concerns. Impacts from safety closures would be short-term and will likely be rare since project areas are not accessible to visitors.

Thinned forest stands could be more susceptible to windthrow in the short-term as trees adapt to growing with more wind exposure. Increased growth made possible by thinning should decrease the risk of catastrophic windthrow in the long-term as trees are better able to support themselves. Windthrow could cause temporary closures to trails if fallen trees pose a safety concern or block access.

Conclusion- Sound intrusions would be one primary adverse impact to visitor use and experience under Alternative 2. Impacts from sound would be adverse given the purpose of the park but could be limited to the short-term and minimized by adopting mitigation measures such as girdling by ax or handsaw instead of using chainsaws.

Impacts to visitor experience from safety closures would be rare and short-term.

Visitor use could also be impacted by increased windthrow in the short-term. Short-term impacts could moderate adverse if they occur near trails or other accessible area. Long term impacts should be beneficial as thinned stands will be more windfirm than untreated areas.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Visitor Use and Experience + Sound impacts

Analysis- Like Alternative 2, the primary impacts to visitor use and experience could result from noise impacts, and windthrow risks. Under this alternative thinning with biomass removal would be possible over a larger portion of the Park increasing the potential for intrusion of human caused sounds on the visitor experience. Quieter alternatives, such as girdling trees with hand tools, could be used in areas near trails.

Another potential disruption to the visitor experience could result from temporary closures around project areas for safety concerns. Impacts from safety closures would be short-term and will likely be rare since project areas are not accessible to visitors.

Thinned forest stands could be more susceptible to windthrow in the short-term as trees adapt to growing with more wind exposure. Increased growth made possible by thinning should decrease the risk of catastrophic windthrow in the long-term as trees are better able to support themselves. Windthrow could cause temporary closures to trails if fallen trees pose a safety concern or block access.

Conclusion- Although Alternative 3 does increase the amount of biomass removal possible, impacts to visitor use and experience should be similar to Alternative 2. Minor short-term adverse impacts from noise would likely be one intrusion on visitor experience. Windthrow impacts could be minor to moderate in the short-term but should decrease in the long-term as treated forests become more windfirm.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Visitor Use and Experience + Sound impacts

Analysis- Alternative 4 again expands the area of the LEWI where restoration with biomass removal is possible. Impacts to visitor use and experience should be similar to those in previous action alternatives but would potentially be slightly more disruptive as biomass removal operations would have to be spread out over more years. However, mitigation measures outlined for previous alternatives should be able to keep noise intrusions to a minimum.

Another potential disruption to the visitor experience could result from temporary closures around project areas for safety concerns. Impacts from safety closures would be short-term and will likely be rare since project areas are not accessible to visitors.

Thinned forest stands could be more susceptible to windthrow in the short-term as trees adapt to growing with more wind exposure. Increased growth made possible by thinning should decrease the risk of catastrophic windthrow in the long-term as trees are better able to support themselves. Windthrow could cause temporary closures to trails if fallen trees pose a safety concern or block access.

Conclusion- Sound impacts from thinning activities could have minor adverse effects in the short and intermediate-term. Long-term impacts of sound under this alternative should be negligible.

Impacts from safety closures during active projects would be minor overall due to the limited amount of times closures will be needed.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Visual Resources

Alternative 1 (No-Action)- Visual Resources

Analysis- The No-Action Alternative should have negligible impacts to visual resources at Fort Clatsop. Forest would likely remain in their current state for an extended period with few perceivable changes.

Negative impacts to visual resources could indirectly arise in the event of largescale blowdown or other large disturbance. No-action would likely increase the possibility of blowdown over time especially in young dense stands where trees are unable to develop the diameter growth needed to resist strong winds (Oliver and Larson 1996).

Conclusion- Short-term impacts to visual resources under the No-Action Alternative should be minor. However, no-action would leave many stands at higher risk of windthrow in the future resulting in moderate to major adverse impacts depending on the location and severity of wind damage.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Visual Resources

Analysis- Direct impacts from forest restoration under Alternative 2 would primarily be from disturbance to vegetation caused by thinning and biomass removal. Impacts would include the sight of crushed vegetation, dead trees, downed logs, debris, and cut stumps. Mitigation efforts and planting could help to minimize visual disturbances. Still most visual impacts should be short-term as the increased light after thinning allows more re-growth of vegetation. Most visual impacts would be along areas of the Fort to Sea Trail that are near stands accessed by the Perkins access roads.

Additional impacts to visual resources could arise from windthrow in visible areas. Short-term windthrow risk would increase slightly in treated areas as trees adapt to additional wind exposure. However, long-term risk of windthrow impacts to visual resources should decrease as treated stands should be better able to resist wind damage (Oliver and Larson 1996).

Planting activities may also cause a visual disruption since tree shelters or other herbivory control methods could be required to successfully establish some species. Potential impacts could either be eliminated by limiting these activities to areas away from visitor access or by incorporating them into visitor education.

Conclusion- Direct visual impacts of actions under Alternative 2 would likely be minor to moderate adverse in project areas. However, visual impacts should be confined to the short-term. Long-term impacts should primarily be beneficial as vegetation grows back and forests mature.

Visual impacts due to wind could occur under any alternative. Treated stands may have a short-term increase in susceptibility to wind damage. Risk of windthrow should decrease over time compared to the No-Action Alternative.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Visual Resources

Analysis- Visual impacts under Alternative 3 would be similar to Alternative 2 in spite of increased biomass removal and road removal. This is because the majority of the activities added in this alternative would occur away from areas visible to visitors. Like Alternative 2, direct impacts to visual resources would primarily result from vegetation disturbance during restoration activities. Impacts would be confined to the short-term as vegetation is expected to rapidly grow back.

Indirect impacts from wind disturbance would also be similar to Alternative 2 with an initial increase in wind risk due to treatment, but an overall decrease in risk in the long-term.

Conclusion- Actions under this alternative could have a short-term adverse impacts on visual resources that would be primarily confined to active project areas. Visual impacts should dissipate rapidly and the long-term benefits should be positive. An initial period of increased windthrow risk may result in additional visual impacts if trees are blown over, however in the long-term visual impacts from windthrow should decrease.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Visual Resources

Analysis- Overall impacts to visual resources under Alternative 4 should be similar to previous alternatives with respect to disturbance and initial short-term increase in wind risk. Alternative 4 may have some additional impacts as hill slopes accessible from Road D could be visible from the Fort to Sea Trail and overlook. Visual impacts could include visibility of cable yarding operations as well as gaps and yarding corridors left after treatment. Visibility of operations would be short-term, lasting only during project implementation. Yarding corridors would be narrow but from afar would still appear as rows. These would blur over time as trees fill in the gaps.

Conclusion- Like previous alternatives impacts to visual resources could be minor to moderate adverse in project areas but should be confined to the short-term as vegetation recovers. Risk of windthrow impacting visual resources may increase slightly in the short-term but decline over time. Visual impacts of

biomass removal along Road D may be slightly more apparent due to the view from the Fort to Sea Trail, however they should be minor in the long-term.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Socioeconomic Factors

Alternative 1 (No-Action)- Socioeconomic Factors

Analysis- Taking no action would leave the Fort Clatsop Unit unchanged and would not impact the socioeconomic condition of the Park or local economy in the short term. Tourism is expected to increase in the future, and the slowly developing forests that would be present in this alternative may limit some of the Park's potential to attract visitors. However, this may be overcome by an increase in the local population and as development increases the rarity of other local forest recreation opportunities.

Conclusion- Impacts to local socioeconomic factors under this alternative should be negligible in the short-term. Long-term impacts could be adverse but should be minor.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Socioeconomic Factors

Analysis- Alternative 2 could have more impacts to local socioeconomic factors due to labor needs to accomplish forest restoration and biomass removal. Biomass removal under this alternative would involve approximately 160 acres and could potentially involve several contracts to conduct thinnings as the Park currently does not have the personnel to carry out this activity. Biomass removed during these activities would primarily be of small diameter and the economic impacts of the material itself would probably be minor.

Forest restoration without biomass removal could be carried out at some level by Park vegetation crews. However, the scope and extended timeframe of forest restoration activities would likely necessitate reliance on contracting local forest management firms for additional assistance.

Conclusion- Socioeconomic impacts of Alternative 2 would likely be beneficial but minor in the short and long-term.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Socioeconomic Factors

Analysis- Alternative 3 would expand the area of the Park where biomass removal would be an option and thus could have more impact to local socioeconomic factors. Biomass removal under this alternative would involve greater potential for contracts available to local forestry firms. The ultimate amount of wood potentially removed from the approximately 410 acres could have short term beneficial impacts to local mills. These benefits would most likely be short-term since biomass removal would be more effective as a restoration technique in the near-term.

Restoration without biomass removal would still take place across much of the Park under Alternative 3. Some of these activities could be accomplished by Park Service crews, but given the size of FOCL and the congruent boundary expansion there is considerable potential for reliance on contracts with local forestry firms.

Alternative 3 would also begin to address decommissioning problem forest roads within the Park. Roads A and B would both be decommissioned under this alternative. Depending on the degree of decommissioning needed, costs could be from $1,000 to $11,000 per mile based on Forest Service figures[25].

Conclusion- Socioeconomic impacts under Alternative 3 would most likely be beneficial in the short and intermediate-terms. Long-term impacts beyond the 20 year scope of this plan are uncertain, but would most likely be beneficial but minor given the short-term nature of individual projects spread over the life of the plan.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Socioeconomic Factors

Analysis- Alternative 4 would again increase the opportunity for benefits to the local economy through biomass removal and forest road contracts. Biomass removal would be possible on approximately 515 acres but like previous alternatives, benefits to the local economy would be limited to the near-term due to the limited timeframe when biomass removal would be most effective in restoration.

Restoration without biomass removal would still take place across much of the Park under Alternative 4. Some of these activities could be accomplished by Park Service crews, but given the size of the Fort Clatsop Unit there is considerable potential for reliance on contracts with local forestry firms.

Road use and decommissioning would be highest under this alternative. Contracts for road clearing and maintenance would be needed in order to make Roads C and D useable again. Decommissioning of forest roads A, B, C, and D would also likely involve considerable expenditures depending on the degree of

[25] http://www.wildlandscpr.org/WCPRpdfs/FSDecom.pdf

decommissioning. Costs could range from $1,000 to $11,000 per mile and would likely rely on contracts to accomplish the work.

Conclusion- Socioeconomic impacts under Alterative 4 would mainly stem from the increase in biomass removal and road decommissioning. Impacts would likely be beneficial to the local economy in the short and intermediate-term. Long term impacts would likely be beneficial but minor given the relatively short timeframe of actions outline in the plan.

Impairment- There would be no impairment of LEWI's resources or values from this alternative.

Infrastructure

Alternative 1 (No-Action)- Infrastructure

Analysis- The No-Action Alternative would involve no changes to current management practices at LEWI. Maintenance will continue and there should be little impact to existing useable Park infrastructure. Over time old abandoned roads will continue to deteriorate which could increase the difficulty of using roads should management directions change in the future.

Conclusion- Negligible short-term impacts. Primary long-term impact will depend on whether forest roads will be involved in future management options.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Infrastructure

Analysis- Alternative 2 would not involve changes to exiting Park infrastructure. Impacts in the short-term would be negligible and may include slightly increased wear on the Perkins access roads. In the long term, abandoned roads would be more difficult to re-open in the future.

Conclusion- Negligible short-term impact to Park infrastructure. Long-term impacts would be minor and mainly be limited to increasing the cost of road treatment in the future.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Infrastructure

Analysis- Short-term impacts to Park infrastructure would primarily be an increase in the useable road network. Some increased in wear along roads would occur as a result of use.

Decommissioning roads A and B would reduce road infrastructure in the Park. Ease of re-establishing these roads would depend on the degree of decommissioning.

Conclusion- Short-term impacts would be minor, however decommissioning roads A and B would reduce road infrastructure available for future management.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Infrastructure

Analysis- Like previous alternatives short-term impacts would mainly stem from increase wear on roads from use. This alterative would involve temporarily making all available forest roads in the Park useable, but would also eventually decommission all except the two Perkins access roads. Depending on the degree of decommissioning, this could permanently reduce road infrastructure at the Park.

Conclusion- Short-term impacts would be a temporary increase in useable Park roads with more potential for wear. In the long-term this alternative would essentially permanently reduce road infrastructure to just the two Perkins accesses.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Air Quality

Alternative 1 (No-Action)- Air Quality

Analysis-The No-Action Alternative would have no foreseeable additional impacts on air quality.

Conclusion- Impacts would be negligible to non-existent. There should be no foreseeable cumulative impacts to air quality resulting from this alternative.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Air Quality

Analysis- Active management under Alternative 2 would involve actions that could impact local air quality. Equipment use during biomass removal and thinning treatments would likely produce some additional exhaust resulting in localized reduction in air quality. These impacts would only be felt during active project periods and would dissipate quickly. The existing Fire Plan does allow prescribed burning to treat fuels accumulations however it currently only applies to the original 125 acres of Fort Clatsop.

Conclusion- Restoration treatments involving thinning and biomass removal could result in minor adverse impacts that would generally be confined to the project area. Impacts from these activities would only be felt in the short-term and would not likely contribute to cumulative impacts on local air quality.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Air Quality

Analysis- Like Alternative 2 short-term localized impacts to air quality could arise from equipment use during restoration treatments. Impacts would be minor and occur only during periods of active projects.

Conclusion- Restoration treatments involving thinning and biomass removal could result in minor adverse impacts that would generally be confined to the project area. Impacts from these activities would only be felt in the short-term and would not likely contribute to cumulative impacts on local air quality.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Air Quality

Analysis- Like the previous action alternatives, impacts to air quality under Alternative 4 could result from equipment used in thinning and biomass removal. However, impacts would most likely be minor and last only during active projects.

The existing Fire Plan does allow prescribed burning to treat fuels accumulations but only within the original Park boundary. Future revisions to the Fire Plan could allow prescribed burning in other areas of the Park. Impacts from prescribed burning would potentially be moderate to major adverse in the short-term.

Conclusion- Restoration treatments involving thinning and biomass removal could result in minor adverse impacts that would generally be confined to the project area. Impacts from these activities would only be felt in the short-term and would not likely contribute to cumulative impacts on local air quality.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Cultural Resources

Alternative 1 (No-Action)- Cultural Resources

Analysis- Alternative 1 would not active management of vegetations within the Fort Clatsop Unit and there would be no impacts to park cultural resources.

Conclusion- No impact to cultural resources.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 2- Cultural Resources

Analysis- Under Alternative 2 active management would be used to restore forests in the Fort Clatsop Unit. Restoration activities in this alternative would involve biomass removal on approximately 160 acres and less intensive thinning across the rest of the unit. Impacts to cultural resources are not anticipated because proposed actions will take place in areas that have previously been disturbed by commercial logging. Significant ground disturbance such as road building or road removal will not take place under this alternative.

Conclusion- Impacts to cultural resources would be unlikely given the past disturbance history of the area. Additional impacts by proposed actions would be negligible to minor.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 3- Cultural Resources

Analysis- Alternative 3 would involve active management including road decommissioning and biomass removal on approximately 410 acres. Like the previous alternative, proposed actions would be occurring in areas that have already been extensively disturbed by previous land practices and there is little potential for further damage to cultural resources. Thinning activities would have negligible impacts to cultural resources since minimal ground disturbance would be involved. Road decommissioning would involve ground disturbance but only in the immediate area of the existing roadbed.

Conclusion- Impacts to cultural resources would be unlikely given the past disturbance history of the area. Additional impacts by proposed actions would be negligible to minor.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

Alternative 4- Cultural Resources

Analysis- Like the previous alternatives, Alternative 4 would only involve areas that have already been previously disturbed as a result of commercial logging. Actions under this alternative would be unlikely to impact cultural resources giving the limited amount of ground disturbance involved. Alternative 4 does call

for decommissioning of several old forest roads in the Park but impacts would be limited to the immediate area of the roadbed. Thinning and biomass removal activities will likely have negligible impacts to cultural resources due to the limited amount of soil disturbance these actions might have.

Conclusion- Impacts to cultural resources would be unlikely given the past disturbance history of the area. Additional impacts by proposed actions would be negligible to minor.

Impairment- There would be no impairment of LEWI's resources or values from this alternative

References

Agee, James K. 1993. *Fire ecology of Pacific Northwest forests*. Washington, D.C.: Island Press.

Beese WJ. 2001. Windthrow: Monitoring of alternative silvicultural systems in montane coastal forests. in S.J. Mitchell aJR, ed. In S.J. Mitchell, and J. Rodney (comp.). *Proceedings of a workshop on windthrow assessment and management in British Columbia. Richmond, BC*: BC Forestry Continuing Studies Network [available on line http:www.for.gov.bc.ca/HFD/library/documents/windthrow.pdf].

Bloom A. 1998. *An assessment of road removal and erosion control treatment effectiveness: a comparison of 1997 storm erosion response between treated and untreated roads in Redwood Creek Basin, northwestern California* (unpublished MS thesis). Humbolt State University, Arcata, CA.

Boeckstiegel, L., Gersonde, R., Richards, B., LaBarge, A., and Nickelson, S. 2005. *700 Road Forest Habitat Restoration Project Site Management Plan*. Cedar River Municipal Watershed. Seattle Public Utilities.

Brenkman, Samuel J., Corbett, Stephen C., and Kennedy, Philip R.. 2007. *Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon*. National Park Service, Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.

Carey AB, Thysell DR, Brodie AW. 1999. *The forest ecosystem study: background, rationale, implementation, baseline conditions and silvicultural assessment*. in Service UF, ed: USDA Forest Service, Portland, OR.

Chan, S. S., D. J. Larson, et al. (2006). Overstory and understory development in thinned and underplanted Oregon Coast Range Douglas-fir stands. *Canadian Journal Of Forest Research-Revue Canadienne De Recherche Forestiere* 36 (10): 2696-2711.

Churchill, Derek. 2003. *The Emerging Consensus for Active Management in Young Forest*. Rural Technology Initiative Fact Sheet #24. [http://www.ruraltech.org/pubs/fact_sheets/fs024/index.asp].

David Evans and Associates (DEA), Inc. 2000. *Wetland Delineation Report: North Coast Business Park, Warrenton, OR* Prepared for Clatsop County, OR.

Deal, RL., Tappeiner, JC. 2002. The effects of partial cutting on stand structure and

growth of western hemlock-Sitka spruce stands in southeast Alaska. *Forest Ecology and Management 159*: 173-186.

Deal RL, Tappeiner JC, Hennon PE. 2002. Developing silvicultural systems based on partial cutting in western hemlock-Sitka spruce stands of southeast Alaska. *Forestry* 75: 425-431.

Deal RL, Hennon PE, Orlikowska H, D.V. DA. 2004. Stand dynamics of mixed red alder – conifer forests in southeast Alaska. *Canadian Journal of Forest Research*. 34: 969-980.

DeBell, DS., Curtis, RO., Harrington, CA., Tappeiner, JC. 1997. Shaping stand development through silvicultural practices. Pages 141-150 in Kohm KA,

Franklin JF, eds. *Creating a forestry for the 21st century: the science of ecosystem management*. Washington, D.C.: Island Press.

Edmonds, RL., Agee, JK., R.I. G. 2000. *Forest Health and Protection*. McGraw-Hill Company.

Franklin, J.F. and Spies, T.A. 1991. Ecological definitions of old-growth Douglas-fir forests. Pg. 61-69 in: Ruggiero, L.F., Aubry, K.B., Carey, A.B., and Huff, M.H. 1991. *Wildlife and Vegetaion of Unmanaged Douglas-fir Forests. US Dept. of Agriculture, Forest Service*. Pacific Northwest Research Station, Portland, OR. General Technical Report PNW-GTR-285.

Franklin, J.F., and Spies, T.A. 1991. Composition, function, and structure of old-growth Douglas-fir forests. Pg. 71-80 in: Ruggiero, L.F., Aubry, K.B., Carey, A.B., and

Franklin, J.F., Spies, T.A., and Van Pelt, R. 2005. Section 1: Report by the Old Growth Definition Committee. Washington Department of Natural Resources.

Franklin, J. F., Spies, T. A., et al. (2002). Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forests as an example. *Forest Ecology and Management* 155(1-3): 399.

Garman, SL., Cissel, JH., Mayo, JH. 2003. *Accelerating development of late-successional conditions in young managed Douglas-fir stands: a simulation study*. Gen. Tech. Rep. PNW GTR 557, 57p.: USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

Grace, JM III. 2002. Sediment Movement from Forest Road Systems - Roads are chief among the factors contributing to erosion and stream sedimentation on forested land. New approaches to control sediment transport may be paramount to reducing the impact of forest road systems on downslope streams. *Resource : Engineering & Technology for a Sustainable World*. 9, 13.

Graham, R.L.L., *The Biomass, Coverage, and Decay Rates of Dead Boles in Terrace Forests, South Fork Hoh River, Olympic National Park.* Unpublished Report.

Grier, C.C. 1978. *A Tsuga heterophylla-Picea sitchensis ecosystem of coastal Oregon: decomposition and nutrient balances of fallen logs*. *Canadian Journal of Forest Research*. 8:198:206.

Gucinski, H., M. Furniss, et al. (2000). *Forest Roads: A Synthesis of Scientific Information*. U.S. Forest Service**:** 117 pgs.

Harrington, CA., Roberts, SD., Brodie, LC. 2005. Tree and understory responses to variable-density thinning in western Washington. Pages 97-106 in Peterson CE, Maguire DA, eds. *Balancing ecosystem values: innovative experiments for sustainable forestry: Proceedings of a conference.* Portland, OR: Gen. Tech. Rep. PNW-GTR-635, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Hennon, PE., Loopstra, EM. 1991. *Persistence of western hemlock and western redcedar trees 38 years after girdling at Cat Island in Southeast Alaska*. U.S.D.A. Forest Service, Pacific Northwest Research Station PNW-RN-507.

Holmberg P, Aulds R, Biesecker R. 2006. *Thinning forest stands, Westside: An interactive self-study and reference pamphlet.* Washington State Department of Natural Resources, Silviculture & Regeneration, Land Management Division.

Huff, M.H. 1991. *Wildlife and Vegetaion of Unmanaged Douglas-fir Forests. US Dept. of Agriculture, Forest Service*. Pacific Northwest Research Station, Portland, OR. General Technical Report PNW-GTR-285.

Kellogg, L. D., G. V. Milota, and B. Stringham. 2002. Timber Harvesting to Enhance Multiple Resources. Pages 135-169 in G. E. Wells, ed. *Forest and Stream Management in the Oregon*

Luce, C. H. (1997). Effectiveness of road ripping in restoring infiltration capacity of forest roads. *Restoration Ecology* 5(3): 265-270.

Madej M, Barr B, Curren T, Bloom A, Gibbs G. 2001. *Effectiveness of road restoration in reducing sediment loads*. Arcata, CA: US Geological Survey, Redwood Field Station.

Mellen, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2006. *DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.0.* USDA Forest Service, Pacific Northwest Region and Pacific

Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf

Morrison, D.J. and Johnson, A. L. S. 1999. Incidence of *Heterobasidion annosum* in precommercial thinning stumps in coastal British Columbia. *European Journal of Forest Pathology*. 29:1-16.

Muir, PS., R.L. M, J.C. T, Bailey, JD., Elliott, WE., Hagar, JC,, Miller, JC., Peterson, EP., Starkey, EE. 2002. *Managing for biodiversity in young Douglas-fir forests of western Oregon*. Corvalis, OR: Forest and Rangeland Ecosystem Science Center. National Park Service Organic Act, 16 U.S.C.1.

Nelson, S. Kim. 1988. *Habitat use and densities of cavity nesting birds in the Oregon Coast Ranges*. M.S. Thesis, Oregon St. Univ., Corvallis. 157 pp.

Neitlich PN, McCune B. 1997. Hotspots of epiphytic lichen diversity in two young managed forests. *Conservation Biology.* 11: 172-182.

Nonaka, Estuko. 2003. *Disturbance and landscape history as a reference for evaluating forest management effects at a regional scale: examples from the Coast Range of Oregon, USA.* M.S. Thesis. Oregon State University, Corvallis.

Oliver CD, Larson BC. 1996. *Forest Stand Dynamics*. New York: John Wiley & Sons, Inc.

Ruth, Robert H., Harris, A.S. 1979. *Management of Western Hemlock-Sitka Spruce Forest for Timber Production*. General Technical Report PNW-88. U.S. Department of Agriculture, Forest Service.

Smith, D. M., Larson, B. C., Kelty, M. J., Ashton, P. M. S., & Bowersox, T. W. 1997. *The Practice of Silviculture -- Applied Forest Ecology, Ninth Edition*. New York: John Wiley & Sons, Inc.

Spies, T.A., and S.P. Cline. 1988. Coarse woody debris in forests and plantations of coastal Oregon pp 5-23 *in* Maser, C., R.F. Tarrant, J.M. Trappe, and J.F. Franklin, eds. 1988. *From the forest to the sea: a story of fallen trees*. Gen. Tech. Rpt. PNW-GTR-229. USDA Forest Service, Portland OR.

Spies, T.A., Franklin, J.F., and Thomas, T.B.. 1988. Coarse woody debris in Douglas-fir forests of western Oregon and Washington. *Ecology* 69:1689-1702.

Stewart, GH. 1988. The influence of canopy cover on understory development in forests of the western Cascade Range, Oregon, USA. *Vegetatio* 76: 79-88.

Switalski, T., Bissonette, J., et al. 2004. "Benefits and impacts of road removal." *Frontiers in Ecology and the Environment* 2(1): 21-28.

Tappeiner, JC., Huffman, D., Marshall, D., Spies, TA., Bailey, JD. 1997. Density, ages, and growth rates in old-growth and young-growth forests in coastal Oregon. *Canadian Journal of Forest Research.* 30: 910-920.

Thies, WG., Goheen, EM. 2002. Major Forest Diseases of the Oregon Coast Range and their Management. Pages 191-210 in Hobbs SD, Hayes JP, Johnson RL, Reeves GH, Spies, TA., Tappeiner, JC., Wells, GE., eds. *Forest and Stream Management in the Oregon Coast Range*. Corvallis, OR: Oregon State University Press.

United States. 2004. *National Park Service Director's Order 12 (DO-12) Handbook: Conservation Planning, Environmental Impact Analysis and Decision Making.* [http://www.nature.nps.gov/protectingrestoring/DO12Site/index.htm] Viewed 9/3/2013.

United States. 1995. *Fort Clatsop National Memorial general management plan, development concept plan, final environmental impact statement*. [Astoria, Or.]: U.S. Dept. of the Interior, National Park Service. U.S. Dept. of the Interior, National Park Service.

United States National Park Service. 2004. *Final Yosemite Fire Management Plan/Environmental Impact Statement.* [Yosemite National Park]: United States Department of the Interior National Park Service.

United States Forest Service. 2003. *Road decommissioning monitoring report. Orofino, ID.* US Department of Agriculture Forest Service, Clearwater National Forest.

Wilson, J. S. 1998. *Wind Stability of Naturally Regenerated and Planted Douglas-fir Stands in Coastal Washington, Oregon, and British Columbia*. College of Forest Resources. Seattle, Washington, University of Washington. Doctor of Philosophy**:** 160.

Zenner EK. 2005. Development of tree size distributions in Douglas-fir forests under differing disturbance regimes. *Ecological Applications* 15: 701-714.

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Appendices

APPENDIX A
BIOLOGICAL ASSESSMENT

SPECIES ACCOUNTS AND HABITAT STATUS WITH EFFECTS

A.1 Background

This Biological Assessment (BA) was developed in accordance with Section 7 (c)(1) of the Endangered Species Act. This subsection requires Federal agencies to request information of the Secretary as to whether any species listed or proposed for listing might be present in the area of the proposed action. If the Secretary advises, based on the best scientific and commercial data available, that such species may be present, the requesting agency shall conduct a biological assessment for the purpose of identifying any endangered species or threatened species which is likely to be affected by the proposed action. For the subject project, documents relevant to the identified potentially affected species were reviewed for baseline information and life history requirements. Additional information was obtained by the LEWI Resources Program Manager and other staff biologists through onsite observations and surveys (survey results are provided in the attachments). Impact analyses were based on several factors: the known or likely occurrence of a species or its habitat in the proposed project vicinity; direct physical loss of habitat; effective loss of habitat resulting from avoidance or abandonment due to construction activity or noise, and species sensitivity to human disturbance.

A.2 Defining Impact Areas

Alternative 3 in the Environmental Assessment is the preferred alternative and describes the proposed action. All action alternatives involve vegetation management within the Fort Clatsop Unit of LEWI – an area of land totaling approximately 1219 acres in size that includes the original Fort Clatsop and the boundary expansion purchased from Weyerhaeuser. The entire Fort Clatsop Unit is made up of lands that were logged at least once and have a history of human disturbance. The boundaries of the Fort Clatsop Unit will also serve as the boundaries for this biological assessment.

A.3 Findings

Specific species and habitat information presented below for the Fort Clatsop Unit was developed by the LEWI resources management staff, and documentation supporting much of the following information can be found on file in the Resource Management office. Direct effects as described in this report refer to mortality or disturbance that results in flushing, displacement, harassment for the animal, or removal of a plant species. Indirect effects refer to modification of habitat and/or effects to prey species.

A.4 Federally Listed Species (from USFWS Project Area Species List Obtained and Dated February 7, 2007, with Reference # 18FF523F0C4510998825727B006BCF80).

Early coordination was conducted with the U.S. Fish and Wildlife Service (USFWS) in Portland, Oregon regarding federally threatened and endangered species that may be affected by the proposed project. In a letter dated February 7, 2007, the USFWS (as per Section 7(c) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)

provided a list of species that may occur within the project area (Appendix B). List updated July 2, 2007.

• **Columbian White-Tailed Dee**r—Federally listed as Endangered, historic reports have placed Columbian white-tailed deer as far west as Astoria in the Columbia River drainage. Anecdotal reports of whitetails in the vicinity of Astoria are received periodically by refuge biologists at the Columbian White-tailed Deer National Wildlife Refuge, but none have been confirmed. USFWS surveys have documented Columbian whitetail deer occurrence only as far west as Karlson Island in the Lewis and Clark Islands National Wildlife Refuge, approximately ten miles east of Astoria.

- **Information Sources**—Clark, Al. Refuge Manager, Columbian White-tailed Deer NWR (2002 pers com); and Verts, B. J. and Carraway, Leslie N. Land Mammals of Oregon. Berkeley: University of California Press, 1998.
- **Direct Effects**—None. Not present in or near project area.
- **Indirect Effects**—None.

• **Marbled Murrelet**—Federally listed as Threatened, marbled murrelets are year-round residents of nearshore waters along the west coast. Although they nest primarily in old-growth coniferous forests, they also have been found to nest in second-growth Sitka spruce/western hemlock forests in Tillamook and Clatsop Counties. Marbled murrelets have not been
surveyed for or confirmed to occur within the Fort Clatsop Unit, although suitable mature Sitka spruce-western hemlock maritime forest habitat exists in very small patches. Marbled murrelets have been noted within the vicinity of the park.

- **Information Source**—Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, Oregon. Federal Land Lease Approval Biological Assessment. February 2005. Washington State Parks and Recreation Commission. Bellevue, Wash: Parametrix Inc.
- **Direct Effects**—Species is not known or expected to occur in or near the project area, therefore no Direct Effects are expected to occur.
- **Indirect Effects**— None.

• **Bald Eagle**—Formerly listed as Threatened, bald eagles are year-round residents in the Columbia River estuary and are regularly observed along the Lewis and Clark River within and near LEWI. An established nest, Lewis and Clark River site #824, located in UTM zone 10 at 5108250mN/ 433040mE, is one half mile east of the park. With the exception of 2005, this nest has successfully produced one to two fledglings each year since recordkeeping began in1998. The bald eagle was officially delisted on August 9, 2007. National management guidelines for continued nest protection delineate a 330 foot buffer around a nest tree with topographic or vegetative obstruction or a 600 foot buffer where there is a clear line of sight.

- **Information Source**—Maurice, Kevin. USFWS Oregon State Office (7/31/2007 pers com) and Isaacs, F.B. and R.G. Anthony. 2004. Bald Eagle nest locations and history of use in Oregon and the Washington portion of the

Columbia River Recovery Zone, 1971 through 2004. Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon, USA. .

• **Direct Effects**— No bald eagle nests occur within 660 feet of the project area, therefore no Direct Effects are expected to occur.

• **Indirect Effects**— None.

•**Northern Spotted Owl—**Federally listed as Threatened, spotted owls occur in all coniferous forest types at low to mid-elevations in western Oregon. Clatsop County spotted owl records since 1996 have documented presence of birds and active nest sites within the Nehalem River watershed only. No birds have been found within the Youngs Bay watershed during this time.

- **Information Source—**Scheuering, Eric. Zoologist/Data Manager, Oregon Natural Heritage Information Center – OSU, Portland, OR. (pers com 4/17/2007). Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, Oregon.
- **Direct Effects—** No individuals present at the location. None.
- **Indirect Effects—**None.

• **Chum Salmon (Lower Columbia River)**—Federally listed as Threatened, chum salmon have been confirmed downriver and north of the project area in Youngs Bay (1990) and in the Youngs River near Wireless Road (2002). They have not been documented in streams within the park.

- **Information Source**- Brenkman, S.J., S.C. Corbett, and P. Kennedy. 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.

  Direct Effects—Any and all work occurring over or within anadromous fish waters will be conducted in permitted timeframes to avoid any direct effects to salmonids that may be in the vicinity.
- **Indirect Effects**—

• **Coho Salmon (Lower Columbia River)—** Federally listed as Threatened, coho are present in the Lewis and Clark River and were documented in two of the park's streams in April 2005.

- **Information Sources—**Brenkman, S. J., S. C. Corbett, and P. Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park; Cain, Lee. Astoria High School Salmonid Biology Class Fish Presence Survey, April 2002.
- **Effects**—Refer to Chum Salmon above.

•**Steelhead (Lower Columbia River, Middle Columbia River, Upper Willamette River, Snake River Basin)—**Federally listed as Threatened, steelhead may be present in the Youngs Bay watershed, but have not been documented within the park.

- **Information Source—**Brenkman, S. J., S. C. Corbett, and P. Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park.
- **Effects—**Refer to chum and coho salmon above.

•**Steelhead (Upper Columbia River)—**Federally listed as Endangered, steelhead may be present seasonally in the Youngs Bay watershed, but have not been documented within the park.

- **Information Source—**Brenkman, S. J., S. C. Corbett, and P. Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park.
- **Effects—**Refer to chum and coho salmon above.

•**Sockeye Salmon (Snake River)—**Federally listed as Endangered, sockeye may be present seasonally in the Youngs Bay watershed, but have not been documented within the park.

- **Information Source—**Brenkman, S. J., S. C. Corbett, and P. Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park.
- **Effects—**Refer to chum and coho salmon above.

•**Chinook Salmon (Lower Columbia River, Upper Willamette River, Snake River)—** Federally listed as Threatened ESUs, Chinook Salmon in the Lewis and Clark River were documented during Oregon Department of Fish and Wildlife surveys between 1948-1996, but have not been recorded in ODFW surveys of the river since that time. On 4/11/2002 a Chinook smolt was seined in stream mile 1 of Hansen Creek (north of the park) during a fish survey by Astoria High School students. Chinook salmon have not been documented within the park.

- **Information Sources—** Brenkman, S. J., S. C. Corbett, and P. Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park; Cain, Lee. Astoria High School Salmonid Biology Class Fish Presence Survey, April 2002; and Oregon Department of Fish and Wildlife. Peak Spawning Ground Counts of Fall Chinook in Tributaries of Youngs Bay, 1948-97.

•**Direct Effects—**Any and all work occurring over or within anadromous fish waters will only be conducted in permitted timeframes to avoid any direct effects to salmonids that my be in the vicinity.

- **Indirect Effects—**

•**Chinook Salmon (Upper Columbia River)—**Federally listed as Endangered. Refer to Chinook salmon ESUs above.

- **Effects—**Refer to chum and coho salmon above.

•**Oregon Silverspot Butterfly—**Federally listed as Threatened, the Oregon silverspot butterfly occupied early successional coastal grasslands on Clatsop Plains in Clatsop County. Its historic population center on the plains is approximately 8 kilometers (5 miles) long and 1.6 kilometers (1 mile) wide, extending from Camp Rilea on the north to the Gearhart Golf Course on the south. The Oregon silverspot population on Clatsop Plains has declined in recent years' surveys, with only a single adult documented in 1998, near Camp Rilea, previously the species' population stronghold within the county. The project site contains no coastal grassland habitat.

- **Information Sources—**U.S. Fish and Wildlife Service. 2001. Oregon silverspot butterfly (*Speyeria zerene hippolyta*) revised recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon; and VanBuskirk, R. 1998. Survey for the presence of the Oregon Silverspot Butterfly, *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae) on the Clatsop Plains in 1998. University of California. The Nature Conservancy, Portland, Oregon.
- **Direct Effects—**No individuals or habitat present at the project location. None.

- **Indirect Effects—**None.

•**Howellia—**Federally listed as Threatened, this aquatic plant occurs in freshwater ponds and lakes. Historic collections of the species have been made from Sauvie Island, Multnomah County (1879, 1886), Marion County (1977), and Clackamas County (1892), all within Oregon's Willamette Valley. There are no known extant occurrences in Oregon, and the species has not been found on the coast.

- **Information Sources—** Brian, Nancy. Endangered Species Specialist – Botanist, National Park Service, Fort Collins, CO (pers com 5/14/2007). Vrilakas, Sue. Botanist/Data Manager, Oregon Natural Heritage Information Center – OSU, Portland, OR. (pers com 4/12/2007).
- **Direct Effects—**None.
- **Indirect Effects—**None.

A.5 Oregon Natural Heritage Program, 2001. Rare, Threatened, and Endangered Plants and Animals of Oregon; Oregon Natural Heritage Program, Portland, Oregon

A.5.1 Plant References

• Sayce, Kathleen. Columbia Coast Vascular Plants: Pacific and Wahkiakum Counties, Washington and Clatsop County, Oregon. Nahcotta, Washington: Shoalwater Botanical, 2001.

• Thomas, Duncan W. The Vascular Flora of the Columbia River Estuary. The Wasmann Journal of Biology 42 (1-2), 1984, pp. 92-106.

• No State-listed plant species within areas of the proposed action or alternatives.

A.5.2 PROPOSED SPECIES

None

A.5.3 CANDIDATE SPECIES

•**Streaked Horned Lark—**Streaked horned lark are reported to be a local and irregular breeding species on the north Oregon coast, especially on the South Jetty of the Columbia River and estuary dredge spoil islands including Rice Island, Miller Sands and Jim Crow Island. Preferred habitat includes estuarine tidal flats, beaches, dunes and sparsely vegetated dredge spoils. The species has not been documented to occur within the park.

Information Sources—Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, Oregon. 768 pp. Patterson, J.M. 2006-2007 LEWI Bird Survey. National Park Service, Lewis and Clark National Historical Park.

Direct Effects—No individuals or habitat present at the location. None.

Indirect Effects—None.

A.5.4 SPECIES OF CONCERN

• **Voles**—The white-footed vole was historically documented within the Fort Clatsop Unit in 1940, but has not been found in more recent park small mammal surveys (1993, 2001). This species is most frequently found in riparian (especially alder) habitat within coniferous forests. Small clearings with forb growth may also provide important habitat. Red tree voles are found along the coast in Sitka spruce forests that contain some Douglas fir, since their diet consists almost exclusively of its needles, and to a lesser extent those of western hemlock, spruce and fir.

Information Sources—Csuti, Blair [et al.] *Atlas of Oregon Wildlife: distribution, habitat and natural history*. Corvallis: Oregon State University Press, 1997; Ek, David. A Selection of Rare Wildlife Species, or Species of Concern, within Clatsop County, Oregon. NPS: FOCL, 2/1997; and Museum of Vertebrate Zoology. Mammals from Accn. 6310 (Clatsop Co., Oregon) in MVZ Collections, 7/95.

• **Direct Effects**—

• **Indirect Effects**—

• **Bats**— Fringed, long-legged and Yuma myotis were mist-netted in coniferous forest habitat near the Fort Clatsop replica during 1995 surveys. Vouchers of these three species were obtained during an earlier 1940 mammal survey of the site. A park mammal survey in 2001 netted a single long-eared myotis at Clay Pit Pond. Pacific big-eared bats have not been found within the Fort Clatsop Unit. A 1958 Clatsop County record reports a Cannon Beach collection location for the species. West of the Oregon Cascades, the bats are associated with moderate to older coniferous forests. They are reported to be very intolerant of human disturbance. Silver-haired bats have not been found within the park. These bats occur throughout Oregon except most areas of the Columbia Basin. Their primary habitat is older Douglas fir/western hemlock forests with riparian forage areas.

• **Information Sources**—Csuti, Blair [et al.] Atlas of Oregon Wildlife: distribution, habitat and natural history. Corvallis: Oregon State University Press, 1997; Ek, David. A Selection of Rare Wildlife Species, or Species of Concern, within Clatsop County, Oregon. NPS: FOCL, 2/1997; Mammals from Accn. 6310 (Clatsop County, Oregon) in MVZ Collections, 7/95; Petterson, Jim. Fort Clatsop Small Mammal Inventory, 2001. National Park Service, Mount Rainier National Park, 3/2002; and Verts, B. J. and Carraway, Leslie N. Land Mammals of Oregon. Berkeley: University of California Press, 1998.

• **Direct Effects**—

• **Indirect Effects**—

• **Band-Tailed Pigeon**—Band-tailed pigeons are present throughout the Columbia River estuary. Their preferred habitats are closed-canopy forest for nesting, open-canopy forests for foraging and mineral sites. They are highly mobile and may travel 32 miles from nest locations to food or mineral sites. Band-tailed pigeons have been documented during linear transect surveys at the project site and elsewhere in the park.

- **Information Sources—** Patterson, J.M. 2006-2007 LEWI Bird Survey. National Park Service, Lewis and Clark National Historical Park; Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, Oregon; and Oregon Breeding Bird Atlas, 1995-1999.

• **Direct Effects**—

• **Indirect Effects**—

• **Olive-Sided Flycatcher**—Olive-sided flycatchers are summer residents in coniferous forests of the Columbia River estuary. They are most frequently found in open coniferous forests with tall snags for perching. The birds have been documented during linear transect surveys at the project site and elsewhere in the park.

• **Information Sources**—Patterson, J.M. 2006-2007 LEWI Bird Survey. National Park Service, Lewis and Clark National Historical Park; Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, Oregon; and Oregon Breeding Bird Atlas, 1995-1999.

• **Direct Effects**—

• **Indirect Effects**—

• **Purple Martin**— Purple martins are summer residents in the Columbia River estuary, nesting and feeding primarily in riparian habitats. The birds were documented on the Lewis and Clark River within the park during a 2006 survey and more recently have been noted to be nesting in piling near the park's Netul Landing site.

• **Information Sources**— Patterson, J.M. 2006-2007 LEWI Bird Survey. National Park Service, Lewis and Clark National Historical Park; Oregon Breeding Bird Atlas, 1995-1999; and Marshall, D.B., M.G. Hunter, and A.L. Contreras, Eds. 2003, 2006. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, Oregon.

• **Direct Effects**—

• **Indirect Effects**—

• **Northern Red-Legged Frog**—Numerous observation and voucher records document the occurrence of northern red-legged frogs in park forest and riparian habitats. Suitable wetland habitat is scatted across the project area and it is probable all sites have populations of red-legged frogs nearby.

• **Information Source**— Layes, Michael (Mount Rainier National Park). 2005 LEWI Amphibian Survey. National Park Service, Lewis and Clark National Historical Park.

• **Direct Effects**—

• **Indirect Effects**—

• **Green Sturgeon**—Green sturgeon occur in mixing and seawater salinity zones within the Columbia River estuary, but no records document them in the Lewis and Clark River. Green sturgeon have not been found in streams within the Fort Clatsop Unit.

• **Information Source**—Bottom, Daniel L., Jones, Kim K., Herring, Margaret J. 1984. Fishes of the Columbia River Estuary: Final Report on the Fish Work Unit of the Columbia River Estuary Data Development Program. Dept. of Fish and Wildlife Research and Development, Corvallis, Oregon.; Samuel J. Brenkman, Stephen C. Corbett, and Philip R. Kennedy. 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.

• **Effects**—Refer to Chum and Chinook Salmon above.

• **River Lamprey**—River lamprey have not been confirmed to exist in streams within the project area, although a 2/2002 fish survey of Hansen Creek netted a juvenile lamprey of unknown identity. Alder Creek within the Fort Clatsop Unit and the stream at the park's south boundary are potential habitat, as well as the Lewis and Clark River.

- **Information Sources**—Bottom, Daniel L., Jones, Kim K., Herring, Margaret J. 1984. Fishes of the Columbia River Estuary: Final Report on the Fish Work Unit of the Columbia River Estuary Data Development Program. Dept. of Fish and Wildlife Research and Development, Corvallis, Oregon; and FOCL Fish Survey, Hansen Creek, 2/2002.; Samuel J. Brenkman, Stephen C. Corbett, and Philip R. Kennedy. 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.
- **Effects**—Refer to Chum and Chinook Salmon above.

• **Western Brook Lamprey**—Western Brook Lamprey were observed in the 2005 LEWI fish survey in Trail creek within the proposed project area. Other small streams within LEWI may also have suitable habitat but Western Brook Lamprey have not been observed in other streams.

- **Information Sources**—Bottom, Daniel L., Jones, Kim K., Herring, Margaret J. 1984. Fishes of the Columbia River Estuary: Final Report on the Fish Work Unit of the Columbia River Estuary Data Development Program. Dept. of Fish and Wildlife Research and Development, Corvallis, Oregon; and FOCL Fish Survey, Hansen Creek, 2/2002.; Samuel J. Brenkman, Stephen C. Corbett, and Philip R. Kennedy. 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.
- **Effects**—Refer to Chum and Chinook Salmon above.

• **Pacific Lamprey**—Pacific lamprey have been found in Youngs Bay, but have not been confirmed in streams within the Fort Clatsop Unit, although a 2/2002 fish survey of Hansen
Creek netted a juvenile lamprey of unknown identity. Several small streams in the project area may provide suitable habitat for Pacific lamprey.

- **Information Sources**—Bottom, Daniel L., Jones, Kim K., Herring, Margaret J. 1984. Fishes of the Columbia River Estuary: Final Report on the Fish Work Unit of the Columbia River Estuary Data Development Program. Dept. of Fish and Wildlife Research and Development, Corvallis, Oregon. FOCL Fish Survey, Hansen Creek, 2/2002.; Samuel J. Brenkman, Stephen C. Corbett, and Philip R. Kennedy. 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park, 600 East Park Avenue, Port Angeles, Washington 98362.
- **Effects**—Refer to Chum and Chinook Salmon above.

•**Coastal Cutthroat (Columbia River, Oregon Coast, Upper Willamette River)—**
Cutthroat trout were documented in two park streams during electrofishing surveys at the

project site in April 2005.

- **Information Source—**Brenkman, Samuel J., Stephen C. Corbett, and Philip Kennedy (OLYM). 2007. Inventory of Fish Species in Lewis and Clark National Historic Park, Oregon. National Park Service, Olympic National Park.

- **Effects—**Refer to chum, coho and Chinook salmon above.

• **Additional Species**—The following animal and plant species have not been documented to occur within the project area: Steller sea lion, western snowy plover, brown pelican, short-tailed albatross, Lewis' woodpecker, mountain quail, tailed frog, Oregon coast steelhead, pink sand verbena, Saddle Mountain bitter cress, Chamber's paintbrush, Willamette Valley larkspur, frigid shootingstar, queen-of-the-forest, Saddle Mountain saxifrage, Henderson sidalcea, bristly-stemmed sidalcea and the moss species Limbella fryei.

Determinations for each Federally Listed Species:

• **Columbian White-Tailed Deer**—No individuals or habitat present in or near the project area, therefore the determination is no effect.

• **Marbled Murrelet**—No individuals or habitat present in or near the project area, therefore the determination is no effect.

• **Bald Eagle**—The project site is outside of the mandatory disturbance distances indicated in the 1986 Pacific Bald Eagle Recovery Plan. Some flushing or minor disturbance could occur if individual eagles are roosting or feeding within the general vicinity of the project area. The documented active nest that is 1/2 mile east of the project site is also in the direct flight path of the Astoria airport which present a constant noise and visual presence to the eagles occupying the nest. This coupled with farming activities and active roadways nearby indicate a high level of tolerance by these birds. The determination of the possible effects of this project are may effect, not likely to adversely effect.

• **Chum Salmon and Chinook Salmon**—All required and available measures will be implemented to mitigate potential increased run-off from the project site that could increase sediment flow into the Lewis and Clark River. Existing storm flow containment features and engineered wetlands will be utilized to catch and store run-off from the site. Construction of boardwalks associated with the trail connecting the parking lot to the park complex will be conducted only during time periods permitted by the appropriate agencies responsible for salmonid conservation. Any potential effects should be minimal in scope and duration. Lon-term stabilization and improvement of this site compared to it's current existing degraded condition should improve riparian and aquatic condition at

and downstream of this site. The determination of the possible effects of this project on all salmonid species are may effect, not likely to adversely effect.

• **Oregon Silverspot Butterfly**—Neither individuals nor habitat are known or expected to occur in or near the project area, therefore determination of effects are no effect.

• **Howellia**—Neither individuals nor habitat are known or expected to occur in or near the project area, therefore determination of effects are no effect.

Mammal and Bird Species Lists

Checklist of Mammal Species
Lewis and Clark National Historical Park
(Updated January 2007)

GROUP Family	Scientific Name	Common Name
MAMMALS		
Cervidae	Cervus elaphus roosevelti	Roosevelt Elk
	Odocoileus hemionus columbianus	Columbian Black-tailed Deer
Canidae	Canis latrans	Coyote
Felidae	Felis rufus	Bobcat
Mephitidae	Spilogale gracilis	Western Spotted Skunk
Mustelidae	Lutra canadensis	River Otter
	Mustela erminea	Short-tailed Weasel
	Mustela frenata	Long-tailed Weasel
	Mustela vison	Mink
Phocidae	Phoca vitulina	Harbor Seal
Procyonidae	Procyon lotor	Raccoon
Vespertilionidae	Corynorhinus townsendii townsendii	Townsend's Big-eared Bat
	Lasiurus cinereus	Hoary Bat
	Myotis californicus	California Myotis
	Myotis evotis	Long-eared Myotis
	Myotis thysanodes	Fringed Myotis
	Myotis volans	Long-legged Myotis
	Myotis yumanensis	Yuma Myotis
Didelphidae	Didelphis virginiana	Virginia Opossum
Soricidae	Sorex bairdii	Baird's Shrew
	Sorex bendirii	Pacific Marsh Shrew
	Sorex monticolus	Montane Shrew
	Sorex trowbridgii	Trowbridge's Shrew
	Sorex vagrans	Vagrant Shrew
Talpidae	Neurotrichus gibbsii	American Shrew-mole
	Scapanus orarius	Coast Mole

	Scapanus townsendii	Townsend's Mole
Leporidae	Lepus americanus	Snowshoe Hare
	Sylvilagus bachmani	Brush Rabbit
Aplodontiidae	Aplodontia rufa	Mountain Beaver
Castoridae	Castor canadensis	Beaver
Dipodidae	Zapus trinotatus	Pacific Jumping Mouse
Echimyidae	Myocastor coypus	Nutria
Muridae	Arborimus albipes	White-footed Vole
	Clethrionomys californicus	Western Red-backed Vole
	Microtus oregoni	Creeping Vole
	Microtus townsendii	Townsend's Vole
	Ondatra zibethicus	Common Muskrat
	Peromyscus maniculatus	Deer Mouse
	Rattus rattus	Black Rat
Sciuridae	Glaucomys sabrinus sabrinus	Northern Flying Squirrel
	Spermophilus beecheyi	California Ground Squirrel
	Tamias townsendii	Townsend's Chipmunk
	Tamiasciurus douglasii	Douglas' Squirrel

Checklist of Bird Species
Lewis and Clark National Historical Park
(Updated June 2007)

GROUP Family	**Scientific Name**	**Common Name**
Anatidae	Branta hutchinsii	Cackling Goose
	Branta canadensis	Canada Goose
	Aix sponsa	Wood Duck
	Anas americana	American Wigeon
	Anas platyrhynchos	Mallard
	Anas clypeata	Northern Shoveler
	Anas crecca	Green-winged Teal
	Aythya collaris	Ring-necked Duck
	Aythya marila	Greater Scaup
	Aythya affinis	Lesser Scaup
	Melanitta perspicillata	Surf Scoter
	Bucephala albeola	Bufflehead
	Lophodytes cucullatus	Hooded Merganser
	Mergus merganser	Common Merganser
	Mergus serrator	Red-breasted Merganser
Phasianidae	Phasianus colchicus	Ring-necked Pheasant
	Bonasa umbellus	Ruffed Grouse
Gaviidae	Gavia stellata	Red-throated Loon
	Gavia pacifica	Pacific Loon
Podicipedidae	Podilymbus podiceps	Pied-billed Grebe

	Aechmophorus occidentalis	Western Grebe
Pelicanidae	Pelecanus occidentalis	Brown Pelican
Phalacrocoracidae	Phalacrocorax auritus	Double-crested Cormorant
Ardeidae	Ardea herodias	Great Blue Heron
	Ardea alba	Great Egret
	Butorides virescens	Green Heron
Cathartidae	Cathartes aura	Turkey Vulture
Accipitridae	Pandion haliaetus	Osprey
	Elanus leucurus	White-tailed Kite
	Haliaeetus leucocephalus	Bald Eagle
	Circus cyaneus	Northern Harrier
	Accipiter striatus	Sharp-shinned Hawk
	Accipiter cooperii	Cooper's Hawk
	Buteo jamaicensis	Red-tailed Hawk
Falconidae	Falco sparverius	American Kestrel
	Falco peregrinus	Peregrine Falcon
	Falco mexicanus	Prairie Falcon
Rallidae	Rallus limicola	Virginia Rail
	Fulica americana	American Coot
Charadriidae	Charadrius vociferus	Killdeer
Scolopacidae	Actitis macularia	Spotted Sandpiper
	Tringa melanoleuca	Greater Yellowlegs
	Calidris alba	Sanderling
	Calidris minutilla	Least Sandpiper
	Calidris alpina	Dunlin
	Gallinago delicata	Wilson's Snipe
Laridae	Larus canus	Mew Gull
	Larus delawarensis	Ring-billed Gull
	Larus californicus	California Gull
	Larus argentatus	Herring Gull
	Larus occidentalis	Western Gull
	Larus glaucescens	Glaucous-winged Gull
	Larus hyperboreus	Glaucous Gull
	Rissa tridactyla	Black-legged Kittiwake
	Hydroprogne caspia	Caspian Tern
Columbidae	Patagioenas fasciata	Band-tailed Pigeon
	Zenaida macroura	Mourning Dove
Tytonidae	Tyto alba	Barn Owl
Strigidae	Megascops kennicottii	Western Screech-Owl
	Bubo virginianus	Great Horned Owl
	Glaucidium gnoma	Northern Pygmy-Owl
	Strix varia	Barred Owl
	Aegolius acadicus	Northern Saw-whet Owl
Trochilidae	Selasphorus rufus	Rufous Hummingbird
Alcedinidae	Ceryle alcyon	Belted Kingfisher
Picidae	Sphyrapicus ruber	Red-breasted Sapsucker

	Picoides pubescens	Downy Woodpecker
	Picoides villosus	Hairy Woodpecker
	Colaptes auratus	Northern Flicker
	Dryocopus pileatus	Pileated Woodpecker
Tyrannidae	Contopus cooperi	Olive-sided Flycatcher
	Contopus sordidulus	Western Wood-Pewee
	Empidonax traillii	Willow Flycatcher
	Empidonax difficilis	Pacific-slope Flycatcher
	Sayornis nigricans	Black Phoebe
Vireonidae	Vireo huttoni	Hutton's Vireo
	Vireo gilvus	Warbling Vireo
Corvidae	Cyanocitta stelleri	Steller's Jay
	Corvus brachyrhynchos	American Crow
	Corvus corax	Common Raven
Hirundinidae	Progne subis	Purple Martin
	Tachycineta bicolor	Tree Swallow
	Tachycineta thalassina	Violet-green Swallow
	Petrochelidon pyrrhonota	Cliff Swallow
	Hirundo rustica	Barn Swallow
Paridae	Poecile atricapillus	Black-capped Chickadee
	Poecile rufescens	Chestnut-backed Chickadee
Aegithalidae	Psaltriparus minimus	Bushtit
Sittidae	Sitta canadensis	Red-breasted Nuthatch
Certhiidae	Certhia americana	Brown Creeper
Troglodytidae	Thryomanes bewickii	Bewick's Wren
	Troglodytes troglodytes	Winter Wren
	Cistothorus palustris	Marsh Wren
Regulidae	Regulus satrapa	Golden-crowned Kinglet
	Regulus calendula	Ruby-crowned Kinglet
Turdidae	Catharus ustulatus	Swainson's Thrush
	Catharus guttatus	Hermit Thrush
	Turdus migratorius	American Robin
	Ixoreus naevius	Varied Thrush
Timaliidae	Chamaea fasciata	Wrentit
Sturnidae	Sturnus vulgaris	European Starling
Motacillidae	Anthus rubescens	American Pipit
Bombycillidae	Bombycilla cedrorum	Cedar Waxwing
Parulidae	Vermivora celata	Orange-crowned Warbler
	Dendroica petechia	Yellow Warbler
	Dendroica coronata	Yellow-rumped Warbler
	Dendroica nigrescens	Black-throated Gray Warbler
	Dendroica townsendi	Townsend's Warbler
	Dendroica occidentalis	Hermit Warbler
	Oporornis tolmiei	MacGillivray's Warbler
	Geothlypis trichas	Common Yellowthroat

	Wilsonia pusilla	Wilson’s Warbler
Thraupidae	Piranga ludoviciana	Western Tanager
Emberizidae	Pipilo maculatus	Spotted Towhee
	Passerculus sandwichensis	Savannah Sparrow
	Passerella iliaca	Fox Sparrow
	Melospiza melodia	Song Sparrow
	Melospiza lincolnii	Lincoln’s Sparrow
	Melospiza georgiana	Swamp Sparrow
	Zonotrichia leucophrys	White-crowned Sparrow
	Zonotrichia atricapilla	Golden-crowned Sparrow
	Junco hyemalis	Dark-eyed Junco
Cardinalidae	Pheucticus melanocephalus	Black-headed Grosbeak
Icteridae	Agelaius phoeniceus	Red-winged Blackbird
	Euphagus cyanocephalus	Brewer’s Blackbird
	Molothrus ater	Brown-headed Cowbird
Fringillidae	Carpodacus purpureus	Purple Finch
	Carpodacus mexicanus	House Finch
	Loxia curvirostra	Red Crossbill
	Carduelis pinus	Pine Siskin
	Carduelis tristis	American Goldfinch
Passeridae	Passer domesticus	House Sparrow

APPENDIX B

USFWS LETTERS

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oregon Fish and Wildlife Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266
Phone: (503)231-6179 FAX: (503)231-6195

Reply To: 8330.SP02(07) February 7, 2007

Scott Stonum
Lewis and Clark National Historic Park
92343 Fort Clatsop Rd.
Astoria, OR 97103

Subject: Fort Clatsop Management Plan/EA Project
USFWS Reference # 18FF523F0C4510998825727B006BCF80

Dear Mr. Scott Stonum:

This is in response to your request, dated February 7, 2007, requesting information on listed and proposed endangered and threatened species that may be present within the area of the Fort Clatsop Management Plan/EA Project in Clatsop County(s). The Fish and Wildlife Service (Service) received your correspondence on February 7, 2007.
We have attached a list (Enclosure A) of threatened and endangered species that may occur within the area of the Fort Clatsop Management Plan/EA Project. The list fulfills the requirement of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). National Park Service requirements under the Act are outlined in Enclosure B. The purpose of the Act is to provide a means whereby threatened and endangered specie and the ecosystems on which they depend may be conserved. Under section 7(a)(1) and 7(a)(2) of the Act and pursuant to 50 CFR 402 *et seq*., the National Park Service is required to utilize their authorities to carry out programs which further species conservation and to determine whether projects may affect threatened and endangered species, and/or critical habitat. A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) which are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (NEPA) (42 U.S.C. 4332 (2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to the Biological Assessment be prepared to

determine whether they may affect listed and proposed species. Recommended contents of a Biological Assessment are described in Enclosure B, as well as 50 CFR 402.12. If the National Park Service determines, based on the Biological Assessment or valuation, that threatened and endangered species and/or critical habitat may be affected by the project, the National Park Service is required to consult with the Service following the requirements of 50 CFR 402 which implement the Act.

Enclosure A includes a list of candidate species under review for listing. The list reflects changes to the candidate species list published May 11, 2005, in the Federal Register (Vol. 69, No. 86, 24876) and the addition of "species of concern." Candidate species have no protection under the Act but are included for consideration as it is possible candidates could be listed prior to project completion. Species of concern are those taxa whose conservation status is of concern to the Service (many previously known as Category 2 candidates), but for which further information is still needed.
If a proposed project may affect only candidate species or species of concern, the National Park Service is not required to perform a Biological Assessment or evaluation or consult with the Service. However, the Service recommends minimizing impacts to these species to the extent possible in order to prevent potential future conflicts. Therefore, if early evaluation of the project indicates that it is likely to adversely impact a candidate species or species of concern, the National Park Service may wish to request technical assistance from this office.

Your interest in endangered species is appreciated. The Service encourages the National Park Service to investigate opportunities for incorporating conservation of threatened and endangered species into project planning processes as a means of complying with the Act. If you have questions regarding your responsibilities under the Act, please contact Kevin Maurice at (503) 231-6179. All correspondence should include the above referenced file number. For questions regarding salmon and steelhead trout, please contact NOAA Fisheries Service, 525 NE Oregon Street, Suite 500, Portland, Oregon 97232, (503) 230-5400.

For future species list requests, please visit our website (http://www.fws.gov/oregonfwo/Species/RequestList.asp) for instructions on how to make requests.

Enclosures
EnclosureA: Clatsop COUNTY.PDF
EnclosureB: EnclosureB_Federal_Agencies_Responsibilities.PDF

ENCLOSURE A

FEDERALLY LISTED THREATENED, ENDANGERED, PROPOSED, CANDIDATE SPECIES AND SPECIES OF CONCERN WHICH MAY OCCUR WITHIN CLATSOP COUNTY, OREGON

LISTED SPECIES[i]

Mammals		
Steller (=northern) sea lion	*Eumetopias jubatus*	T*
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	E
Birds		
Marbled murrelet[ii]	*Brachyramphus marmoratus*	CH T
Western snowy plover (coastal pop.)[iii]	*Charadrius alexandrinus nivosus*	T
Bald eagle[iv]	*Haliaeetus leucocephalus*	T
Brown pelican	*Pelecanus occidentalis*	E
Short-tailed albatross[v]	*Phoebastria (=Diomedea) albatrus*	E
Northern spotted owl[vi]	*Strix occidentalis caurina*	CH T
Fish		
Chum salmon (Columbia River)[vii]	*Oncorhynchus keta*	T*
Coho salmon (Lower Columbia River)[viii]	*Oncorhynchus kisutch*	T*
Steelhead (Lower Columbia River)[ix]	*Oncorhynchus mykiss* ssp.	T*
Steelhead (Snake River Basin)[x]	*Oncorhynchus mykiss* ssp.	T*
Steelhead (Middle Columbia River)[xi]	*Oncorhynchus mykiss* ssp.	T*
Steelhead (Upper Columbia River)[xii]	*Oncorhynchus mykiss* ssp.	E*
Steelhead (Upper Willamette River)[xiii]	*Oncorhynchus mykiss* ssp.	T*
Sockeye salmon (Snake River)[xiv]	*Oncorhynchus nerka*	CH E*
Chinook salmon (Lower Columbia River)[xv]	*Oncorhynchus tshawytscha*	T*
Chinook salmon (Upper Columbia River)[xvi]	*Oncorhynchus tshawytscha*	E*
Chinook salmon (Upper Willamette River)[xvii]	*Oncorhynchus tshawytscha*	T*
Chinook salmon (Snake River) [xviii]	*Oncorhynchus tshawytscha*	CH T*
Invertebrates		
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	T
Plants		
Howellia	*Howellia aquatilis*	T

PROPOSED SPECIES

None

CANDIDATE SPECIES[xix]

Birds	
Streaked horned lark	*Eremophila alpestris strigata*

SPECIES OF CONCERN

Mammals	
White-footed vole	*Arborimus albipes*
Red tree vole	*Arborimus longicaudus*
Pacific western big-eared bat	*Corynorhinus townsendii townsendii*
Silver-haired bat	*Lasionycteris noctivagans*

Long-eared myotis (bat)	*Myotis evotis*
Fringed myotis (bat)	*Myotis thysanodes*
Long-legged myotis (bat)	*Myotis volans*
Yuma myotis (bat)	*Myotis yumanensis*
Birds	
Band-tailed pigeon	*Columba fasciata*
Olive-sided flycatcher	*Contopus cooperi*
Lewis' woodpecker	*Melanerpes lewis*
Mountain quail	*Oreortyx pictus*
Purple martin	*Progne subis*
Amphibians and Reptiles	
Tailed frog	*Ascaphus truei*
Northern red-legged frog	*Rana aurora aurora*
Fishes	
Green sturgeon	*Acipenser medirostris*
River lamprey	*Lampetra ayresi*
Pacific lamprey	*Lampetra tridentata*
Coastal cutthroat trout (Lower Columbia R.)	*Oncorhynchus clarki clarki*
Coastal cutthroat trout (Oregon Coast)	*Oncorhynchus clarki clarki*
Coastal cutthroat trout (Upper Willamette)	*Oncorhynchus clarki clarki*
Steelhead (Oregon Coast)	*Oncorhynchus mykiss* ssp. *
Plants	
Pink sand verbena	*Abronia umbellata* ssp. *breviflora*
Saddle Mountain bitter cress	*Cardamine pattersonii*
Chambers' paintbrush	*Castilleja chambersii*
Willamette Valley larkspur	*Delphinium oreganum*
Frigid shootingstar	*Dodecatheon austrofrigidum*
Queen-of-the-forest	*Filipendula occidentalis*
Moss	*Limbella fryei*
Saddle Mountain saxifrage	*Saxifraga hitchcockiana*
Henderson sidalcea	*Sidalcea hendersonii*
Bristly-stemmed sidalcea	*Sidalcea hirtipes*

(E) - Listed Endangered *(T) - Listed Threatened* *(CH) - Critical Habitat has been designated for this species*
(PE) - Proposed Endangered *(PT) - Proposed Threatened* *(PCH) - Critical Habitat has been proposed for this species*

Species of Concern - Taxa whose conservation status is of concern to the Service (many previously known as Category 2 candidates), but for which further information is still needed.

* *Consultation with NOAA's National Marine Fisheries Service may be required.*

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i/ U.S. Department of Interior, Fish and Wildlife Service, October 31, 2000, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12
ii/ Federal Register Vol. 57, No. 45328, October 1, 1992, Final Rule - Marbled Murrelet
iii/ Federal Register Vol. 64, No. 234, December 7, 1999, Final Rule - Critical Habitat for the Western Snowy Plover

iv Federal Register Vol. 60, No. 133, July 12, 1995, - Final Rule - Bald Eagle
v Federal Register Vol. 65, No. 147, July 31, 2000, - Final Rule To List the Short-Tailed Albatross as Endangered in the United States
vi Federal Register Vol. 57, No. 10, January 15, 1992, Final Rule - Critical Habitat for the Northern Spotted Owl
vii Federal Register Vol. 64, No. 57, March 25, 1999, Final Rule - Columbia River Chum Salmon
viii Federal Register Vol. 60, No. 142, July 25, 1995, Proposed Rule - Threatened Status for Three Contiguous ESUs of Coho Salmon
ix Federal Register Vol. 63, No. 53, March 19, 1998, Final Rule-West Coast Steelhead
x Federal Register Vol. 62, No. 159, August 18, 1997, Final Rule - Snake River Steelhead
xi Federal Register Vol. 64, No. 57, March 25, 1999, Final Rule - Middle Columbia and Upper Willamette River Steelhead
xii Federal Register Vol. 62, No. 159, August 18, 1997, Final Rule – Upper Columbia River Steelhead
xiii Federal Register Vol. 64, No. 57, March 25, 1999, Final Rule - Middle Columbia and Upper Willamette River Steelhead
xiv Federal Register Vol. 56, No. 224, November 20, 1991, Final Rule - Snake River Sockeye Salmon
xv Federal Register Vol. 64, No. 56, March 24, 1999, Final Rule - West Coast Chinook Salmon
xvi Federal Register Vol. 64, No. 56, March 24, 1999, Final Rule - West Coast Chinook Salmon
xvii Federal Register Vol. 64, No. 56, March 24, 1999, Final Rule - West Coast Chinook Salmon
xviii Federal Register Vol. 57, No. 78, April 22, 1992, Final Rule – Snake River Chinook Salmon
xix Federal Register Vol. 69, No. 86, May 4, 2004, Notice of Review - Candidate or Proposed Animals and Plants