Spring 2014

# Proposed reintroduction of fishers in the North Cascades National Park environmental impact assessment

Cameron Coronado
*Western Washington University*

Monica Tonty
*Western Washington University*

Wiley Chubb
*Western Washington University*

Chris Foss
*Western Washington University*

Spencer Ward
*Western Washington University*

# Proposed Reintroduction of Fishers in the North Cascades National Park Environmental Impact Assessment

Huxley College of the Environment
Environmental Impact Assessment
Spring 2014

**Environmental Impact Assessment**
Huxley College of the Environment

We grant Western Washington University the non-exclusive royalty-free right to archive, reproduce, distribute, and display this Environmental Impact Assessment document in any and all forms, including electronic format, via and digital library mechanisms maintained by WWU.

We represent and warrant this is original work, and does not infringe or violate any rights of others. We warrant that we have obtained written permissions from the owner of any third party copyrighted material included in this document.

We acknowledge that we retain ownership rights to the copyright of this work, including but not limited to the right to use all or part of this work in future works, such as articles or books. Library users are granted permission for individual, research and non-commercial reproduction of this work for educational purposes only. Any further digital posting of this document requires specific permission from the author(s).

Any copying or publication of this document for commercial purposes, or for financial gain, is not allowed without my/our written permission.

X _____
Cameron Coronado

X _____
Wiley Chub

X _____
Chris Foss

X _____
Monica Tonty

X _____
Spencer Ward

Date 6-3-14

**Concerned Citizens Letter**

Dear Concerned Citizen,

The purpose of this Environmental Impact Assessment (EIA) is to assess the probable impacts of the reintroduction of fishers (*Martes pennanti*) into the North Cascades National Park. Fishers are mid-sized carnivores in the weasel family (Mustelidae) that were once present in the low to mid-elevation forested areas throughout Washington (Lewis et al. 2012).

The fisher population experienced a sharp decline during the mid-1800s as a result of commercial trapping (Lewis and Hayes 2004). The degradation of suitable old growth forest habitat, incidental capture, and pest and predator control measures are other factors that contributed to the fisher's steady decline (Lewis and Stinson 1998, Aubry and Lewis 2003, Lofroth et al. 2010).

Despite the prohibition of fisher trapping since 1934, a viable population has not recovered in the years since. This has prompted the Washington Department of Fish and Wildlife (WDFW), the National Park Service (NPS), the U.S. Forest Service (USFS), and fellow concerned citizens to implement a statewide recovery plan for fishers. The species is currently listed as endangered at the state level, and has been listed as a "species of concern" for roughly 20 years (USFWS 2013) under the federal Endangered Species Act (ESA). Rather than awaiting the more serious implications of a federally endangered species listing, the above agencies and citizen groups have successfully reintroduced fishers into the Olympic National Park (NPS 2007). The next step in the recovery plan is to reintroduce fishers into the North Cascades National Park, an action that is more likely ensure a thorough recovery of the species in Washington State.

Fishers have an important ecological role to fill as predators in the North Cascades ecosystem. Because this species once existed within this area's natural predator-prey dynamic, it is essential that natural systems and species, like the fisher, be restored as much as possible. Without the presence of fishers, the wilderness value of the North Cascades National Park is diminished.

Sincerely,

Monica Tonty

Spencer Ward

Chris Foss

Cameron Coronado

Wiley Chubb

# Proposed Reintroduction of Fishers in the North Cascades National Park Environmental Impact Assessment

Prepared for:

Dr. Leo Bodensteiner
Environmental Impact Assessment
ESCI 493
Huxley College of the Environment
Western Washington University

Prepared by:

Cameron Coronado
Monica Tonty
Wiley Chubb
Chris Foss
Spencer Ward

**Note:** This report represents a class project that was carried out by students at Western Washington University, Huxley College. It has not been undertaken at the request of any persons representing local government or private individuals. Nor does it necessarily represent the opinion or position of individuals from government or the private sector.

# Fact Sheet

**Project Title**
Environmental Impact Assessment for the Reintroduction of Fishers in the North Cascades

**Description of Project**
The proposed action is the reintroduction of fishers in the North Cascades. Approximately 160 fishers will be translocated from British Columbia to the North Cascades over a four to six year period. The Washington Department of Fish and Wildlife (WDFW), the National Park Service (NPS), and the U.S. Forest Service (USFS) have proposed this action.

**Legal Description of Location**
The Cascade Range stretches from the Canadian border within northern Whatcom and Okanogan Counties, and south approximately 370 km to the Columbia River in southern Skamania County (Hayes and Lewis 2006). The Cascades Recovery Area includes lands administered by the North Cascades and Mt. Rainer National Parks, and the Mt. Baker-Snoqualmie, Okanogan-Wenatchee and Gifford Pinchot National Forests. There have been two areas identified for the reintroduction of fishers within the North Cascades; the southwestern and the northwestern reintroduction areas. The southwestern reintroduction area consists of Mt. Rainer National Park, most of Gifford Pinchot National Forest, and the southernmost portions of the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forest. The northwestern Cascades reintroduction area includes the Mt. Baker-Snoqualmie National Forest and the North Cascades National Park Service Complex. The Northern Cascades Park Service Complex includes 277 hectares near the northern crest of the Cascade Range from the Canadian border south to Lake Chelan (NPS 2007a).

**Proponent**
Washington Department of Fish and Wildlife
Wildlife Program
600 Capitol Way North
Olympia, WA 98501-1091

**Lead Agency:**
Washington Department of Fish and Wildlife

**Author Contributions:**
Cameron Coronado
Co-editor
Fact Sheet
Executive Summary
Natural Environment

Soundscapes
Potential Genetic Isolation Effects
Table of Contents
Glossary

Monica Tonty
Co-editor
Plants and Animals
Scoping Process and Public Participation
GIS
Appendices

Wiley Chubb
Co-editor
Impact Matrix
Transportation
Public Services and Utilities

Chris Foss
Co-editor
Energy and Natural Resources
Habitat-Related Fire Effects
Urban Quality
Conclusion
Glossary

Spencer Ward
Co-editor
Concerned Citizen Letter
Legal Context
Proposed Action Permits
Consideration of Lands Outside Complex Boundaries
Built Environment

**Distribution list:**
Dr. Leo Bodensteiner
Department of Environmental Sciences
Huxley College of the Environment
Western Washington University 98225-9181

Wilson Library
Available online in Huxley College Digital Collections
Western Washington University 98225-9181

**Acknowledgements:**
Dr. Leo Bodensteiner, Professor of Environmental Sciences
Dr. John McLaughlin, Professor of Environmental Sciences
Roy Zipp, Environmental Protection Specialist, National Park Service
Elizabeth Boerke, Environmental Protection Specialist, National Park Service

**Issue Date:**
June 5th, 2014

**Public Presentation:**
REI Community Room
400 36th St. Bellingham, WA 98225
Thursday, June 5th from 5:00-8:00 PM

# Table of Contents

# List of Tables Figures and Acronyms

### Tables



### Figures



### Acronyms

**DPS -** Distinct Population Segment
**ESA** – Federal Endangered Species Act
**GMPEIS** - General Management Plan and Environmental Impact Statement
**NPS** - National Park Service
**NRA** - National Recreation Areas
**USFS** - United States Forest Service
**USFWS** - United States Fish and Wildlife Service
**WDFW** - Washington Fish and Wildlife Commission
**WSDA** - Washington State Department of Agriculture

# 1.0 Executive Summary

## 1.1 Purpose

The purpose of this Environmental Impact Assessment is to evaluate the potential impacts of the reintroduction of fishers to the North Cascades National Park.

## 1.2 Site Description

Reference will be made to the North Cascades National Park Complex as “the Complex” hereafter, which includes the North Cascades National Park (204,278 hectares), Lake Chelan National Recreation Area (25,070hectares) and Ross Lake National Recreation Area (47,580 hectares) (Figure 1).

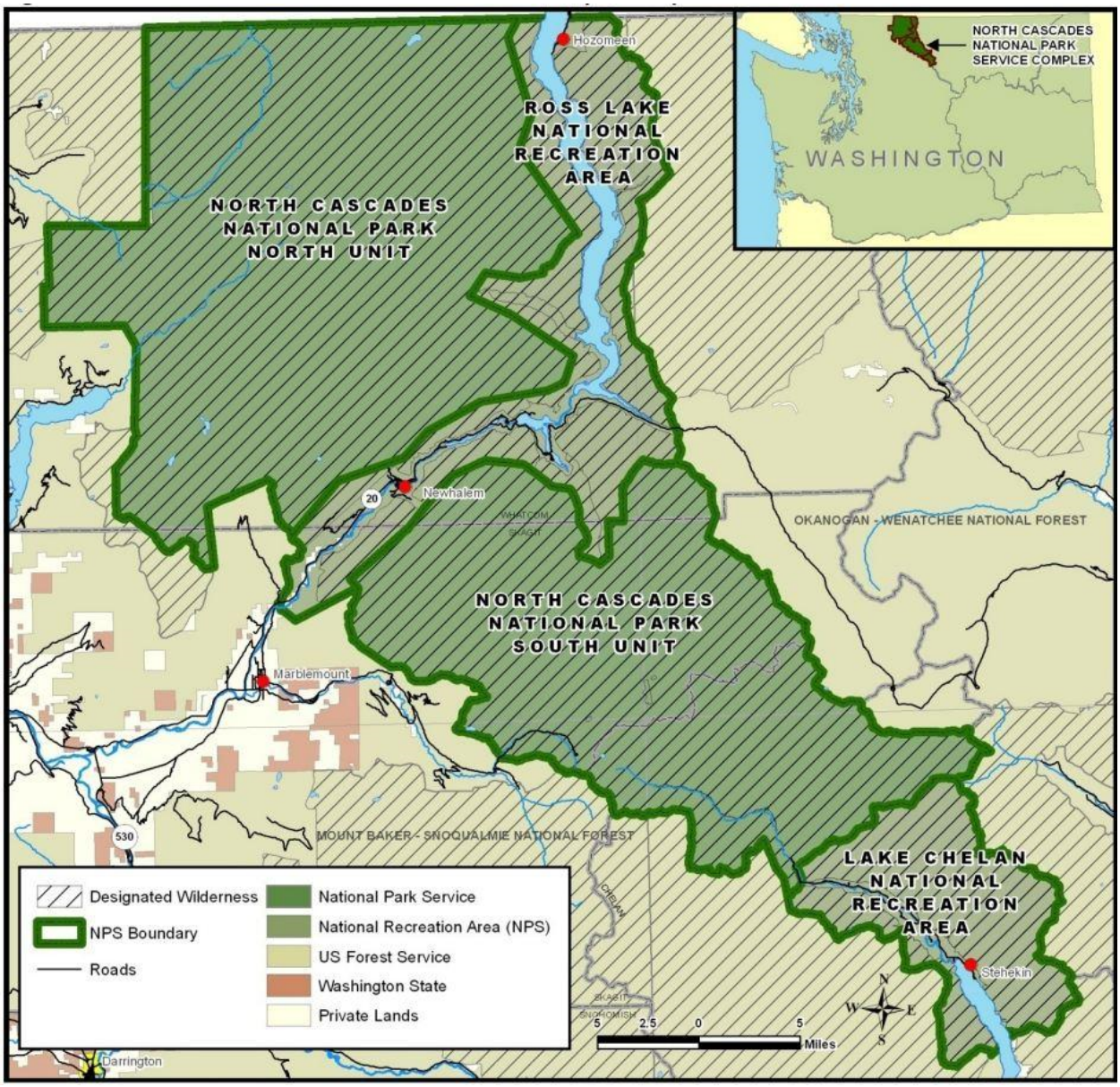


Figure 1. Map of the North Cascades National Park. The Complex includes the North Cascades National Park North Unit, North Cascades National Park South Unit the Ross Lake National Recreation Area, and Lake Chelan National Recreation Area (NPS 2011).

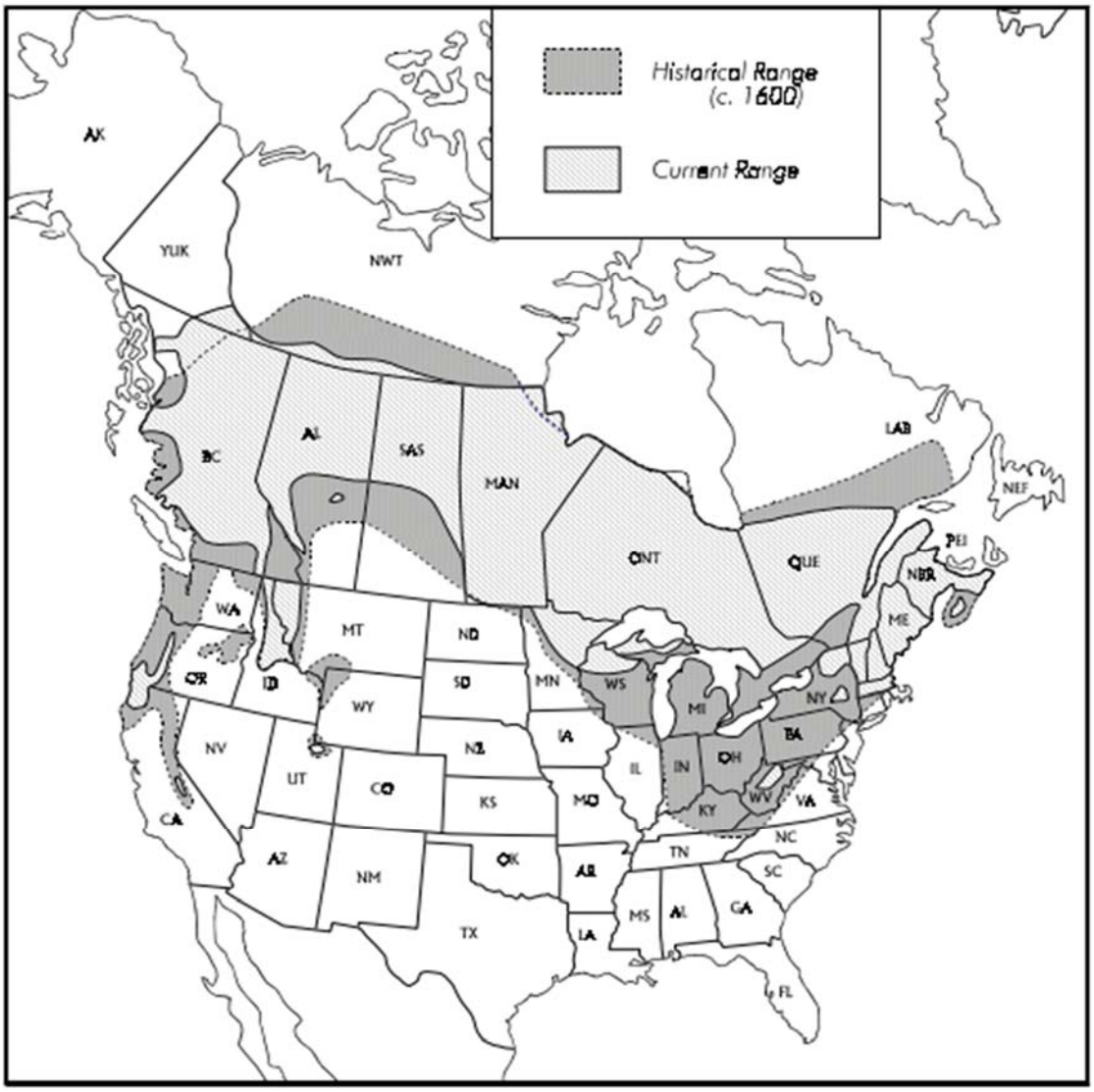


Figure 2. Historical and current range of the fisher in North America. The current range in Washington is unknown. Modified from Gibilsco (1994) by Lewis and Stinson (1998).

# 2.0 Proposed Action and Alternatives

## 2.1 Need for Action

A self-sustaining fisher population is not likely to become reestablished without the aid of humans. Reintroduction is the most likely way to successfully reestablish fisher populations to their historic range in the Complex (Hayes and Lewis 2006). A Washington State feasibility assessment for reintroducing fishers identified three areas that would provide suitable habitat. Two of the three areas are located in the Complex (Lewis and Hayes 2004). Fishers would be down-listed to a Washington state sensitive status from a state endangered status if self-sustaining populations are reestablished in multiple locations within the recovery area.

## 2.2 Proposed Action

The WDFW and the NPS are proposing the translocation of approximately 160 fishers from British Columbia into the North Cascades region (Figures 3 & 4). This will be done in two stages. The first stage will be the reintroduction of ≥80 fishers to areas located in the southwestern portion of the North Cascades. This will be done over a two to three year period, releasing approximately 40 fishers per year. The second stage will be the reintroduction of ≥80 fishers in the northwestern portion of the North Cascades, again over a two to three year period releasing approximately 40 fishers per year. This northwestern Cascades reintroduction area is the focus of this analysis, as it is the portion that directly affects areas within the boundaries of the Complex.

There are six candidate release sites in the northwestern Cascades reintroduction area (Figure 4). Based on the results of the reintroduction of fishers to Olympic National Park, the current strategic plan in the Cascades is to release a larger number of fishers into fewer release sites (Boerke, pers. comm. June 3, 2014). Each fisher will be monitored using a radio-transmitter tracking their movement, survival, and home range establishment. An adaptive management plan will be used. For example, if the fishers released at a particular site have low success, a different potential release site will be utilized for the next release.

*Mitigation Strategy:* Timing of release will strategically occur before January. This will allow time for females to find den sites as well as have enough time to recover from the stress of captivity before sexual reproduction from February-April and gestation from March-early May (Lewis 2013).

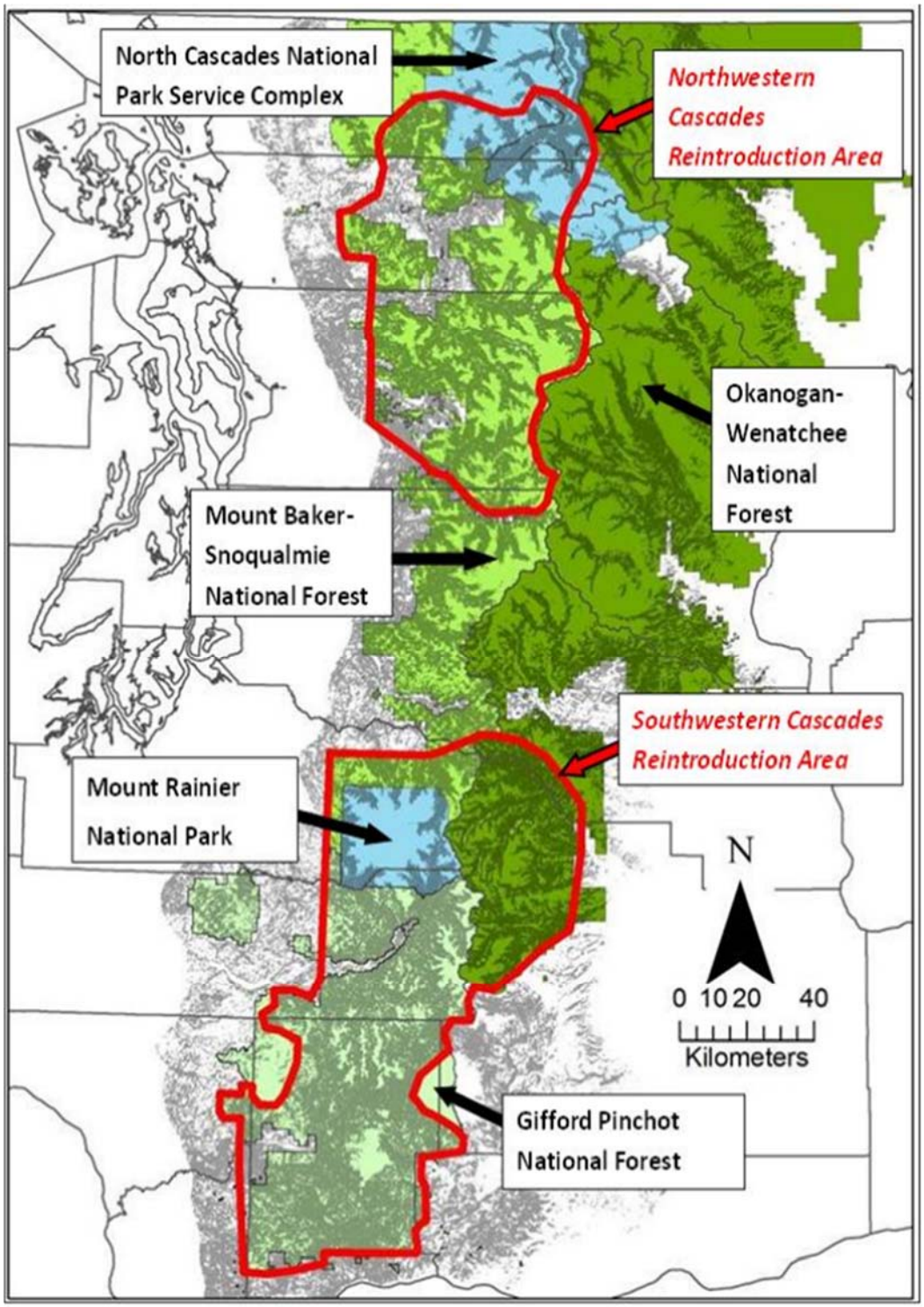


Figure 3. The northwestern and southwestern Cascades reintroduction areas for fishers. The gray shading represents high-quality fisher habitat (Lewis 2013). Federal lands are indicated with black arrows. The scope of this environmental assessment is limited to the area within the North Cascades National Park Service Complex.

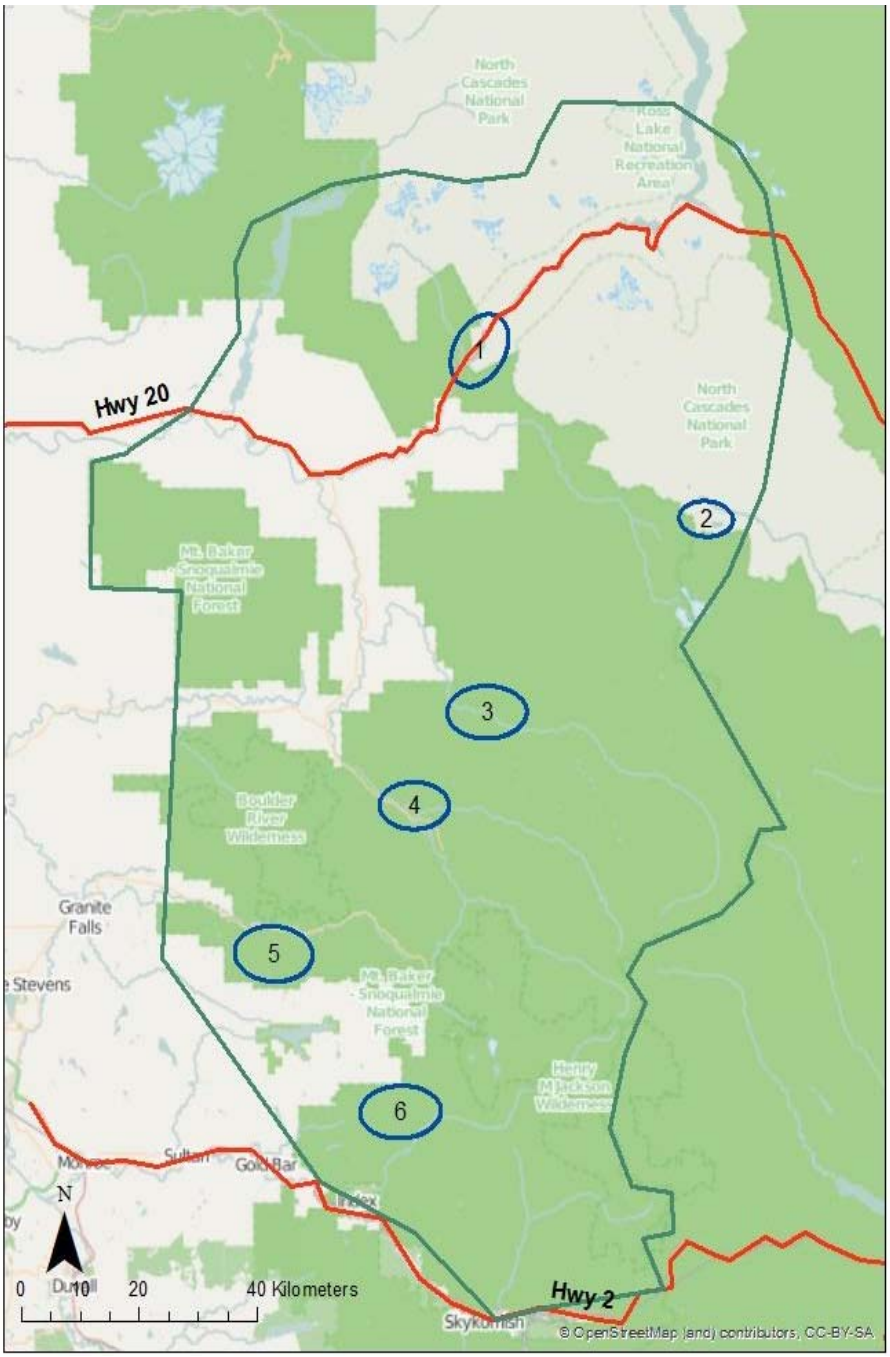


Figure 4. The northwestern Cascades reintroduction area is outlined in green. Six candidate release sites (blue ovals) are located in the reintroduction area and include: 1) middle Skagit/lower Ross Lake Recreation Area, 2) north fork Cascade River, 3) middle Suiattle River, 4) Sauk River and White-Chuck River confluence, 5) south Boulder River Wilderness, 6) middle Skykomish River. Our scope is limited to the sites within the Complex, which includes sites 1 and 2 (modified from Lewis 2013).

### 2.3 Alternative Action

The alternative action for reintroducing fishers in the Complex would be to use captive breeding. This alternative would be used if the availability of fishers from Canada was limited. This alternative would use the available fishers for a breeding stock to create an adequately sized population needed for reintroduction. Fishers would be bred in captivity until there are enough to serve as a source population. Once the captive population size is large enough fishers would be released and monitored using the same methods as described in the proposed action. This alternative would be used if there were too few fishers available for translocation from Canada, or if the translocation of fishers from Canada would risk the persistence of the donor population (Gilpin and Soule 1986).

### 2.4 No Action Alternative

A no action alternative would not reintroduce fishers into the Complex. Without reintroduction efforts a naturally reproducing viable fisher population would most likely not be established in the Complex. A no action alternative could potentially have adverse effects on habitat and ecosystem structures due to the lack of historic predator-prey relationships. Presuming there are no fishers currently in the Complex, NPS personnel would not need to monitor fishers. Other carnivore inventory and monitoring may, however, detect fishers, if present, in the Complex.

# 3.0 Impact Matrix

The impact matrix is an informative overview of all of the potential impacts examined in our analysis of the fisher reintroduction project within the Complex. The team chose the categories included in the matrix based on the magnitude and context of the categories, in addition to those considered most affected by the fisher reintroduction process and fisher inhabitation within the Complex. The accompanying scale provides the numeric value thresholds for positive, neutral, or negative impacts.

Positive Impact (+1 to +5)
No Impact = 0
Negative Impact (-1 to -5)

| Natural Environment | Proposed Action | Alternative Action | No Action |
|---|---|---|---|
| **Earth** | | | |
| Geology | 0 | 0 | 0 |
| Soils | 0 | 0 | 0 |
| **Air** | | | |
| Air Quality | 0 | 0 | 0 |
| **Water** | | | |
| Water Quality | 0 | 0 | 0 |
| **Plants and Animals** | | | |
| Plants | 0 | 0 | 0 |
| Pika | 0 | 0 | 0 |
| Bald Eagle | 0 | 0 | 0 |
| Marbled Murrelet | +1 | +1 | 0 |
| Northern Spotted Owl | -1 | -1 | 0 |
| Western grey squirrel | 0 | 0 | 0 |
| Wolverine | 0 | 0 | 0 |
| Grey Wolf | 0 | 0 | 0 |
| Genetics | 0 | -1 | 0 |
| Diversity | +3 | +3 | -1 |
| Habitat | 0 | 0 | 0 |
| **Energy and Natural Resources** | | | |
| Amount required | -1 | -2 | 0 |
| **Built Environment** | | | |
| **Environmental health** | | | |
| Noise | -1 | -1 | 0 |
| **Land use** | | | |
| Aesthetics | +1 | +1 | 0 |
| Relationship to Land Use plans | 0 | 0 | 0 |
| **Transportation** | | | |
| Vehicular traffic | 0 | 0 | 0 |
| Parks or other Recreational facilities | +2 | +1 | 0 |
| **Public Services and Utilities** | | | |
| Fire | -1 | -1 | 0 |
| | | | |
| **Total** | +3 | 0 | -1 |
| **Relative Score** | +3 | 0 | -1 |

### 3.1 Recommendation

Our recommendation is the proposed action to reintroduce fishers into the Complex using translocation. Reasons for this preferred action are as follows:

- Fishers were historically present in the Complex but have been extirpated from the area due to anthropogenic disturbances.
- Suitable fisher habitat in Washington State is limited to three areas. These include the northwestern and southwestern Cascades reintroduction areas (Lewis and Hayes, 2004).
    - The most effective way to recover fisher populations in Washington is to reintroduce them into suitable habitat, so the two possible sites in the Complex within the northwestern Cascades reintroduction area should be utilized.
- WDFW has a stewardship responsibility to protect, restore, and enhance native wildlife populations and their habitat.
- The alternative action of reintroducing fishers using captive breeding could decrease the fitness of fishers. Captive breeding reduces the genetic variability of a population, potentially making them more susceptible to adverse environmental conditions. Over many generations fishers that are bred in captivity could have lower fitness than naturally occurring fishers.
- The NPS should strive to restore the biological and physical components of natural systems in parks. This includes restoring native plant and animal species to their historic range. This is laid out in the NPS Management Policies 2006.
- The proposed action received the highest relative score in our impact matrix for positive impacts to the Complex.

# 4.0 Background

### 4.1 History of Fishers in Washington

Fishers (*Martes pennant)* are located only in North America and were historically located throughout the state of Washington in low to mid-elevation late successional forests.
The fisher is a medium-sized mammalian carnivore and the largest member of the genus *Martes* in the family Mustelidae (Powell and Zielinski 1994). They resemble weasels in that they have a long slender body, short legs, rounded ears, pointed face, and a well-furred tail. The fur of a fisher is usually dark brown but the rump, tail and legs are black while the head and shoulders are flecked with gold and/or silver (Douglas and Strickland 1987). Fishers have large home ranges and generally avoid large forest openings. In western Washington, fishers may have been constrained to elevations below 1800 m because of frequent soft snow and deep snow packs (Lewis and Stinson 1998). Currently fishers are very rare in Washington. Infrequent sightings and incidental captures indicate that there may be a small number of fishers still present in the state. However, despite extensive surveys, no study has been able to detect a viable population throughout the state.

Two major factors caused fisher numbers to steadily decline until they were extirpated from Washington. These factors included over-exploitation from commercial trapping, and degradation and fragmentation of suitable habitat from deforestation and development. The trapping of fishers became illegal in 1934, but despite legal protection the fisher has not recovered. The fisher was listed as endangered in Washington in 1998 (WAC 232-12-014) and is likely extirpated from the state (Lewis and Hayes 2004). Reintroduction is considered to be the only way to recover fishers in Washington due to the absence of nearby populations to recolonize the state (Lewis and Stinson 1998). A feasibility report was undertaken by the WDFW in partnership with Northwest Ecosystem Alliance to determine if Washington is a suitable location for reintroduction. There were three potential sites located in Washington that fit the requirements of suitable fisher habitat: the Olympic Peninsula, northwestern Cascades, and southwestern Cascades. This particular proposal will be focused on the northwestern Cascade area. There are a number of stakeholders that are interested in fisher reintroduction including the Northwest Ecosystem Alliance, NPS, USFWS, Northwest Trek Wildlife Park, Point Defiance Zoo, Woodland Zoo, and Oregon Zoo (Lewis and Hays 2004).

### 4.2 Legal Context

The NPS manages the natural resources of parks to maintain them in an unimpaired condition for present and future generations, in accordance with applicable environmental laws. An overview of laws considered relevant for this context is provided.

**National Park Service Organic Act of 1916**[1]

This act established the NPS and charged it with maintaining and promoting national parks. The fundamental purpose of these parks is as follows:

> "... to conserve the scenery and the natural and historic objects and the wildlife 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."

Park officials will intervene when human activities have altered the biological or physical processes enough so as to need proactive management for restoration. The aim is to restore the area to its natural condition or to maintain the closest approximation of the natural condition when a truly natural system is no longer attainable (Management Policies 2006).

**Wilderness Act of 1964 -**

This act specifies the abilities of Congress to designate certain public lands as units of the National Wilderness Preservation System and determines policy for their management. "A wilderness...is recognized as an area where the earth and its community of life are untrammeled by man...Wilderness areas shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness and the preservation of their wilderness character."[2] Restoration of an extirpated native species can be considered an act to preserve wilderness character under section 4(b).

**The Endangered Species Act of 1973**[3]

This act provides regulatory approaches for preventing extinction. The provisions of the act come into effect when a species is listed on the federal Endangered Species List under ESA section four. According to the most recent Candidate Notice of Review compiled by the USFWS, fishers that comprise a Distinct Population Segment (DPS) on the West Coast are considered "warranted but precluded" (2013). This status as a candidate species has been maintained since 2004. Though the implications of a federal listing would be significant, especially section 9 prohibitions and the development of a habitat conservation plan, such regulations remain only a future possibility and will thus be given minimal attention in this assessment.

[1] 16 USC 1 et seq.
[2] 16 USC 1131 et seq
[3] 16 U.S.C. § § et seq. (1973, as amended)

### Washington State Laws

**Washington Administrative Code 232-12-297**: **"Endangered, threatened, and sensitive wildlife species classification"**

This section includes a list referred to generally as "species of concern." Fishers have been listed as endangered by the State of Washington since 1998 (Lewis and Stinson 1998).

**Revised Code of Washington 77-15-120**: **"Endangered fish or wildlife"**

This statute defines actions that constitute the unlawful taking of an endangered species, and lists the penalties for such actions.

**North Cascades National Park Service Complex - Superintendent's Compendium of Designations, Closures, Permit Requirements and Other Restrictions Imposed Under Discretionary Authority**[4]

This 2013 Superintendent's Compendium provides a list of regulatory provisions specific to the Complex, in addition to the more general National Park Service prescriptions in the Code of Federal Regulations. These specific provisions are updated annually and apply to all persons and activities within the boundaries of the Complex.

[4] 36 CFR, Chapter 1, § 1-7

## 4.3 Proposed Action Permits

**Provincial; British Columbia and Alberta -**
The proposed action will require a "possession permit" for transport of fishers within and out of Canada. Only those fishers deemed fit for translocation by a veterinarian accredited by the Canadian Food Inspection Agency will be listed on the possession permit.

**State; Health Certificate and Permit -**
The Washington State Department of Agriculture (WSDA) requires issuance of a health certificate prior to entry into Washington State (Lewis 2006). Certification is contingent upon the inspection for communicable and infectious diseases performed by a licensed and accredited veterinarian. This inspection is meant to satisfy all similar state, federal, and provincial requirements for the capture and translocation of fishers. A full list of veterinary tasks is provided in appendix A. When passed, each fisher will be permanently marked and WSDA will provide an individual permit number to be written on the health certificate for each fisher (Lewis 2013).

**Canadian Customs -**
Customs agents require prior notification of the shipment of fishers by the WDFW project leader. Agents reserve the right to inspect the fishers, their holding units, all paperwork, and question anyone accompanying the fishers.

**U.S. Customs; Declaration Form 3-177 -**
Concomitant inspection is required by the USFWS at the U.S. - Canadian border prior to U.S. entry. In addition, the USFWS form 3-177 declaration of importation of live animals and tissues needs to be completed. A USFWS agent will review this paperwork and inspect the fishers and holding boxes to ensure humane transport (Lewis 2013).

# 5.0 Elements of the Environment

**Scoping Process and Public Participation**

To determine the scope of issues to be analyzed in depth in this environmental assessment, meetings were conducted with Leo Bodensteiner, the assessment team, and other parties associated with preparing this document. The issues selected for further analysis represent those with the potential for concern in one or more of the alternatives.

## 5.1 Impacts Considered but Dismissed from Further Analysis

### 5.1.1 Natural Environment

#### Geology

The core of the Complex is granite rock formed from the recrystallization of heavy oceanic crust. The rocks found in the Complex date back to at least 400 million years. The mountain ranges of the Complex were once separate pieces created far apart from each other and far away from where they now reside. Over time tectonic plates brought them all together to what we now call western Washington. Some of these pieces were then uplifted, eroded, buried, reshaped and brought back to our view. A volcanic arc then grew across this complex mosaic of terrains covering some of the older rocks, and incorporating some of the old rock back into the hot molten interior of the earth. Erosion from water, wind, and glaciers have shaped and are continuing to reshape the Complex. Fishers will not be able to change the terrain of the Complex. They will not interact with tectonic plates, will not interact with volcanic activity, and will not have a significant effect on erosion in the Complex. Therefore fisher reintroduction would have no known impact on geologic conditions in the Complex.

#### Soils

There is a wide variety of soils throughout the Complex due to the variety of topographic settings, parent material, vegetation types, climatic regimes, and ages of landforms. Parent materials include alluvium, glacial drift, colluvium, volcanic ash, and bedrock (NPS, 2011). There are differences in soil texture and origin throughout the Complex. Steep bedrock slopes have thin, poorly developed soils, whereas soil formed by glacial drifts and alluvium are thicker and better developed. Fishers do use the ground for foraging and moving between habitats, however they do not burrow into the ground and they do not have an effect on the biodegradation of soils. Therefore the reintroduction of fishers will have no known impacts on soils in the Complex.

### Topography

The Complex is an ecosystem with rich biodiversity from deep forested valleys to high alpine mountains. The topographic features found throughout the park were created by multiple ice age glaciations including both alpine and continental ice sheets. These extreme elevation gradients result in a high diversity of vegetation and animals. Fishers' preferred habitat is low to mid-elevation late successional forests so they will most likely be found in these areas. Even though fishers will be found in these areas they will not have an impact on topography because they do not dig or excavate.

### Unique Physical Features

Old growth forests are unique from new and middle age stands and are characterized by large old trees, multi-layered canopy cover, and a large amount of snags and coarse woody debris. Fishers den and rest in large trees and downed logs which makes the Complex and its unique features preferable habitat for fishers. These activities do not have significant adverse effects on the features of old growth forests.

### Odor

Fishers use urine, feces, and glandular secretions to scent-mark territories, den sites, and carcasses (Frost et al. 1997). This will possess an odor detectable by fishers as well as other species, however, the effects will be negligible to the health of the ecosystem. There will be no significant impact on odor in the Complex as a result of fisher reintroduction.

### Disease Transmission

Although fishers are susceptible to diseases such as rabies, the precautionary measures and inspection processes to be completed before translocation and reintroduction would ensure that only healthy and disease-free fishers would be reintroduced. A list of full veterinary tasks to be performed is provided in Appendix A. Therefore, no impacts from inter-species disease transmission are expected.

### Climate

A warming climate may give fishers the ability to move to higher elevations due to increased temperatures and decreased snowpack. However, tree species found at higher elevations do not meet the needs of a fisher in the same ways that tree species found at low to mid elevations do. Therefore climate change will not have an impact on fisher reintroduction, at least for the foreseeable future.

### Water Quality

There are 318 glaciers in the park that, along with precipitation, help feed 240 natural lakes in the Complex. The park Complex has two major watersheds, the Skagit River and Stehekin River. The Skagit River drains an area of 7,770 $km^2$ before draining out into Puget Sound. The Stehekin River along with its tributaries cover a distance of more than 48.3 stream km and provides more than 50% of the flow into Lake Chelan. The main stream reaches of these rivers and other tributaries have low to moderate gradients which allow for a wide variety of fish and aquatic life. Higher ordered tributaries exhibit moderate to steep gradients. Waterfalls, boulder beds, and cascades are common in these reaches and act as barriers to fish migration upstream. Water quality in the lakes, streams, and rivers in the Complex is generally in excellent condition. There are, however, specific areas in the Complex that have been either listed as impaired or are at an elevated risk of impairment under the Clean Water Act (NPS 2008). The reintroduction of fishers would have no significant effects on water quality in the Complex. Their urine and feces have the potential to leach into ground water, lakes, ponds, streams, and rivers, but the effect will be well within natural variation and have no significant impact on water quality.

### 5.1.2 Energy and Natural Resources

#### Source/Availability

The source of energy required will be primarily fossil fuels for aerial telemetry and transportation from British Columbia to the Complex. These energy requirements will be minimal and will have no known significant impact on the source or availability of energy with the reintroduction of fishers. Energy will not be needed for extended use, so the source of the energy is not an issue for the reintroduction.

#### Nonrenewable Resources

The reintroduction of fishers will rely on fossil fuels for the majority of the proposed and alternative action. However, the amount of fossil fuels required will be negligible, meaning the reintroduction of fishers will have little to no known impacts on nonrenewable resources.

#### Conservation and Renewable Resources

The reintroduction of fishers will have no effect on renewable resources, as fishers will have no known impact on existing or future renewable resource infrastructure. The proposed action will require minimal seasonal restrictions in and around known fisher habitat, increasing conservation for the released fishers.

### 5.1.3 Built Environment

#### Risk of Explosion

The reintroduction of fishers into the Complex will have no known increase in the risk of explosions. Fishers do not interact with any machinery capable of exploding, or with explosive devices themselves. There is the potential for the aircraft used to monitor fishers to crash and

explode; however, this is very unlikely and should not be considered as an added risk of explosion.

### Releases or Potential Releases to the Environment Affecting Public Health, such as Toxic or Hazardous Materials

Fisher urine and feces have the potential to leach into groundwater and run off into lakes and streams. This impact however would be negligible and well within natural variations. The reintroduction of fishers into the Complex will cause no significant increase in the risk of potential releases to the environment.

### Land and Shoreline Use

There are 19 boat-in camps lining the shores of Ross Lake. These campsite areas have fire-rings, picnic tables, vault toilets, and bear-resistant food storage boxes. The use of such boxes keeps most wildlife, including fishers, from scavenging for human food. Fishers are terrestrial carnivores who do not consume fish, decreasing the probability that fishers will frequent campsites along lakes within the Complex. The requirement of backcountry permits for overnight stay in the park limits the amount of human visitation in general. Thus the chance encounter of people and fishers is minimal, making any potential interactions between humans and fishers insignificant.

### Impacts to Existing Land-Use Plans

The Stephen Mather Wilderness Area comprises 94% of the Complex, and extractive industry is not permitted within National Parks (Pub. L. 100-668, 1988). Development within the project area is concentrated along the corridors created by highways 2 and 20, and within the Ross Lake NRA. The Complex has a current total of 260 buildings and approximately 637 km of trails. As described in sections 4.1 and 5.1.1., essential den and nest sites for fishers are located in more densely forested areas. The reintroduction implementation plan lists the following criteria for candidate release-site selection (Lewis 2013):

1. Surrounded by suitable (i.e., mature forest) habitat
2. More than 10 km away from highway corridors in most cases
3. Accessible by vehicle during all or majority of the release season (November-February)

Wilderness designation provides assurance that viable habitat characteristics such as downed logs, snags, and large cavities are maintained into the future. These areas also contain diverse prey (Banci, 1989), and fishers tend to avoid open areas (Lewis 1998). For these reasons, fishers are not expected to establish home ranges within the Ross Lake or Lake Chelan NRAs in the Complex. Both NRAs are of preferable elevation for fishers, but their disturbed status and centrality along large bodies of water conflict with the optimal habitat of fishers. Disturbances include large structures such as dams and powerhouses, and roads connecting these areas

fragmenting potential habitat areas. Fishers are unlikely to have an extended presence in areas occupied by humans and are therefore unlikely to affect land-use plans within the Complex (Zipp, pers. comm. May 28, 2014).

Despite their general avoidance of roads and built structures, newly reintroduced fishers will typically travel more than 50 km after release (Powell 1993). Only those land use plans that are in the vicinity of release sites 1 and 2 (Figure 4) were discussed. Reintroduction in the northwestern area (sites 1 and 2) is planned to take place one year after reintroduction begins in the southwestern reintroduction area (Figure 3). If funding is secured and this plan is implemented, then fishers would be reintroduced in the northwestern area no sooner than November 2016 (Lewis, 2013).

Therefore, only land-use plans with timelines projected beyond 2016 will be considered, given that the potential effects of fishers on such plans is predicated upon their presence in the area of ongoing activity.

**Ross Powerhouse Rockslide Stabilization**

The Ross Dam and Ross Powerhouse are in a remote location where primary access is by boat (NPS 2012). Seattle City Light is the entity that oversees the Skagit River Hydroelectric Project within the Ross Lake NRA. In March of 2010, a rockslide damaged infrastructure used by Seattle City Light for routine maintenance and operation of the dam and powerhouse. An environmental assessment was prepared, which considered the hazards caused by the rockslide to all visitors, and to the decreased access for Seattle City Light personnel in the context of maintenance and emergency planning. The major objectives of this project include restoring motor vehicle access between the dam and the powerhouse, re-establishing access for large equipment and supplies for powerhouse rehabilitation and operation, and restoring public trail access between Diablo and Ross lakes (NPS 2012). The biological evaluation of the project concluded that the project activities will either have “no effect” or “may affect, not likely to adversely affect” the five terrestrial species of concern that could potentially be found in the project area (NPS 2012 Biological Assessment).

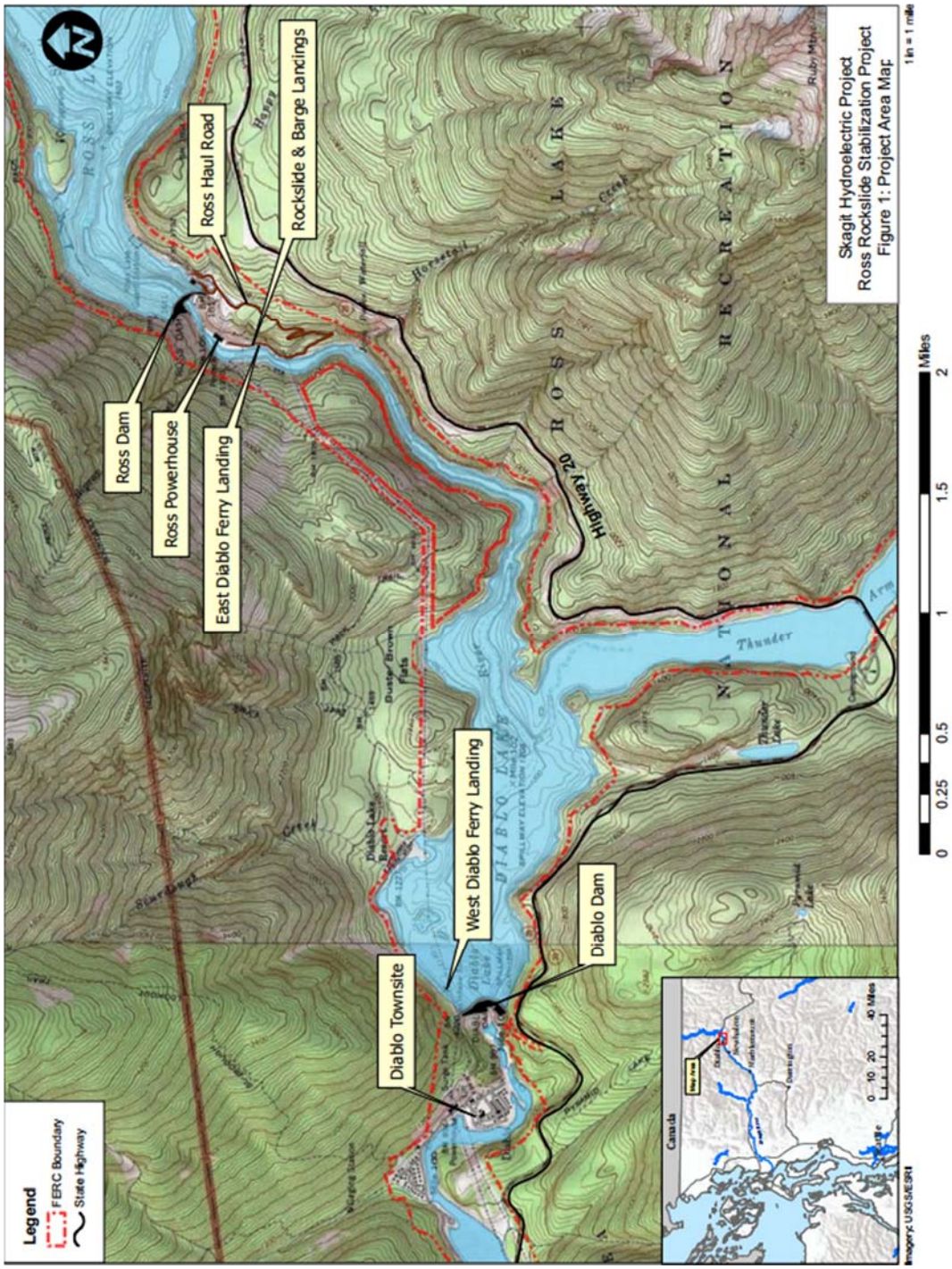


Figure 5. Current plans for Ross Powerhouse rockslide stabilization project (NPS 2012).

**Replacement of Administrative Facilities at Stehekin**

There are current plans to relocate fire and maintenance facilities and one single family residence out of the floodplain and channel migration zone of the Stehekin River within the Lake Chelan NRA. Proposed sites for the maintenance facilities are among existing developments along the airstrip (Figure 6). The aging facilities are becoming inefficient to operate and maintain, and much of the plans included in the public scoping documents revolves around a solution for solid waste disposal for the new sites. An environmental assessment is currently being prepared and will be available for public review during the summer of 2014. From the available project information and its location outside of the suitable habitat areas for fishers (Figure 9), reintroduction is not expected to conflict with these relocation plans.

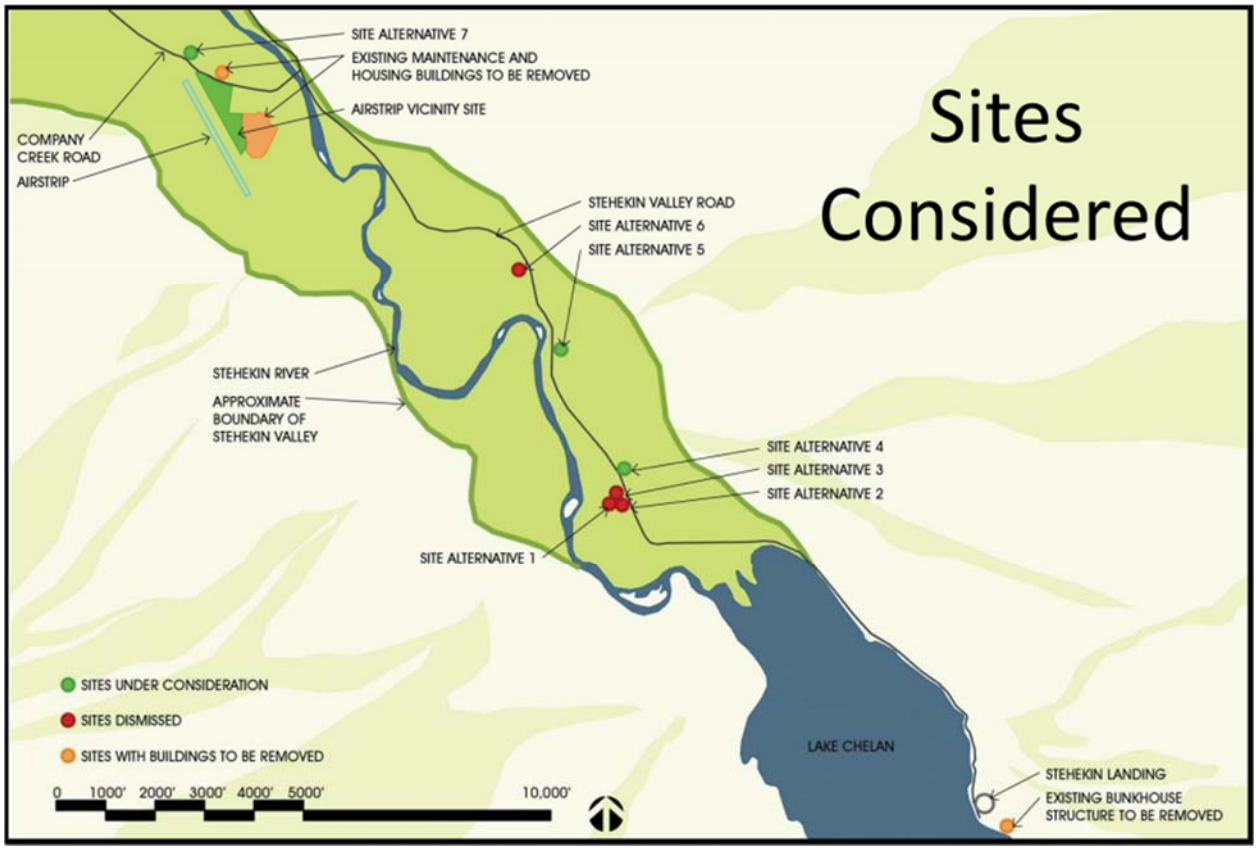


Figure 6. NPS public scoping image for maintenance facilities and one residential housing unit in the Stehekin River corridor.

#### Housing

The number of permanent residents within the Complex is <1,000 and mostly limited to employees of the Skagit River Hydroelectric Project. Fisher reintroduction will have no known impact on the housing structures in the unincorporated towns of Newhalem and Diablo because they are highly unlikely to interact with built structures located in open areas (Lewis 1998).

#### Light and Glare

Fishers are not known to interact with sources of light in the wild or in built environments. Therefore no actions or alternatives will have impacts on light and glare within the Complex.

#### Aesthetics

The subjectivity of aesthetics can mean either an improvement or deterioration in in the aesthetics of the Complex with the presence of fishers. Because of this subjectivity, and that fisher sightings are so rare, impacts to the area's aesthetics will not be considered.

#### Recreation and Tourism

It is possible that tourism/recreation in the Complex could increase due to perceived benefits of the park to visitors as a result of fisher reintroduction. However, such an increase is likely to be slight and difficult to quantify. Therefore, impacts from tourism/recreation increase were dismissed from further analysis.

#### Historic and Cultural Preservation

No plans to reintroduce fishers are expected to adversely affect historic sites, as NPS staff conduct their activities in accordance with the National Historic Preservation Act. There are sites in the Complex that are on the National Historic Places Register, but no documented activities of fishers could cause significant impacts to known and unknown archaeological and other historical sites or structures. Therefore, fishers will have no known significant impact on historical and cultural sites.

#### Agricultural Crops

No lands within the Complex are used for agriculture. Therefore fishers cannot have an effect on agricultural lands.

#### Transportation

No impact on transportation systems, parking, movement and circulation of people or goods, or waterborne, rail and air traffic are anticipated as a result of fisher reintroduction. This is because fishers live in the wilderness, away from the infrastructure and conveyance systems.

### 5.1.4 Public Services and Utilities

### Local Fire Departments

The reintroduction of fishers into the Complex will not require any additional resources from local fire departments. The Marblemount Fire Department is the closest fire department on the north west side of the Complex on highway 20, and Winthrop Fire Department on the east side of highway 20. If an accident were to occur in the Complex, one of the two fire departments would be contacted for assistance. No impacts on local fire departments are anticipated as a result of fisher reintroduction.

### Police Departments

Fisher reintroduction into the Complex will not require any additional resources from surrounding police departments. The Complex is in a National Park with federal park rangers on duty. If additional assistance were required, Concrete and Marblemount police departments would be contacted. No impacts on local police departments are anticipated as a result of fisher reintroduction.

### Public Maintenance

The reintroduction will occur in a wilderness area where there are many trails that are maintained;, however, it is the rangers' job to maintain the trails, not the local maintenance department. No impacts on public maintenance are anticipated as a result of fisher reintroduction.

### Communication

Fisher reintroduction will require the use of communication equipment; however, the Complex is already equipped with communication technologies. No impact on the communication capacity of the Complex is anticipated as a result of fisher reintroduction.

### Storm Water

The proposed action does not require the construction of buildings or other changes in permeable surfaces. For the alternative action a breeding facility will be required, but this will not be located in the Complex and will therefore not affect storm water. Fishers are physically unable to change features of the land that impact storm water flows. Therefore, the reintroduction of fishers will have no known impact on storm water.

### Sewer Water

Solid Waste Disposal Sites in units of the National Park System (36 CFR Part 6) and other government service or utilities are not anticipated to change as a result of fisher reintroduction. Fishers are very unlikely to interact with sewer water systems.

**Consideration of Lands Outside of Complex Boundaries**

Fisher reintroduction will not measurably impact uses of public or private lands. Nonetheless, results of the Olympic fisher reintroduction project indicate a wide distribution potential of fishers once released (NPS 2007a). The scope of this analysis is limited to impacts within the Complex, but the potential impacts of fisher presence in adjacent lands warrants consideration.

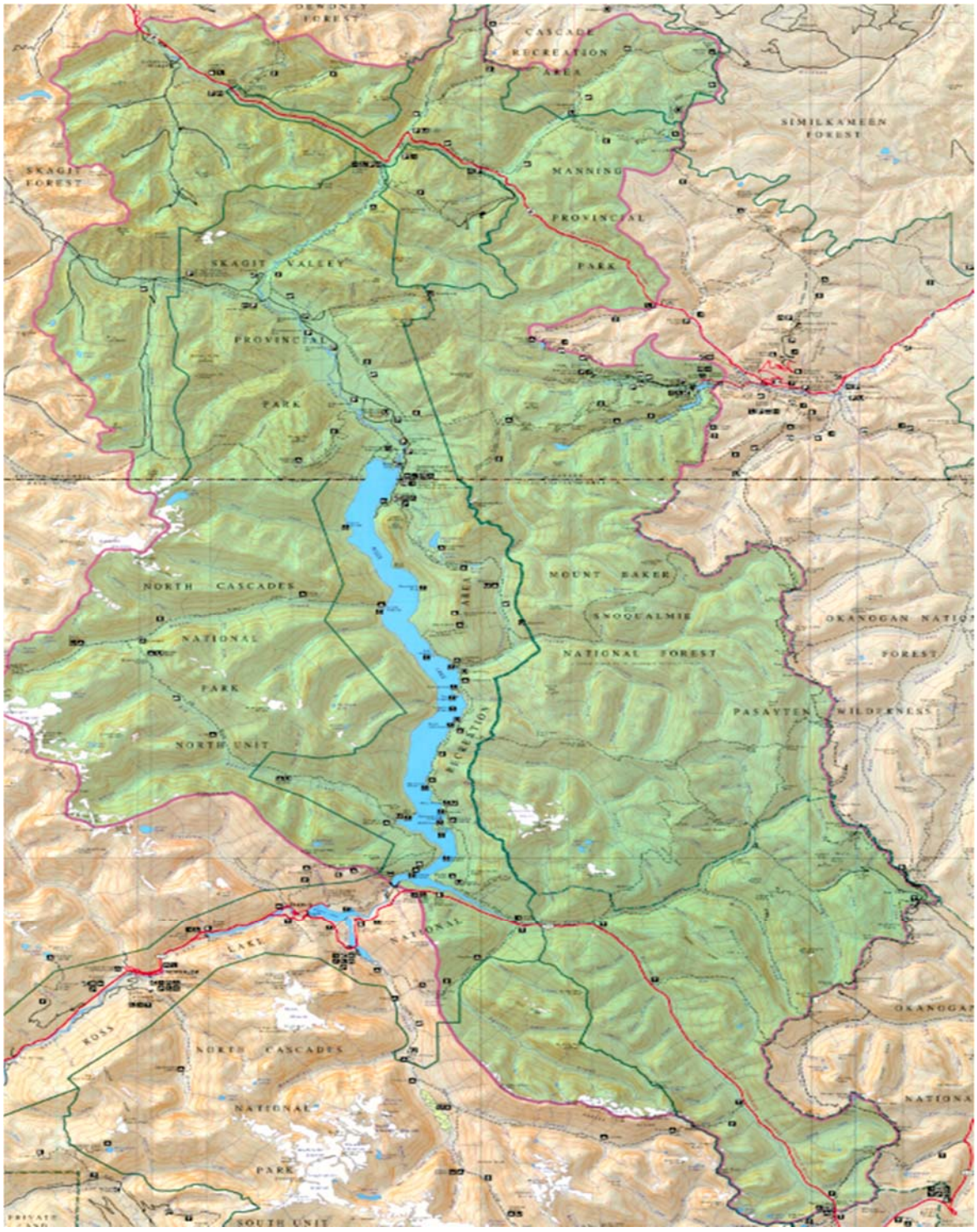


Figure 7. Upper Skagit River watershed recreation map (G M Johnson and Associates)

### Transboundary Ecosystem Management

Through direct relationships with the British Columbia Ministry of the Environment, and the Skagit Environmental Endowment Commission, the Complex is focused on transboundary activities to increase cooperation on visitation, resource management, and other operational issues (NPS Foundation Document 2012).

### Adjacent Tribal Lands

There is one area of tribally-held lands in proximity to the Mt. Baker-Snoqualmie National Forest, which borders the Complex and can be considered part of a contiguous viable habitat. This was considered because Indian lands are not federal public lands, and their status as sovereign territories exempts them from state and federal public land laws. An “affected tribe” is any tribe in the state of Washington that is federally recognized by the United States Secretary of the Interior that may or will be affected by the proposed action (WAC 197-11-710).

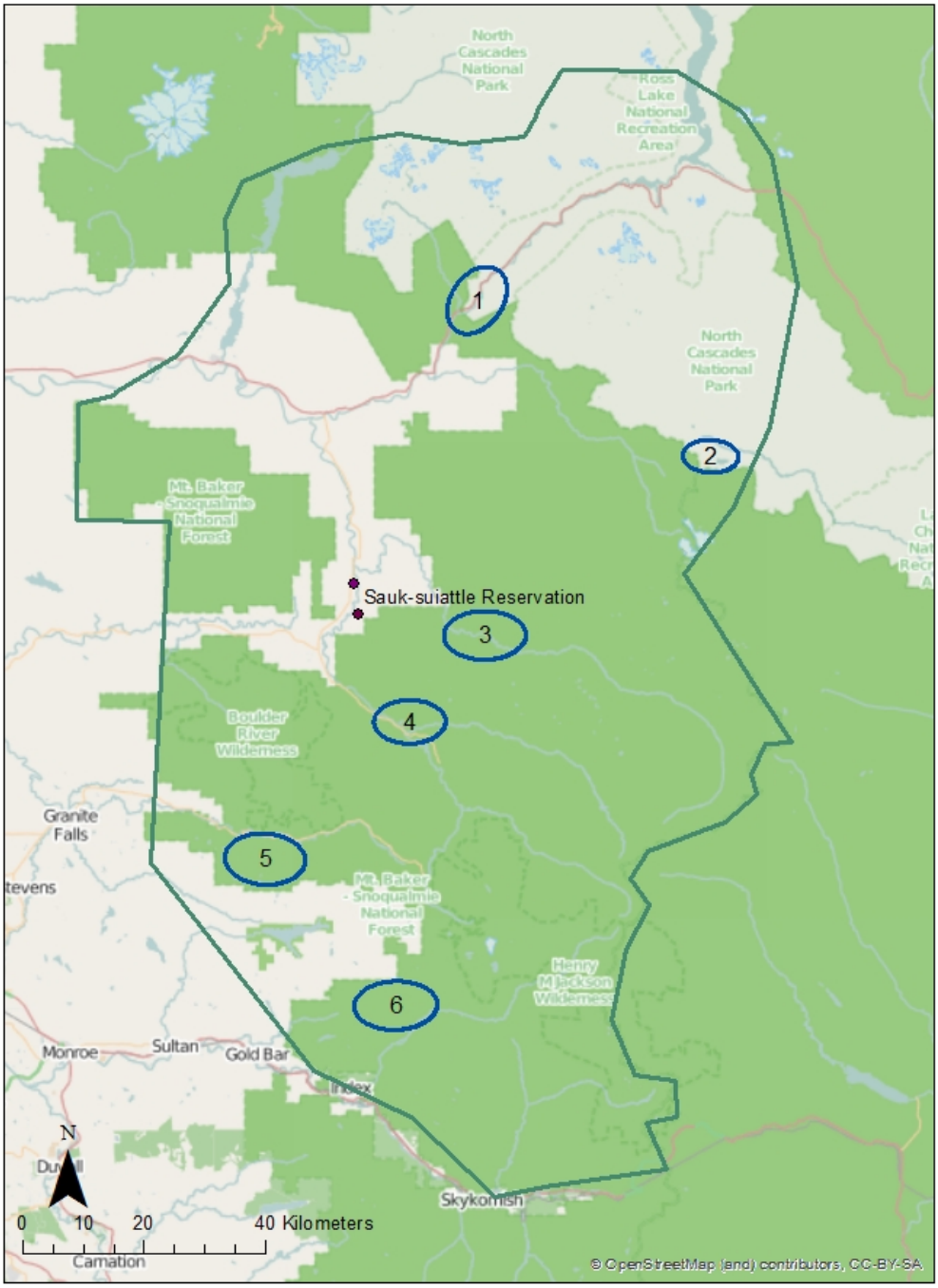


Figure 8. The location of tribal lands relative to the Complex and proposed fisher release sites

**Sauk-Suiattle**

The main reservation is approximately 14 hectares in size, located 8 km north of Darrington along Highway 530. The southern reservation parcel is approximately 9 hectares (EPA 2014). Both of these lands are over 50 km away from the Complex (Figure 8). Any significant impacts to the Sauk-Suiattle tribe is predicated upon fishers becoming federally listed under the ESA, whereby government-to-government consultation would take place between the tribe and federal

agencies in developing a safe harbor agreement or similar conservation measures. Federal listing is unlikely at this time. The prospect of fishers traveling such distances and establishing themselves in such a precise area would be unlikely. For these reasons, impacts to this tribal community were dismissed from further analysis.

### Urban Quality

There is a small chance that fishers could wander from their projected habitats into neighboring communities and prey on domestic animals such as cats, dogs, and chickens. This is expected to be rare as fishers generally avoid built environments and human communities (Lewis 1998).

# 5.2 Affected Environment

### 5.2.1 Natural Environment

#### Air Quality

**Current Condition**

The air quality in the Complex is primarily affected by westerly winds carrying pollutants from road traffic, industrial activities, and agricultural practices. Even though the Complex is designated as a Class 1 area which gives it the highest degree of air quality protection, the pollutants carried by these winds are still deposited throughout the Complex (NPS Air Quality). These pollutants can be deposited at all elevations within the park. Once the pollutants are deposited in the park via precipitation or fallout, some of them are capable of being incorporated into the food web. Air quality is currently being monitored in the Complex. Some of the pollutants that are being monitored are particulate matter, ozone, acid deposition, mercury, and pesticides.

**Proposed Action Impacts**

Fisher reintroduction would have no known impact on air quality in the Complex. Aircraft may be used to monitor fishers which may affect air quality. However, these impacts would be negligible because of the small spatial scale and limited duration; therefore, they would not have a significant impact on overall air quality.

**Alternative Action Impacts**

Fisher reintroduction using captive breeding would have no known impact on air quality in the Complex. Aircraft may be used to monitor fishers which may affect air quality. However, these impacts would be negligible because of the small spatial scale and limited duration, therefore it would not have a significant impact on overall air quality.

**No Action Impacts**

Taking no action to reintroduce fishers would mean no increased air traffic to monitor the fishers; thus there would be no significant impact on overall air quality.

### 5.2.2 Plants and Animals

#### Habitat for and Diversity of Species of Plants, Fish or Other Wildlife

The Complex is a diverse region with four general vegetation zones: lowland forest, montane forest, subalpine parkland, and the alpine zone. These are due to differences in rainfall, slope, aspect and elevation. There are three additional zones that encompass the four vegetation zones caused by two orographic boundaries: the Boston-Picket-Spickard Divide and the Cascade Crest.

West of the Boston-Picket-Spickard Divide is a temperate marine climate with mild, wet conditions, while east of the Cascade crest is a semi-arid continental zone. The third zone between the Boston-Picket-Spickard divide and the Cascade Crest is a transitional zone. This area encompasses much of the Ross Lake recreation area (NPS 2011).

Fishers are most likely to occur in the lowland forest (0-915 m) and montane forest zones (915-1,646 m). Vegetation in the lowland forests is dominated by: western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata)*, and Douglas fir (*Pseudotsuga menziesii).* The montane forest is dominated by Pacific silver firs (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), with some subalpine fir (*Abies lasiocarpo),* grand fir (*Abies grandis)*, and Alaska yellow cedar (*Chamaecyparis nootkatensis)*. Moist and exposed areas in the Complex, such as floodplains, are dominated by deciduous species: bigleaf maple (*Acer macrophyllum)*, black cottonwood (*Populus balsamifera spp. trichocarpa),* red alder (*Alnus rubra*), paper birch (*Betula papyrifera)*, slide alder (*Alnus viridis),* vine maple (*Acer circinatum)*, and willow (*Salix spp.)* (NPS, 2011).

The Complex has over 320 vertebrate species: 75 mammals, 20 reptiles and amphibians, 210 bird species, and at least 28 fish species (NPS, 2011). There is limited quantitative data on the population status and distribution of animals within the park boundaries.
Common mammal species within the park include pika, Townsend's chipmunk, hoary marmot, Douglas squirrel, beaver, black bear, and black-tailed deer.

**Unique Species**

**Plant Species of Special Concern**

Three plants listed as threatened are known or likely to occur within the Complex. The hair-like sedge (*Carex capillaries)*, the large awned sedge (*Carex macrochaeta),* and the strawberry saxifrage (*Saxifragopsis fragarioides)*. The elevation range of all three of these plant species overlaps with fisher elevation range (Table 1).

Table 1. Washington State rare plants known or likely to occur in the Complex (NPS 2011)

| Scientific name | Elevation | Habitat | Blooming time | Status |
|---|---|---|---|---|
| *Botrychium lanceolatum* lance-leafed moonwort | 760'-6000' | Moist sites, alpine meadows | June-September | Watch |
| *Botrychium lunaria* common moonwort | 3000'-6400' | Moist open areas in meadows and forests | June-September | Watch |
| *Botrychium minganense* moonwort | 2000'-5700' | Moist sites in deciduous and coniferous forest, subalpine sites | June-September | Watch |
| *Botrychium pedunculosum* stalked moonwort | 1600'-3000' | Moist wooded sites | June-September | Sensitive |
| *Carex atrosquama* blackened sedge | | Open wet meadows and dry slopes at moderate to high elevations | July-August | Review group 2 |
| *Carex buxbaumii* Buxbaum's sedge | 700'-6200' | Bogs, marshes, wet meadows | June-August | Watch |
| *Carex capillaries* hair-like sedge | 2800'-6500' | Stream banks, wet meadows, wet ledges, and marshy lake shores | June-August | Threatened |
| *Carex comosa* bristly sedge | 50'-2000' | Marshes, lake edges, wet meadows | July-August | Sensitive |

| Scientific name | Elevation | Habitat | Blooming time | Status |
|---|---|---|---|---|
| *Carex flava* yellow sedge | 2000'-4000' | Wet meadows, forested wetlands, bogs shores of streams and lakes | July-August | Sensitive |
| *Carex heteroneura* different nerved sedge | Moderate to high elevation | Wet meadows to dry slopes | June-August | Review group 2 |
| *Carex machrochaeta* large awned sedge | 600'-3200' | Open wet meadows, seeps, waterfalls | July-August | Threatened |
| *Carex magellanica ssp. Irrigua* poor sedge | 2000' | Bogs, sedge meadows, fens, spruce/sedge association | August | Sensitive |
| *Carex pluriflora* several flowered sedge | 100'-3100' | Marshes, stream banks, lake margins | July-August | Sensitive |
| *Carex saxatilis var. major* russet sedge | 2500'-5500' | Wet meadows, edges of streams and ponds, bogs | July-August | Watch |
| *Carex scopulorum var. priono-phylla* mountain sedge | 4600' | Moist-wet meadows, lakeshores, stream banks | July-August | Watch |
| *Cicuta bulbifera* bulb-bearing hemlock | 240'-3700' | Edges of marshes, lakes, bogs, meadows shallow standing or slow moving water | August-September | Sensitive |
| *Epipactis gigantean* giant hellebore | 0'-4000' | Stream banks, lake shores, seeps, springs | April-July | Watch |
| *Erigeron salsihii* Salish fleabane | 6000'-8000' | Dry alpine ridges | July-August | Sensitive |
| *Eriophorum viridicarinatum* green keeled cottongrass | 2000'-6600' | Cold swamps and bogs | June-July | Sensitive |
| *Fritallaria camschatcensis* black lily | 0'-3000' | Moist to wet meadow, open, riparian areas, tide flats | May-June | Sensitive |
| *Galium kamtschaticum* boreal bedstraw | 1500'-2100' | Moist coniferous forest, seeps and areas of standing water | July-August | Watch |
| *Githopsis specularioides* common blue-cup | 200'-2300' | Dry, open places in foothill, areas of thin soils, talus slopes | April-June | Sensitive |
| *Hypericum majus* Canadian St. Johnswort | 100'-2300' | Along ponds and lakeshores, riparian areas | July-September | Sensitive |
| *Iliamna longisepala* longsepal globemallow | 500'-4500' | Sagebrush steppe, open hillsides, dry streams, open Ponderosa and Douglas fir forest | June to August | Sensitive |
| *Impatiens Aurelia* orange balsam | Low elevation | Moist shaded areas | June-August | Review group 2 |
| *Limosella acaulis* mudwort | < 4000' | Ponds edges, lakeshores, river edges in areas of slow moving water | May-November | Watch |
| *Lycopodiella inundata* bog clubmoss | 1500'-6400' | Bogs, marshes pond margins | July | Sensitive |
| *Lycopodium dendroideum* treelike clubmoss | 800'-3600' | Rock outcrops, talus fields, moss and significant debris layer | June-July | Sensitive |

| Scientific name | Elevation | Habitat | Blooming time | Status |
|---|---|---|---|---|
| *Pellea brachyptera* Sierra cliff brake | 770'-2200' | Dry Rocky slopes, talus, outcrops in Douglas fir and Ponderosa Pine forest | August-September | Sensitive |
| *Penstemon eriantherus var. whitedii* fuzzy-tongued penstemon | 3500' | Open sagebrush shrub, open areas in valleys and foothills | May-July | Sensitive |
| *Pinguicula vulgaris* common butterwort | 1500'-7000' | Moist seeps, meadows and talus slopes | July-August | Watch |
| *Planthera obtusata* small northern bog orchid | 800'-5000' | Moist places in forests, bogs, stream banks, marshes, meadows, | June-July | Sensitive |
| *Pleuricospora fimbriolata* Sierra sap | 1000'-4000' | Dry coniferous forest with little understory | July-August | Watch |
| *Potemogeton obtusifolius* blunt leaved pondweed | 50'-2000' | Waters of lakes and slow moving streams | August-September | Sensitive |
| *Saxifragopsis fragarioides* strawberry saxifrage | 1400'-4500' | Crack and crevices on cliffs and rock outcrops in Ponderosa pine and Douglas fir forest. | June-July | Threatened |
| *Silene seelyi* Seely's silene | 1500'-6300' | Cliffs and talus slopes | May-August | Sensitive |
| *Spiranthes porrifolia* Western ladies tresses | 60'-6800' | Meadows, seeps streams | May-August | Sensitive |
| *Swertia perennis* Swertia | 4000' | Montane to subalpine meadows, stream banks | July-August | Review group 1 |
| *Utricularia minor* sesser bladderwort | 300'-2000' | Shallow standing/slow moving water | June-September | Review group 1 |

**Proposed Action Impacts**

Fisher reintroduction is not expected to affect plant species of special concern because fishers have a predominantly animal-based diet. However, they may feed on fruit such as huckleberries and salal berries in the fall and winter. This could have short-term, negligible impacts on those specific species but would not affect the plant community of the park overall. Secondary effects from predation on herbivores could occur but is not expected to have a significant impact on vegetation.

**Alternative Action Impacts**

Fisher reintroduction using captive breeding is not expected to affect plant species of special concern because fishers have a predominantly animal-based diet. However they may feed on fruit such as huckleberries and salal berries in the fall and winter. This could have short-term, negligible impacts on those specific species but would not affect the plant community of the park overall. Secondary effects from predation on herbivores could occur but is not expected to have a significant impact on vegetation.

**No Action Impacts**

Taking no action to reintroduce fishers would have no known impacts to plants in the Complex. No action would have no potential effects on the plant community or secondary effects from predation by fishers.

**Animals**

The Complex has 27 species listed as threatened, endangered, candidate, monitor, and/or sensitive. These species are listed in Table 2. Determinations on whether any of the listed species could be affected by fisher reintroduction can be found in the following sections.

Table 2. Threatened and endangered wildlife within Washington (federal and state listed)

| | | Status* | |
|---|---|---|---|
| **Common Name** | **Scientific Name** | **Federal** | **State** |
| American peregrine falcon | *Falco peregrinus anatum* | M | S |
| American white pelican | *Pelecanus erythrorynchos* | | E |
| Bald eagle | *Haliaeetus leucocephalus* | M | S |
| Black-backed woodpecker | *Picoides albolarvatus* | | C |
| Bull trout | *Salvelinus confluentus* | T [1&2] | C |
| California wolverine | *Gulo gulo luteus* | | C |
| Canada lynx | *Lynx Canadensis* | T | T |
| Columbia spotted frog | *Rana luteiventris* | C | C |
| Ferruginous hawk | *Buteo regalis* | | T |
| Golden eagle | *Aquila chrysaetos* | | C |
| Gray wolf | *Canus lupus* | E [1&2] | E |
| Grizzly bear | *Ursus arctos* | T [1&2] | E |
| Lewis' woodpecker | *Melanerpes lewis* | | C |
| Marbled murrelet [3] | *Brachyramphus marmoratus marmoratus* | T [1&2] | T |
| Merlin | *Falco columbarius* | | C |
| Northern goshawk | *Accipiter gentilis* | | C |
| Northern spotted owl | *Strix occidentalis caurina* | T [1] | E |
| Pacific fisher | *Martes pennanti pacifica* | C | E |
| Pileated woodpecker | *Dryocopus pileatus* | | C |
| Puget Sound Chinook salmon | *Oncorhynchus tshawtscha* | T [1] | C |
| Puget Sound steelhead | *Oncorhynchus mykiss* | T | none |
| Sandhill crane | *Grus canadensis* | | E |
| Townsend's big-eared bat | *Corynorhinus townsendii* | | C |
| Vaux's swift | *Chaetura vauxi* | | C |
| Western gray squirrel | *Sciurus griseus griseus* | | T |
| Western grebe | *Aechmorphorus occidentalis* | | C |
| Western toad | *Bufo boreas* | | C |

*Status refers to Endangered Species Act designations on federal and state lists: C = Candidate; E = Endangered; M = Monitor; S = Sensitive (informal); T = Threatened.

---

[1] Federal critical habitat defined; [2] Federal recovery plan approved; [3] West side of Cascade Crest only

**Species of Concern**

Species selected for further analysis are those who are potential prey or competitors of fishers and were either listed as threatened, endangered, candidate, monitor, or sensitive, or are a species of interest identified in the scoping process.

### American Pika

The American pika (*Ochotona princeps*) is a small mammal primarily constrained to alpine and subalpine, or high elevations in western North America. It is a species of interest due to its sensitivity to climate change (Bruggerman 2010). Surveyors in the Complex found pikas in patches ranging in elevation between 351 and 2,130 m, which spanned the entire range of elevations for patches surveyed (Bruggerman 2010). Fishers occur in a wide range of elevations, but generally prefer relatively low-elevation sites. West of the Cascade Range crest in Washington, 87% of sighting and trapping records from 1894 to 1991 were from <1,000 m, and none were from elevations >1,800 m. However, east of the crest 70% of records were from sites >1,000 m and 18% were from sites 1,800-2,200 m in elevation (Meyer 2007).

In a survey of fisher scat and stomach contents, small mammals made up the highest percentage; however, pikas were found in less than 1% (Table 3). So while there is some overlap in range, it is unlikely that fisher reintroduction would impact pika populations in the Complex.

### Gray Wolf

The gray wolf (*Canus lupus)* is listed as endangered both federally and in Washington State. Once common throughout Washington State, they declined between 1850-1900 due to trapping, poisoning, and hunting as settlers expanded west (Wiles et al. 2011). Three recovery regions for Washington State were identified in the WDFW Wolf Conservation and Management Plan, and one of these is the northern Cascades. It is expected that wolves from British Columbia will migrate into the North Cascades (Wiles et al. 2011). As of July, 2011 there were signs of one grey wolf pack in the Complex.

Grey wolves may prey on fishers and outcompete fishers for carrion; however, grey wolves are extremely dispersed so the impact to fishers is expected to be negligible (Boerke, pers. comm. June 3, 2014).

Table 3. Percent occurrence of food items in fisher scat and gastrointestinal tracts from western North America. Includes data from seven different surveys (Hayes and Lewis 2006)

| | | Season | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | All | Winter | | | | | | Spring | Summer | Fall |
| Prey | OR[1] | BC[2] | MT[3] | ID[4] | ID[5] | CA[6] | CA[7] | CA[7] | CA[7] | CA[7] |
| Mammals | | | | | | | | | | |
| *Neurotrichus gibbsii* | 2 | | | | | | | | | |
| Rodentia unknown | 4 | | | | | | | | | |
| *Peromyscus maniculatus* | | 16 | | | | | | | | |
| *Peromyscus leucopus* | | | | 14 | | | | | | |
| *Peromyscus* spp. | <1 | | 14 | | | 25 | 8 | 6 | 16 | |
| *Clethrionomys gapperi* | | 23 | | 29 | 6 | | | | | |
| *Clethrionomys* spp. | <1 | | | | | | | | | |
| Unident. voles | | | | | 28 | | | | | |
| *Microtus* spp. | <1 | 8 | 3 | | | | 13 | 6 | 5 | |
| *Reithrodontomys megalotis* | | | | | | 13 | | | | |
| *Neotoma cinerea* | | 2 | 7 | | | | | | | 4 |
| *Neotoma* spp. | <1 | | | | | | | | | |
| *Zapus princeps* | | | | | 6 | | | | | |
| *Zapus* spp. | <1 | | | | | | | | | |
| *Marmota flaviventris* | | | | 14 | 6 | | | | | |
| *Tamiasciurus hudsonicus* | | 34 | | 14 | 22 | | | | | |
| *Tamiasciurus douglasii* | 3 | | | | | | 4 | 11 | 6 | 4 |
| *Tamius* spp. | 3 | | 3 | | 6 | | | | 1 | 8 |
| *Glaucomys sabrinus* | 2 | 8 | | | | | | | 1 | |
| *Sciurus griseus* | <1 | | | | | 13 | 8 | 2 | 4 | 4 |
| Sciuridae, unk. spp. | 6 | | | | | | | | | |
| *Spermophylus beecheyi* | 11 | | | | | | | 6 | 4 | 4 |
| *Spermophylus lateralis* | 3 | | | | | | | | | |
| *Spermophylus* spp. | 2 | | | | 6 | | | | | |
| *Thomomys bottae* | | | | | | | | 6 | 6 | 4 |
| *Thomomys* spp. | <1 | | | | 6 | | | | | |
| *Castor canadensis* | | | | 29 | 6 | | | | | |
| *Ondatra zibethicus* | 2 | | | | | | | | | |
| *Erethizon dorsatum* | 2 | 20 | 6 | 6 | | | | | | |
| Unident. rodents | | | 6 | | | | | | | |
| *Sorex* spp. | <1 | 15 | | | | | | 1 | 3 | 4 |
| *Scapanus latimanus* | | | | | | 13 | | 4 | 2 | |
| *Lepus americana* | | 39 | 49 | 29 | 50 | | | | | |
| *Sylvilagus bachmani* | | | | | | 13 | | | | |
| Lagomorpha; unknown | <1 | | | | | | | | | |
| Leporidae, unk. spp. | 23 | | | | | | | | | |
| *Ochotona princeps* | <1 | | | | | | | | | |
| *Martes pennanti* | | 10 | | | | | | | | |
| *Martes americana* | | 11 | 7 | | | | | | | |
| *Martes* spp. | | | 6 | | | | 8 | 28 | 15 | 35 |
| Unident. Mustelids | 3 | | | | 6 | | | 2 | | |
| *Spilogale putorius* | | | | | | | | | | 4 |
| *Odocoileus* spp. | | 10 | 3 | 14 | 11 | 25 | | | | |
| *Cervus elaphus* | | | | 29 | 6 | | 25 | 4 | | |
| *Alces alces* | | 15 | | 14 | 11 | | | | | |
| Unident. ungulate | 9 | | | 29 | 22 | | | | | |
| Mammalia, unknown | 15 | | | | | | | | | |
| Birds | | | | | | | | | | |
| Galliformes | | 9 | | | | | | | | |
| Unident. birds | 28 | | | 14 | 17 | | 25 | 32 | 51 | 27 |
| Reptiles | 6 | | | | | | | 38 | 20 | 4 |
| Insects | 25 | | | | 22 | 25 | 42 | 53 | 62 | 50 |
| Fruit[8] | | tr | | | | | tr | | tr | tr |
| Seeds | | | | | 17 | | | | | |
| Plants | 14 | | | | | | | | | |

[1]Aubry and Raley (2006), n = 387 scats for males and females combined; [2]Weir et al. (2005), n = 215 stomachs; [3]Roy (1991), n = 80 scats; [4]Jones (1991), n =7 gastrointestinal tracts; [5]Jones (1991), n = 18 scats; [6]Grenfell & Fasenfest (1979), n = 8 gastrointestinal tracts; [7]Zielinski et al. (1999), n = 201 scats; [8]*Vaccinium* spp. or *Ribes* spp. berries

### Bald Eagle

The bald eagle (*Haliaeetus leucocephalus)* is a Washington State sensitive species and federally-listed as "monitor". The largest over-wintering habitat in Washington is within and adjacent to the Complex along the Skagit River due to an abundant food source provided by spawning salmon. Bald eagles spend the fall and winter near the river and depart in March to their breeding grounds (NPS 2011).

Bald eagles were delisted as federally threatened on June 27, 2007, citing that population and productivity levels were adequate to ensure survival of the species (NPS 2007a; 2011). Though some overlap in prey species exists, bald eagles are opportunistic feeders and will eat a variety of small mammals, amphibians, crustaceans, and birds. Potential impacts to the bald eagle from fisher reintroduction are expected to be insignificant.

### Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) is listed as threatened both federally and in Washington State. The pigeon-sized seabird nests in old-growth forests, such as those found in the Complex. Suitable nesting habitat is similar to fisher habitat. They require multi-layered, old growth coniferous stands with moderate to high canopy closure within 80 km of saltwater feeding areas. Therefore they are only found on the western side of the Cascade crest (Nelson et al. 2006; NPS 2007a). Nesting occurs from late April through late August (McShane et al. 2004). They have been detected in stands up to 1,500 m in the North Cascades (USFSW 2009).

The California/Oregon/Washington marbled murrelet population is a DPS that is threatened by nesting habitat loss, habitat fragmentation, and predation (USFWS 2009). Marbled murrelets are at a high risk to nest site predation (NPS 2007a). Though there is suitable marbled murrelet habitat in the Complex, 2009 and 2010 ground surveys could not confirm murrelet presence (Hamer Environmental L.P. 2010).

Birds were the second-most common food item found in the scat and gastrointestinal tracts of fishers (Hayes and Lewis, 2006). This is most likely because marbled murrelet have nests high in the canopy, above where fishers normally climb (Boerke, pers. comm. June 3, 2014). However, fishers are not known to prey on marbled murrelets. Fishers do prey on mice and squirrels, which are known predators of marbled murrelet eggs (NPS 2007a).

*Mitigation Strategies:* One strategy is to strategically time the release of fishers so as not to interfere with marbled murrelet nesting seasons. Another strategy would be to only use aircraft between September 15 and February 28 to avoid impacts to nesting. We recommend applying these measures to the Complex during fisher reintroduction.

### Northern Spotted Owl

The northern spotted owl (*Strix occidentalis)* is listed as threatened federally and endangered in Washington State. They require moderate to high canopy closure, a multilayered, multispecies canopy, and a high number of large trees with deformities, cavities, broken tops, and large snags, and woody debris. These features are necessary habitat for nesting, roosting, and foraging and are most commonly found in old growth, late-successional forests (NPS 2007a). Northern spotted owls are mostly detected below 1,500 m in elevation (NPS 2011).

Currently competition with barred owls poses a significant threat to the spotted owl, with the barred owls becoming more common than northern spotted owls in the western portion of the Complex (USFWS 2011). In a survey of the Complex, six northern spotted owl activity sites were documented while 35 barred owl activity sites were documented (NPS 2011).

The tree structures that northern spotted owls use for nesting are also used by fishers for denning. Northern spotted owls feed on small mammals, such as fishers, but northern spotted owls mainly consume nocturnally active prey. Common prey species for northern spotted owl, wood rats (*Neotoma spp.*) and flying squirrels (*Glaucomys sabrinus),* occurred in fisher scat and gastrointestinal tracts 0-7% and 0-8% of the time, respectively (Table 3). Based on these two factors there could be some competition between these two species. However, both species will be low in numbers and will be very dispersed throughout the Cascades (Boerke, pers. comm. June 3, 2014).

*Mitigation Strategies:* These impacts are not likely to affect northern spotted owl in the Complex with mitigation measures and because enough suitable habitat exists for both species. These measures include releasing fishers from September 15 to February 28 to avoid impacts to nesting northern spotted owls. The same strategy is predicted to apply to the Cascades reintroduction proposal.

### Western Gray Squirrel

The western gray squirrel (*Sciurus griseus)* is listed in Washington State as threatened. They are the largest native tree squirrel in the state. Three geographically isolated populations remain in Washington. One of these populations is located within the Stehekin Valley of the Lake Chelan NRA. They depend on forests with a mixture of oak and conifer trees; however, the Complex is one of the only areas where it exists without oak trees.

Fishers are likely to prey on this species. They were found in scat and gastrointestinal tracts of fishers in six out of ten studies with 1-13% occurrence in those six studies (Table 3). The proposed northwestern Cascades fisher reintroduction area is outside of current distribution of western gray squirrel populations, but it is adjacent to the Okanogan population (Figure 9). While there is no current impact of fishers to the western gray squirrel, fishers in the Complex

could affect the expansion of western gray squirrel populations or fishers could expand into the habitat of the Okanogan population in the future.

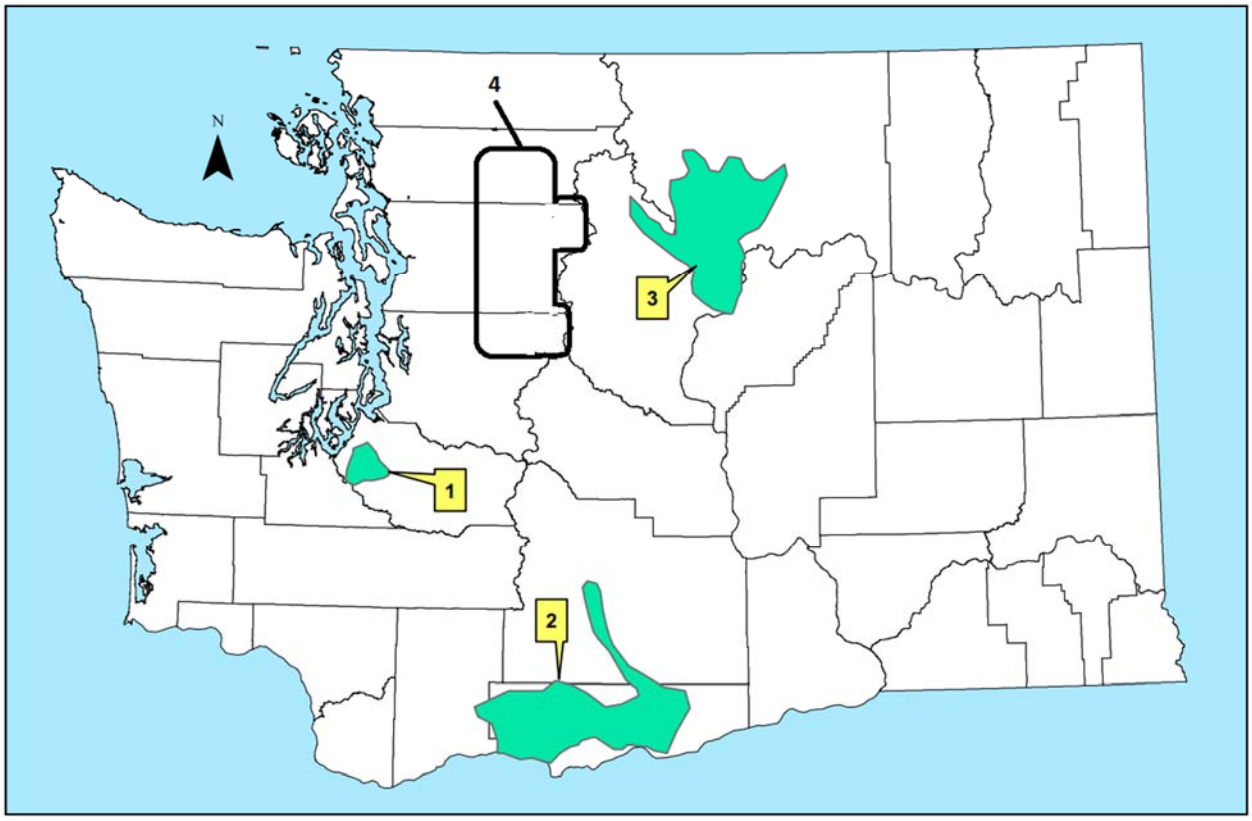


Figure 9. Current Western gray squirrel distribution in Washington: 1) Puget Trough; 2) Klickitat; 3) Okanogan. 4) Outline of Northwestern Cascade Reintroduction Area (adapted from WDFW, 2007).

**Wolverine**

The wolverine (*Gulo gulo)* is a large carnivorous mammal. It is considered a sensitive species in the Pacific Northwest by the USFS and is a candidate species for listing in Washington State (Aubry et al. 2010). They are wide-ranging and prefer remote areas. Wolverines are sensitive to human disturbance near natal and maternal den sites; thus winter recreation activities in the North Cascades may adversely affect wolverine populations. One monitored Wolverine has been located within the North Cascades National Park (Aubry et al. 2010).

Fishers and wolverine are both scavengers and may compete for prey; however, wolverine are expected to be dominant (Boerke, pers. comm. June 3, 2014). Wolverine tend to inhabit higher elevations than fishers, around tree line, which occurs at elevations ranging from 1800-2100 meters (Aubry et al. 2010) (Boerke, pers. comm. June 3, 2014). Another concern of fisher reintroduction is disease transmission between fishers and wolverines (Boerke, pers. comm. June 3, 2014). However, this will be avoided by veterinary inspections prior to fisher release.

**Proposed Action Impacts**
Fisher reintroduction using translocation would cause a change in the current ecosystem by potentially increasing the local diversity and abundance of carnivores. It is expected that the reestablishment of a native species would be beneficial because it would restore the predator-prey interactions. Cumulative impacts on wildlife species and the overall ecosystem are expected to be beneficial.

**Alternative Action Impacts**
Fisher reintroduction using captive breeding would cause a change in the current ecosystem by potentially increasing the local diversity and abundance of carnivores. It is expected that the reestablishment of a native species would be beneficial because it would restore predator-prey interactions. Cumulative impacts on wildlife species and the overall ecosystem are expected to be beneficial.

**No Action Impact**
Taking no action to reintroduce fishers would not change the current ecosystem and would not have the potential to increase the local diversity and abundance of carnivores. This area would then not be able to receive the benefits of a naturally restoring predator/prey community.

### 5.2.3 Energy and Natural Resources

**Amount of Energy Required/Rate of Use Efficiency**
The reintroduction of fishers into the Complex will require the use of fossil fuels for transportation. The proponent will rent vehicles to transport fishers as far on appropriate logging roads as possible, at which point foot travel will be used. Aerial telemetry via helicopter or small airplane will be used at a maximum of 225 hours for the first year, 270 for the second year, and 180 hours for the third year (Lewis 2013).

**Proposed Action Impacts**
Trappers will be hired to capture the required fishers, and energy will be required to transport them to Washington from Canada. Holding facilities, which will require energy to build and maintain, will be required as fishers are captured and obtained for the reintroduction,. The translocation of fishers will have a negligible impact on energy use because it only requires energy for a short span of time.

**Alternative Action Impacts**
Trappers will be hired to obtain a suitable breeding group from the source population. After a suitable group has been found, a facility will be built to house the fishers. This process can take up to three years and will constitute an extended use of energy. The reintroduction of fishers

using captive breeding will have a greater impact on energy use than the proposed action, as it requires extended use of energy as a healthy fisher population is established (Lewis 2013).

**No Action Alternative**
Taking no action to reintroduce fishers to the Complex will have no effect on energy because it requires no additional input of energy.

#### Scenic Resources

**Current Conditions**
The Complex currently has over 204,000 hectares of National Park land in its boundaries. It is the largest National Park in Washington, making it rich in valuable scenic resources. These resources include wildlife, lakes, rivers, mountains, trail systems, and campgrounds.

**Proposed Action Impacts**
The proposed action would likely have a positive impact on scenic resources in the Complex. Visitors to the Complex will have the potential to see fishers as part of the ecosystem, increasing the value of current scenic resources.

**Alternative Action Impacts**
The alternative action would likely have a positive impact on scenic resources in the Complex. Visitors to the Complex will have the potential to see fishers as part of the ecosystem, increasing the value of current scenic resources.

**No Action Impact**
The no action alternative will have no impact on scenic resources as the current amount of scenic resources in the Complex will not be affected.

### 5.2.4 Built Environment

#### Noise

**Current Conditions**
A soundscape is the combination of all the sounds in an area, including sounds inaudible to the human ear. Soundscapes can be comprised of natural sounds, anthropogenic sounds, or a mix of both. The NPS is required to preserve natural soundscapes that exist in the absence of human-caused sounds. Natural soundscapes found in the Complex include birds, running water, wind, and calls from mammals and amphibians. Some of the common human-caused sounds include vehicles, boats, voices, music, and jet airplanes. Natural sounds are vital to the functioning of natural ecosystems. Many species rely on sounds for communication. If these vocalizations cannot be heard, it could potentially harm their ability to find mates, reproduce, and even

survive. Natural soundscapes are also a key component that visitors come to the Complex to experience (Ross Lake National Recreation Area Final GMPEIS).

**Proposed Action Impacts**

Aerial telemetry will be used to monitor the success of fisher reintroduction in the Complex. The air traffic in the Complex will have no known overall impact on the soundscape of the park. The duration and length of such noise exposure will be seasonally-restricted to short term and comprise a minor adverse impact.

**Alternative Action Impacts**

Aerial telemetry will be used to monitor the success of fisher reintroduction in the Complex. The air traffic in the Complex will have no known overall impact on the soundscape of the park. Even though there will be more noise, the duration of exposure will be short enough to have no adverse effects.

**No Action Impacts**

If there were no action for fisher reintroduction, then there would be no need to monitor them and thus no need for the use of aerial telemetry. Therefore, there would be no impact to the natural soundscape of the park. Routine aircraft usage by NPS personnel will continue as usual.

**Transportation**

Sites 1 and 2 were selected because of accessibility, for this reason there may be impacts on traffic systems. The maximum male range, as seen in Figure 11, shows the potential overlap the ranges will have with highway 20, the Scenic North Cascades Highway. Scenic North Cascades Highway is busier in the summer months causing increased chance of wildlife collisions (WSDOT 2014).

**Current Conditions**

Due to avalanche conditions, roads within the Complex close in late November to early December, and re-open at the end of April to early May. Cascade River Road will be closed after Labor Day 2014 to perform construction on the Boston Creek Crossing.

**Proposed Action Impact**

Transport vehicles for the fishers will drive cautiously when set out to release. Minimal to no impact on traffic is anticipated from fisher reintroduction. The reintroduction of fishers may potentially bring more visitors to the Complex during the time of release and after, increasing traffic.

**Alternative Action Impact**
Vehicles transporting fishers will drive cautiously when set out to release. Minimal to no impact on traffic is anticipated from fisher reintroduction. The reintroduction of fishers may potentially bring more visitors to the Complex during the time of release and after, increasing traffic. The captive breeding of fishers will have no effect on transport and traffic.

**No Action Impact**
If no action is taken, then there will be no impact on vehicle traffic from fisher reintroduction. Traffic will continue to flow throughout the park even without fishers.

### Traffic Hazards

**Current Conditions**
During the park season, wildlife, fallen rock, traffic and hazardous road conditions may be present throughout the Complex. Visitors are encouraged to drive cautiously while traveling through the park to prevent accidents and road kill. Highway 20 is a popular scenic mountain pass through the Complex that has traffic flowing through from opening day till the close in late fall.

**Proposed Action Impact**
The reintroduction of fishers in the Complex may increase the amount of animal traffic on roadways. Although fishers are not known to migrate across roads, they have been spotted as road kill (Lewis 1998). Fishers reintroduced into the Olympic National Park are known to cross highways. Fishers are also expected to cross highways in the Complex, especially highway 20 when it is closed during the winter (Borke, pers. Comm. June 3rd, 2014).

**Alternative Action Impact**
The reintroduction of fishers in the Complex may increase the amount of animal traffic on roadways. Although fishers are not known to migrate across roads, they have been spotted as road kill (Lewis 1998). However, the captive bred fishers could be more prone to crossing roads and have a decreased survivorship. Fishers reintroduced into the Olympic National Park are known to cross highways. Fishers are also expected to cross highways in the Complex, especially highway 20 when it is closed during the winter (Borke, pers. Comm. June 3rd, 2014).

**No Action Impact**
If no action is taken, then there be will no impact on traffic hazards from fisher reintroduction.

### 5.2.5 Potential Genetic Isolation Effects

Genetic isolation may have adverse effects. This is a potential issue for both the proposed action and the alternative action. Genetic isolation can lead to overall decreased fitness of a population. A population that is isolated from other populations of the same species can be subject to genetic drift. Genetic drift is a change in allele frequency in a population. If the population is small then genetic drift is more likely and has increasingly adverse effects on the population over time. Genetic drift can decrease genetic variation and lower the fitness of populations over time.

**Proposed Action**

Genetic isolation and the effects that are associated with it could occur through the proposed action. There were more fisher detections in California in areas associated with larger forest stands and higher connectivity, suggesting fishers are sensitive to fragmentation (Rosenberg and Raphael 1986). Since fishers rely upon mid to low-land elevation late successional forests, they will be confined to these forest types. Early and mid-successional stands do not provide the same prey availability, den and rest sites, and high canopy cover (Powell and Zielinski 1994). This means there is a potential for fisher populations to be fragmented and isolated from one another. Figure 10 shows that old growth patches suitable for fishers are small and fragmented.

Fishers are also reluctant to cross wide paved roads (Lewis 1998). Fishers found in Oregon do not maintain home ranges on both sides of the road (Lewis and Hayes 2004). However fishers reintroduced into the Olympic National Park have been found to cross roads and maintain home ranges on both sides of the road (Boerke, pers. comm. June 3, 2014). This implies that highway 20 located in the northern part of the Complex and highway 2 located in the southern part of the Complex may or may not fragment fisher habitat (Figure 11).

Being that male home ranges are two to three times bigger than female home ranges, 40-50 $km^2$ for males to 15-20 $km^2$ for females (Lewis and Stinson 1998), these small areas that are suitable habitat for fishers will only hold a small number of individuals. Fishers will typically travel up to 5 km per day, and will travel even further during mating season (Powell 1993). The fishers reintroduced into the Olympic National Park were found to travel a maximum distance of 114 m. This is believed to have happened because fishers were in search of one another. This suggests that the release locations in the Olympic National Park were too far away from one another and required fishers to travel long distances in search of each other (Boerke, pers. comm. June 3, 2014). Fishers are however reluctant to travel in low canopy cover so these small patches of old growth may constrain their distance and direction of travel. This will decrease the likelihood of finding a mate from a different population and increase the chances of inbreeding.

*Mitigation Strategies:* Results of the Olympic reintroduction suggest that release sites in the Complex should be closer to one another compared to the Olympic release sites so fishers do not have to travel such great distances in order to find mates.

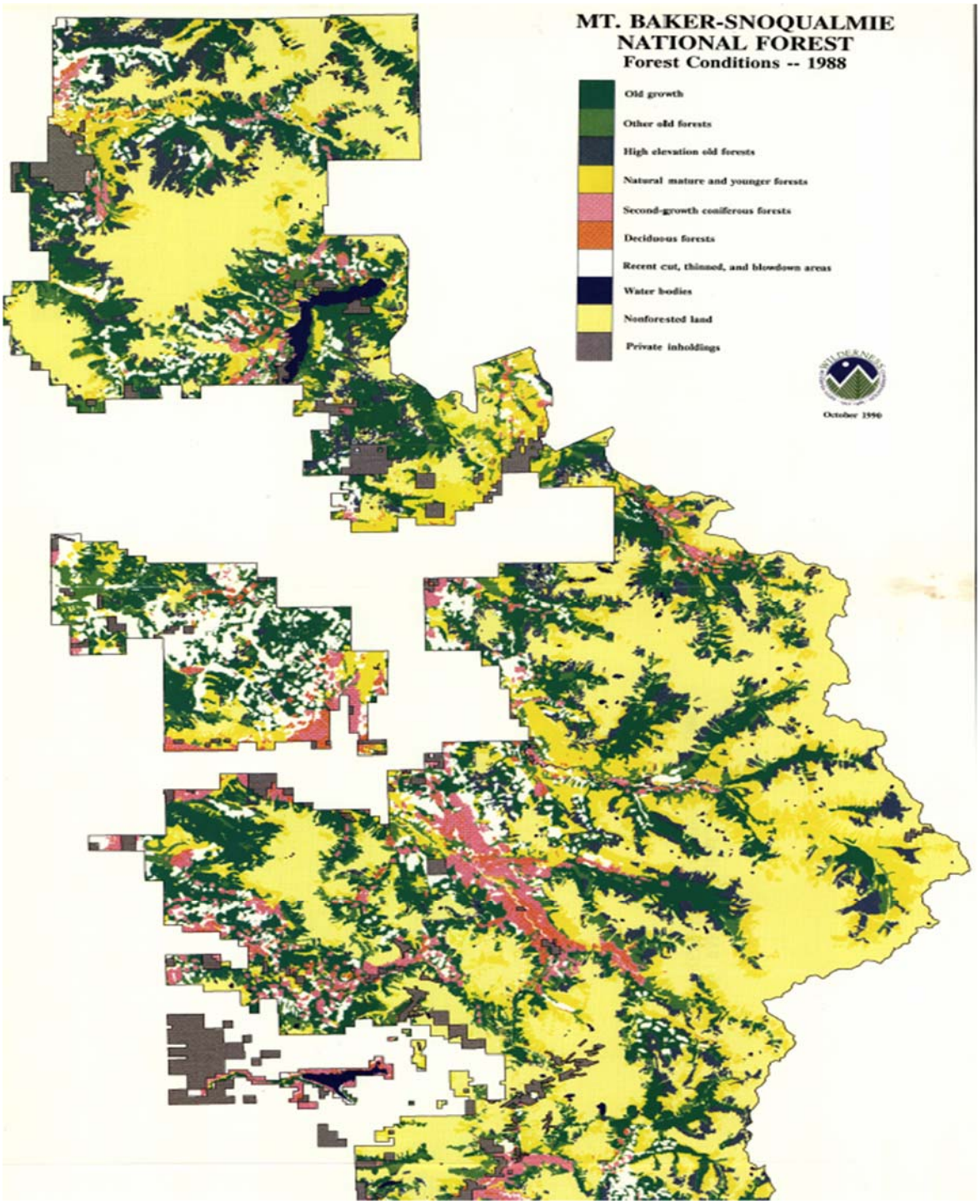


Figure 10. Forest conditions for the Mt. Baker-Snoqualmie National Forest which is located adjacent to the Complex. Fishers will most likely migrate into these areas after release. Suitable fisher habitat is denoted in green. Old growth habitats are small and fragmented, potentially creating isolated fisher populations.

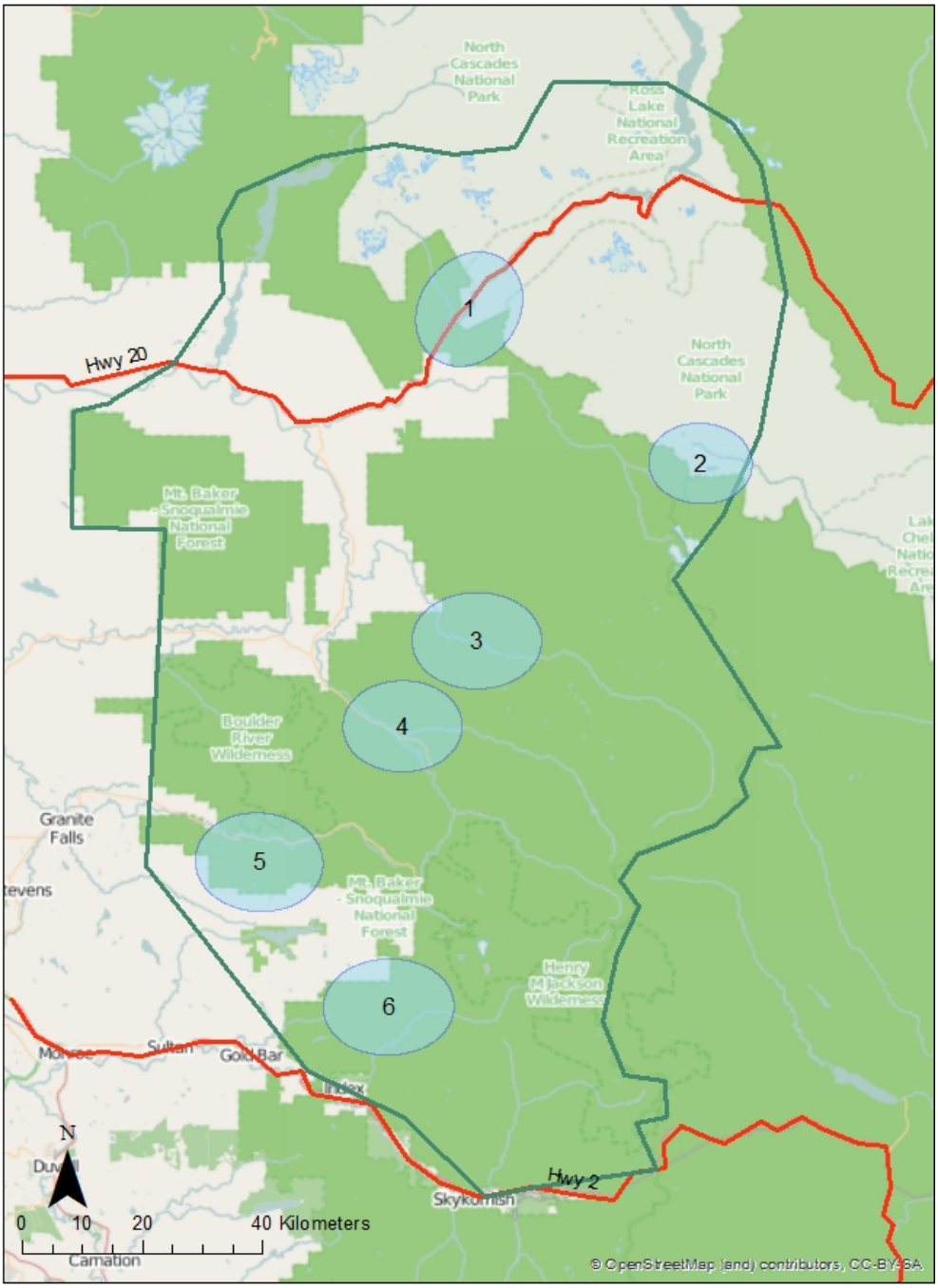


Figure 11. The Complex area is outlined in green. Six candidate release sites (blue ovals) are located within the reintroduction area. The blue shading represents the typical home range of a male fisher (50 $km^2$).

**Alternative Action**

Captive breeding is meant to preserve the genetic diversity of particular species. However, captive breeding can actually have the opposite effect. A common problem in reintroduction

efforts using captive breeding is that there is a limited brood stock and inbreeding can become increasingly difficult to avoid with successive generations in captivity (Rollison et al. 2014). Inbreeding can lead to inbreeding depression, which lowers the genetic variation in a population and can ultimately reduce genetic fitness in a population.

**No Action**
If no action were undertaken to reintroduce fishers in the Complex, there would be no potential for genetic drift, genetic isolation, and bottleneck effects because there are no known fishers.

### Habitat-Related Fire Effects

**Current Conditions**
A major goal of the Complex is to allow natural fire regimes to prevail. Historically, the Complex has had major fire events every 100 years. Currently, the fire management plan allows prescribed burns when appropriate, and allows fire management in areas that pose risks to communities and endangered plants and animals. These prescribed burns remove underbrush and snags to deplete fuel buildup and prevent natural fires from burning out of control (NPS 2007b).

**Proposed Action Impacts**
The reintroduction of fishers using translocation to the Complex will require protection of known fisher habitats, which may affect aspects of the fire management plan (Meyers 2007).

**Alternative Action Impacts**
The reintroduction of fishers using captive breeding to the Complex will require protection of known fisher habitats, which may affect aspects of the fire management plan (Meyers 2007).

**No Action Impacts**
Taking no action to reintroduce fishers will have no known impact on habitat related fire effects because there will be no changes to aspects of the fire management.

### Park and other Recreation Facilities

**Current conditions**
During the fiscal year of 2010, the Complex employed 246 people at its height in summer, and 84 during the winter months, with 53 employees working year round. The largest sector of employment is in facility and resource management. Other positions include visitor and resource protection, interpretation and education, and administration. The park received $7.7 million in appropriated base funding from Congress, of which $7.3 million went to appropriated base expenditures; $6 million of these went to funding personnel, $396,000 for travel, $315,000 in

supplies and materials, $290,000 in contracted services, and $274,000 for other services (NPS 2012).

**Proposed Action Impact**

The reintroduction of fishers will require an increase in National Park services. The reintroduction will affect different divisions of the Complex. The natural resources management division, which "is responsible for preserving and managing the natural resources of the Complex and coordinating scientific research," is responsible for resource inventory, monitoring and evaluation, impacts restoration and mitigation, fish and wildlife management, and wilderness preservation and monitoring (NPS 2006). The responsibility of the resource and visitor protection division "includes visitor management and resource protection duties, including law enforcement, emergency medical services, wildland firefighting, visitor use management in the Complex, search- and- rescue activities, and wilderness management and permitting" (NPS 2006). The resource education division will be assigned to help connect the park resources and the public through operations of the park visitor centers, programs, written materials, off site programs and the park's website (NPS 2006). These are all fully functioning programs within the Complex that would not require additional resources to support them; however, it would require a shifting of resources among programs . The reintroduction would require an additional three staff members to monitor the group: a coordinator, lead wildlife biologist, and assistance wildlife biologist. For a 3-year reintroduction plan, the estimated cost would be $550,706. This would include the cost of coordinator expenses, veterinarian expenses, permit and processing expenses, trapper payments, transport to and from Canada, monitoring equipment, and monitoring expenses. If a 4-year introduction plan is implemented the estimated cost is $749,528. It would only cost the park $19,000 a year on the 4-year plan, and $24,100 a year on the 3-year plan to obtain the fishers (Lewis 2013).

**Alternative Action Impact**

The alternative action impact would require the same additional costs and services as the proposed action. However, because the fishers would be bred in captivity instead of translocated, breeding costs would have to be incorporated. In the Olympic National Park Fisher Reintroduction Plan, additional costs of fisher breeding were estimated to be $700,000 to $750,000 for a 3-year program (NPS 2007a). These costs include expenses for hiring biologists to conduct the captive rearing, release, monitoring and the genetic analyses of the fishers.

**No Action Impact**

If no action was taken for fisher reintroduction, then there would be no additional impact on the park budget and staff.

# Conclusion

The purpose of this environmental impact assessment was to assess and evaluate the reintroduction of fishers to the Complex. It is the interest of the proponent and all involved parties to reintroduce fishers to the Complex, with the intention of reestablishing a viable population in Washington.

After evaluating the potential impacts of reintroduction on the elements of the environment, it is the recommendation of this environmental assessment team that the proposed action be implemented. The proposed action has the greatest chance of achieving the proponent's goals while minimizing environmental costs. The alternative action will require more funding and labor and will be reintroducing fishers that are potentially less genetically fit. The no action alternative has the potential to have negative effects on the Complex due to the ongoing lack of historic predator-prey relationships.

# Glossary

**Aesthetics-** A set of principles concerned with the nature and appreciation of beauty

**Allele-** One of a number of alternative forms of the same gene or same genetic locus

**Alluvium-** Loose, unconsolidated soil or sediments which has been eroded, reshaped by water in some form, and redeposited in a non-marine setting

**Anthropogenic-** Of, relating to, or resulting from the influence of human beings on nature

**Bedrock- C**onsolidated rock underlying the surface of a terrestrial planet

**Biodegradation-** Chemical breakdown of materials by bacteria or other biological means

**Breeding Stock-** A number of individuals bred to generate successive generations

**Candidate Species-** Species shows biological vulnerability and is under consideration for official listing

**Canopy Cover-** The amount or percentage of trees and shrub above head

**Captive Breeding-** The process of breeding animals in human-controlled environments with restricted settings

**Captivity-** Animals living under human care and control

**Coarse Woody Debris-** Fallen dead trees and the remains of large branches on the ground in forests, rivers, and wetlands

**Colluvium-** Loose, unconsolidated sediments that have been deposited at the base of hill slopes by either rainwash, sheetwash, slow continuous downslope creep, or a variable combination of these processes

**Deforestation-** Removal of a forest or stand of trees where the land is thereafter converted to a non-forest use

**Elevation-** The height above or below a fixed reference point, usually sea level

**Endangered Species-** Species in danger of extinction throughout all or a significant portion of its range.

**Endangered Species Act**- Federal act with a a purpose of protecting and recovering imperiled species and the ecosystems upon which they depend. It is administered by the USFWS and the Commerce Department's National Marine Fisheries Service (NMFS) (US Fish and Wildlife Service 2013).

**Erosion-** Process by which soil and rock are removed from the Earth's surface by exogenic processes such as wind or water flow, and then transported and deposited in other locations

**Extinction-** The end of an organism or of a group of organisms; the death of the last individual of a species

**Extirpated**- The condition of a species which ceases to exist in a particular geographic location but it still exists somewhere else

**Fitness-** Describes the ability of an individual or population to both survive and reproduce

**Food Web-** Depicts feeding connections (what-eats-what) in an ecological community

**Foraging-** Searching for wild food resources

**Fossil Fuels-** Fuels formed by natural processes such as anaerobic decomposition of buried dead organisms

**Fragmentation/fragment**- The process or state of breaking or being broken into small or separate parts for general public, or for conservation

**Genetic Drift-** The change in the frequency of alleles in a population due to random sampling

**Genetic Isolation-** Population of organisms that has little or no genetic mixing with other organisms within the same species

**Gestation**- The carrying of an embryo or fetus inside the body of a mother

**Glacial Drift**- Material such as gravel, sand, or clay, transported and deposited by a glacier or by glacial meltwater

**Glaciations-** An interval of time (thousands of years) within an ice age that is marked by colder temperatures and glacier advances

**Glaciers-** Persistent body of dense ice that is constantly moving under its own weight; it forms where the accumulation of snow exceeds the melting of snow over many years, often centuries

**Glandular Secretions-** Chemical messengers in the body that are capable of making and expelling secretions

**Historic Range-** The geographic area of a species before human disturbances

**Home Range-** Area in which an animal lives and travels

**Inbreeding-** Production of offspring from the mating or breeding of individuals or organisms which are closely related genetically

**Late-Successional Forest-** Mature forest, typically greater than 100 years old, that consists of a multilayered tree canopy along with shade tolerant understory species and an abundance of dead wood and snags

**Lithosphere-** The rigid outermost shell of a rocky planet

**Migration-** Travelling of long distances in search of a new habitat

**Monitor Species-** A species in recovery recently removed from ESA listing but being monitored to ensure that recovery goals are met within a five-year period after removal.

**National Forest-** A large plot of forest that is owned and maintained by the federal government

**National Park-** A plot of land owned and protected by the federal government for the use of the

**National Recreation Area (NRA)-**Land set aside for preservation of historic and natural resources, while allowing for outdoor recreation of large amounts of people

**Natural Resources-** Usable materials and substances that occur in nature

**Nocturnal-** An animal behavior characterized by activity during the night and sleeping during the day

**Old Growth-** Forest with trees of great age without significant disturbances; Characterized by multi-layered canopies and canopy gaps, greatly varying tree heights and diameters, diverse tree species, and diverse classes and sizes of woody debris

**Opportunistic Feeders-** Organisms that take advantage of a wide array of food sources, depending on what is available

**Parent Material-** The underlying geological material from which soil horizons form

**Prescribed Burns-** Technique sometimes used in forest management which decreases the likelihood of more serious, hotter fires

**Radio-Transmitter-** Electronic device that which with the aid of an antenna produces radio waves. These waves are able to be picked up by receptors and are used to locate animals wearing a radio-transmitter.

**Roosting-** To rest or sleep on a perch, typical of waterfowl and other birds

**Sensitive Species-** Informal category for species that have potential for listing within the state but population decline and habitat loss have not yet reached a critical level that would trigger consideration for listing.

**Significant-** Sufficiently great or important to be worthy of attention; noteworthy

**Slope-** Describes both the direction and the steepness of a line

**Snags-** Standing dead or dying tree, often missing a top or most of the smaller branches

**Soundscape-** A sound or combination of sounds that forms or arises from an environment

**Source Population-** Population that individuals are pulled from

**Subalpine-** Referring to the zone just before the timberline on high slopes of mountains

**Tectonic Plates-** Massive, irregularly shaped slab of solid rock generally composed of both continental and oceanic lithosphere

**Telemetry-** Method of locating and tracking specific animals equipped with radio frequency emitters

**Threatened Species -** Any species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future

**Topography-** The arrangement of the natural and artificial physical features of an area

**Transboundary-** An ecosystem that crosses at least one political border

**Translocation-** Transporting an animal from one area and releasing it into a new one

**Tributaries-** Stream or river that flows into a main stem (or parent) river or a lake; A tributary does not flow directly into a sea or ocean

**Untrammeled-** Not deprived of freedom of action or expression; not restricted or hampered

**Vertebrate Species-** Species that have backbones

**Volcanic Ash-** Fragments of pulverized rock, minerals and volcanic glass, created during volcanic eruptions, less than 2 mm in diameter

**Wilderness Area-** Plot of federally-owned land that is preserved to retain its natural character, with little to no human influence

# Appendix A

*From Appendix B of WDFW Implementation plan*

**Veterinary tasks and information to document when inspecting and processing fishers for translocation.**

1) Date, time, location, names of vets and assistants
2) Identify individual fisher with a letter/number code (e.g., F01, M02)
3) Determine sex and estimate age based on tooth wear, teat, sagittal crest, baculum measurements
4) Morphological measurements – weight; length of tail, hind foot, ear, total; neck circumference; and chest circumference.
5) Conduct complete physical examination
6) Determination of suitability for reintroduction – individuals meet following minimum criteria:
   a. no broken bones
   b. > 2 intact canines
   c. no debilitating wounds or injuries
   d. no missing limbs
   e. no feet with >1 missing toe
   f. no apparent disabilities
   g. no fishers that appear in poor condition
   h. no diarrhea
   i. no ocular or nasal discharge
   j. no significant unexplained hair loss
   k. no excessive tooth wear indicative of advanced age
   l. no heavy external parasite infestations
7) Conduct implant surgery on suitable fishers
   a. Chemical immobilization provided by project veterinarian.
   b. Drugs, dosages, times for injection, induction, reversal, recovery will be recorded
   c. Monitor pulse, temperature, respiration, and capillary refill time
8) Treatment of minor injuries and wounds
9) DNA sample(s) – ear punch and hair sample
10) Blood sample
    a. Clot tube for serum
    b. EDTA or heparin tube for whole blood
11) Fecal sample – refrigerate
12) Ectoparasites – collect and place in alcohol
13) PIT tagging
14) Vaccinate for Rabies (Imrab-3) and Distemper (Purevax ferret vaccine)
15) Endoparasite treatment – Ivermectin and Droncit
16) Ectoparasite treatment – flea powder, Frontline or Revolution, if necessary
17) Photograph individuals – face, teeth, ventral markings, wounds, injuries, abnormalities
18) Give reversal, if indicated
19) Monitor recovery and reactions to vaccinations
20) List suitable individuals as certified

# Appendix B

*From Implementation Plan for Reintroducing Fishers to the Cascade Mountains (Lewis 2013)*

## Proposed budget for a 3-year reintroduction project in one fisher reintroduction area in North Cascades National Park.

| | Year 1 | | Year 2 | | Year 3 | |
|---|---|---|---|---|---|---|
| **Cost of Coordinator's Time (@ 35 US$/hr)** | **Hours** | **Cost** | **Hours** | **Cost** | **Hours** | **Cost** |
| Trapper coordination and preparation | 70 | 2,450 | 50 | 1,750 | | |
| Fisher transport | 180 | 6,300 | 180 | 6,300 | | |
| Set up of facility and take down | 40 | 1,400 | 40 | 1,400 | | |
| Husbandry: feeding, care, cleaning, maintenance | 400 | 14,000 | 400 | 14,000 | | |
| Documentation and Final report | 40 | 1,400 | 40 | 1,400 | | |
| **Subtotal** | | **25,550** | | **23,450** | | |
| **Cost of Coordinator's Expenses** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Building/obtaining equip. (boxes, runs, stands) | 35 sets | 3,500 | 5 | 500 | | |
| Fisher Transfer travel costs ($0.88/mi.) | 5500 mi. | 4,840 | 5500 mi. | 4,840 | | |
| Supplies (i.e., food, litter, bedding) | | 180 | | 180 | | |
| Facility rental - 3 months @ $500/month | | 1,500 | | 1,500 | | |
| Office expenses | | 250 | | 250 | | |
| **Subtotal** | | **10,270** | | **7,270** | | |
| **Other Provincial Expenses** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Veterinarian expenses: time, travel, supplies | | 4,000 | | 4,000 | | |
| Ministry expenses (Permit and processing) | | 100 | | 0 | | |
| Trapper payments: @ $500/fisher | 40 | 20,000 | 40 | 20,000 | | |
| **Subtotal** | | **24,100** | | **24,000** | | |
| **Transport to and from BC** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Mileage ($0.56/mile) | 2200 | 1,122 | 2200 mi. | 1,122 | | |
| Per diem ($60) | 16 staff-days | 960 | 16 staff-days | 960 | | |
| Salary ($33/hr) | 16 staff-days | 4,224 | 16 staff-days | 4,224 | | |
| **Subtotal** | | **6,306** | | **6,306** | | |
| **Monitoring Equipment** | **Number** | **Cost** | **Number** | **Cost** | **Number** | **Cost** |
| Transmitters – Holohil AI-2HM implants ($290 ea) | 45 | 13,050 | 45 | 13,050 | | |
| Pit tags - 90 sterile packages | 90 | 640 | available | 0 | | |
| Radio receivers, antennas, cables (3 sets avail.) | 2 sets | 1,500 | available | 0 | | |
| Field gear- tents, radios, etc | available | 0 | available | 0 | | |
| **Subtotal** | | **15,190** | | **13,050** | | |
| **Monitoring Expenses** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Personnel | | | | | | |
| Wildlife Biologist (Lead; $5812/mo) | 8 mo. | 46,496 | 8 mo. | 46,496 | 6 mo. | 34,872 |
| Wildlife Biologist (Asst.; $4200/mo) | 8 mo. | 33,600 | 8 mo. | 33,600 | 6 mo. | 25,200 |
| Transportation - vehicle rental and expenses | 1 | 4,200 | 1 | 4,200 | 1 | 4,200 |
| Aerial Telemetry flight time ($250/hour; 4-6 hrs/wk, 45 wks) | 225 hrs | 56,250 | 270 hrs | 67,500 | 180 hrs | 45,000 |
| GIS support | | | | | | 2,000 |
| Genetic Analysis - Genotyping (~$50/fisher) | 40 | 2,000 | 40 | 2,000 | | |
| **Subtotal** | | **142,046** | | **153,296** | | **111,272** |
| **Yearly Grand Totals** | **Year 1** | **217,062** | **Year 2** | **222,372** | **Year 3** | **111,272** |
| **3 -Year Grand Total** | | | | | | **550,706** |

# Proposed budget for a 4-year reintroduction project in one fisher reintroduction area in the North Cascades National Park.

| | Year 1 | | Year 2 | | Year 3 | | Year 4 | |
|---|---|---|---|---|---|---|---|---|
| **Cost of Coordinator's Time (@ 35 US$/hr)** | **Hours** | **Cost** | **Hours** | **Cost** | **Hours** | **Cost** | **Hours** | **Cost** |
| Trapper coordination and preparation | 70 | 2,450 | 50 | 1,750 | 50 | 1,750 | | |
| Fisher transport | 140 | 4,900 | 140 | 4,900 | 140 | 4,900 | | |
| Set up of facility and take down | 40 | 1,400 | 40 | 1,400 | 40 | 1,400 | | |
| Husbandry: feeding, care, cleaning | 300 | 10,500 | 300 | 10,500 | 300 | 10,500 | | |
| Documentation and Final report | 40 | 1,400 | 40 | 1,400 | 40 | 1,400 | | |
| **Subtotal** | | **20,650** | | **19,950** | | **19,950** | | |
| **Cost of Coordinator's Expenses** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Building/obtaining equip. (boxes, runs, stands) | 35 sets | 3,500 | 5 | 500 | 5 | 500 | | |
| Fisher Transfer travel costs ($0.88/mi.) | 5500 mi. | 4,840 | 5500 mi. | 4,840 | 5500 mi. | 4,840 | | |
| Supplies (i.e., food, litter, bedding) | | 180 | | 180 | | 180 | | |
| Facility rental - 3 months @ $500/month | | 1,500 | | 1,500 | | 1,500 | | |
| Office expenses | | 250 | | 250 | | 250 | | |
| **Subtotal** | | **10,270** | | **7,270** | | **7,270** | | |
| **Other Provincial Expenses** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Veterinarian expenses: time, travel, supplies | | 4,000 | | 4,000 | | 4,000 | | |
| Ministry expenses (Permit and processing) | | 100 | | 0 | | 0 | | |
| Trapper payments: @ $500/fisher | 30 | 15,000 | 30 | 15,000 | 30 | 15,000 | | |
| **Subtotal** | | **19,100** | | **19,000** | | **19,000** | | |
| **Transport to and from BC** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Mileage ($0.56/mile) | 2,200 | 1,122 | 2200 mi. | 1,122 | 2200 mi. | 1,122 | | |
| Per diem ($60) | 16 staff-days | 960 | 16 staff-days | 960 | 16 staff-days | 960 | | |
| Salary ($33/hr) | 16 staff-days | 4,224 | 16 staff-days | 4,224 | 16 staff-days | 4,224 | | |
| **Subtotal** | | **6,306** | | **6,306** | | **6,306** | | |
| **Monitoring Equipment** | **Number** | **Cost** | **Number** | **Cost** | **Number** | **Cost** | **Number** | **Cost** |
| Transmitters – Holohil AI-2HM implants ($290 ea) | 45 | 13,050 | 45 | 13,050 | | | | |
| Pit tags - 90 sterile packages | 90 | 640 | available | 0 | available | 0 | | |
| Radio receivers, antennas, cables (3 sets avail.) | 2 sets | 1,500 | available | 0 | available | 0 | | |
| Field gear- tents, radios, etc | available | 0 | available | 0 | available | 0 | | |
| **Subtotal** | | **15,190** | | **13,050** | | **0** | | |
| **Monitoring Expenses** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** | **Amount** | **Cost** |
| Personnel | | | | | | | | |
| Wildlife Biologist (Lead; $5812/mo) | 8 mo. | 46,496 | 8 mo. | 46,496 | 8 mo. | 46,496 | 6 mo. | 34,872 |
| Wildlife Biologist (Asst.; $4200/mo) | 8 mo. | 33,600 | 8 mo. | 33,600 | 8 mo. | 33,600 | 6 mo. | 25,200 |
| Volunteers (5-10) | | 0 | | 0 | | 0 | | 0 |
| Transportation - vehicle rental and expenses | 1 | 4,200 | 1 | 4,200 | 1 | 4,200 | 1 | 4,200 |
| Aerial Telemetry flight time ($250/hour; 4-6 hrs/wk, 45 wks) | 225 hrs | 56,250 | 270 hrs | 67,500 | 270 hrs | 67,500 | 180 hrs | 45,000 |
| GIS support | | | | | | | | 2,000 |
| Genetic Analysis - Genotyping (~$50/fisher) | 30 | 1,500 | 30 | 1,500 | 30 | 1,500 | 0 | |
| **Subtotal** | | **138,546** | | **149,796** | | **149,796** | | **111,272** |
| **Yearly Grand Totals** | **Year 1** | **213,562** | **Year 2** | **218,872** | **Year 3** | **205,822** | **Year 4** | **111,272** |
| **4 -Year Grand Total** | | | | | | | | **749,528** |

# References

Aubry, K.B., Rohrer, J., Raley C.M., Lofroth, E.C., Fitkin, S. 2010. Wolverine Distribution and Ecology in the North Cascades Ecosystem Annual Report. USDA Forest Service, Olympia, WA.

Bruggerman, J.E. 2010. Pilot Study on Factors Affecting Pika Populations in the North Cascades Ecosystem. Beartooth Wildlife Research, LLC. 82 pp.

Douglas, C. W. and M. A. Strickland. 1987. Fisher. Pages 511-529 in Novak et al., technical editors. Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resources, Toronto, Ontario.

Frost, H. C., William B. Krohn, and C. R. Wallace. 1997. Age-Specific Reproductive Characteristics in Fishers. J.Mamm. 72:598-612.

Gibilisco, C.J. 1994. Distributional Dynamics of American Martens and Fishers in North America. Pages 59-71 in Buskirk, S.W., A.S. Harestad, M.G. Raphael, and R.A. Powell, eds. Martens, sables, and fishers: biology and conservation. Cornell Univ. Press, Ithaca, NY. 684 pp.

Gilpin, M.E. and M.E. Soule. 1986. "Minimum Viable Populations: Processes of Species Extinction." In Conservation Biology: The Science of Scarcity and Diversity, edited by M. E. Soule, 19–34. S underland, MA: Sinauer

Hamer Environmental L.P. 2010. Use of Radar and Audio-Visual Surveys to Determine the Presence/Probable Absence of Marbled Murrelets in North Cascades National Park, Washington. Unpublished report to National Park Service, North Cascades National Park Service Complex. 51 pp.

Hayes, G. E., and J. C. Lewis. 2006. Washington State Recovery Plan for the Fisher. Washington Department of Fish and Wildlife, Olympia. 62+ viii pp.

Lewis, J. C. 2013. Implementation Plan for Reintroducing Fishers to the Cascade Mountain Range in Washington. Washington Department of Fish and Wildlife, Olympia. 29 pp.

--------- and G. E. Hayes. 2004. Feasibility Assessment for Reintroducing Fishers to Washington. Washington Department Fish and Wildlife, Olympia. 70 pp

--------- and Stinson, D.W. 1998. Washington State Status Report for the Fisher. Washington Department of Fish and Wildlife, Olympia. 64 pp.

McShane, C., Hamer, T., Carter, H. 2004. Evaluation Report for the 5-year Status Review of the Marbled Murrelet in Washington, Oregon, and California. Portland, OR: U.S. Department of Interior, Fish and Wildlife Service.

Meyer, Rachelle. 2007. Martes pennanti. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).

Nelson, S. K., M. H. Huff, S. L. Miller, M. G. Raphael. 2006. Status and Trends of Populations and Nesting Habitat for the Marbled Murrelet. Northwest Forest Plan Northwest Research Station: 9-30. Chapter 2.

NPS. 2006. *Management Policies 2006*.

NPS. 2007a. Fisher Reintroduction Plan/Environmental Assessment. National Park Service, Olympic National Park, Port Angeles, WA.

NPS. 2007b. North Cascades National Park Fire Management Plan. National Park Service, North Cascades National Park, Sedro-Woolley, WA.

NPS. 2008. Mountain Lakes Fishery Management Plan/ Environmental Impact Statement. National Park Service. Web. http://parkplanning.nps.gov/projectHome.cfm?projectID=10007

NPS. 2011. Invasive Non-Native Plant Management, Environmental Assessment. North Cascades National Park Service Complex, Sedro-Woolley, WA.

NPS. 2012. North Cascades National Park 2012 Business plan, US Department of the Interior. Oregon. xvi + 258 pp. PNW-GTR-650. Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific

NPS. 2012. Ross Powerhouse Rockslide Stabilization Environmental Assessment. North Cascades National Park Service Complex. Web. file:///C:/Users/coronac2/Documents/Ross_Powerhouse_Rockslide_EA_Final.pdf

Powell, R. A. 1977. Hunting Behavior, Ecological Energetics, and Predator-Prey Community Stability of the Fisher (*Martes pennanti*). Ph.D. dissertation, Univ. of Chicago. 132 pp. Range in Washington. Washington Department of Fish and Wildlife, Olympia. 29 pp.

---------.1993. The fisher: Life history, Ecology and Behavior. Second ed. Univ. of Minnesota Press, Minneapolis. 237 pp.

---------and W. J. Zielinski. 1994. Fisher. Pages 38-73 in Ruggerio, L. F., K. B. Aubry, S. W. Buskirk, L. Jack Lyon, and W. J. Zielinski, eds. The Scientific Basis for Conserving Forest Carnivores: American marten,fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. Fort Collins, CO: U.S. Dept. Agric., Rocky Mountain For. and Range Exp. Sta. 183 pp.

Rollison, N., Keith, D. M., Houde, A.S., Debes. P. V., McBride, M. C., & Hutchings, J. A. 2014. Risk Assessment of Inbreeding and Outbreeding Depression in a Captive-Breeding Program. *Conservation Biology*, 28(2), 529-540 pp. doi: 10.1111/cobi.12188.

Ross Lake NRA General Management Plan and EIS. 2012. National Park Service.

United States Statutes at Large. "An Act to Designate Wilderness within Olympic National Park, Mount Rainer National Park, and North Cascades National Park Service Complex in the State of Washington, and for Other Purposes." (Pub. L. 100-668, 16 Nov. 1988).

USFWS. 2009. Marbled Murrelet *(Brachyramphus marmoratus)* 5- year review. U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office, Lacey, Washington. June 12, 2009.

USFWS. 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS. 2013. "Candidate Notice of Review". Federal Register Doc. 78 FR-27391.

WDFW. 2007. Washington State Recovery Plan for the Western Gray Squirrel. Washington Department of Fish and Wildlife, Olympia, Washington.

Wiles, G.J., Allen, H.L., Hayes, G.E. 2011 Wolf Conservation and Management Plan forWSDOT. 2014. SR 20 – North Cascades Highway. Washington. Washington State Department of Fish and Wildlife, Olympia, Washington. 297 pp.Transportation.

**Personal Communications**

Zipp, R. North Cascades National Park
2014 Telephone conversation with S. Ward, ESCI 493. May 28.

Boerke, E. North Cascades National Park
2014 Telephone conversation with M. Tonty, ESCI 493. June 3.