United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

In Reply Refer To:
13410-2011-F-0067

SEP 16 2011

Y. Robert Iwamoto
Mt. Baker-Snoqualmie National Forest
Supervisor's Office
2930 Wetmore Ave, Suite 3A
Everett, Washington 98201

Dear Mr. Iwamoto:

Subject: Monte Cristo CERCLA Project

This letter transmits the U.S. Fish and Wildlife Service's Biological Opinion (Opinion) and concurrence based on our review of the proposed Monte Cristo Comprehensive Environmental Response, Compensation, and Liability Act project on the Darrington Ranger District, Mt. Baker-Snoqualmie National Forest in Snohomish County, Washington (T29N, R11E, Section 21). The attached document evaluates the effects of the proposed action on the threatened northern spotted owl (*Strix occidentalis caurina*) and designated northern spotted owl critical habitat, the threatened marbled murrelet (*Brachyramphus marmoratus*) and designated marbled murrelet critical habitat, and the threatened bull trout (*Salvelinus confluentus*) and designated bull trout critical habitat. Your request for initiation of formal consultation is in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.). Your November 29, 2010, request for formal consultation for the northern spotted owl and the marbled murrelet was received on November 30, 2010. Your March 10, 2011, request for formal consultation for the bull trout was received on March 11, 2011. This Opinion is based on information provided in the November 29, 2010, and March 10, 2011, Biological Assessments, telephone conversations, field investigations, and other sources of information. A complete record of this consultation is on file at this office.

In your Biological Assessments for the proposed action, you made "may affect, not likely to adversely affect" determinations for northern spotted owl critical habitat, marbled murrelet critical habitat, the grizzly bear (*Ursus arctos horribilis*) and the gray wolf (*Canis lupus*). We do not concur with your determinations of "may affect, not likely to adversely affect" for northern spotted owl critical habitat or marbled murrelet critical habitat, but we do concur with your determination of "may affect, not likely to adversely affect" for the grizzly bear and the gray wolf. Our rationale for concurrence for these determinations can be found after the Consultation History section of the Opinion. The enclosed Opinion and concurrence concludes that the proposed action "is not likely to jeopardize" the northern spotted owl, marbled murrelet, or the bull trout and "is not likely to destroy or adversely modify" designated critical habitat for the northern spotted owl, marbled murrelet, and bull trout.

If there are any questions regarding the Opinion or our joint responsibilities under the Endangered Species Act, please contact Mark Hodgkins at (360) 753-9532 or Carolyn Scafidi at (360) 753-4068, of this office.

Sincerely,

Carolyn Scafidi

for Ken S. Berg, Manager
Washington Fish and Wildlife Office

cc:
Mt. Baker National Forest, Everett, WA (J. Plumage)
Mt. Baker National Forest, Everett, WA (L. Everest)
Mt. Baker National Forest, Everett, WA (P. Reed)

Endangered Species Act Section 7 Consultation

Biological Opinion

U.S. Fish and Wildlife Service Reference: **13410-2011-F-0067**

Monte Cristo CERCLA Project
Agency:
U.S. Forest Service
Everett, Washington

Consultation conducted by:
U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Lacey, Washington

Carolyn Scafidi (signature)
Ken S. Berg, Manager
for Washington Fish and Wildlife Office

9/16/11
Date

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LIST OF ACROYNMS AND ABBREVIATIONS

BA	Biological Assessment
BMU	Monte Cristo Bear Management Unit
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CHU	Critical Habitat Unit
County	Snohomish County
CR	Conservation Recommendations
dB	decibel
dbh	diameter at breast-height
ESA	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
Forest	Mt. Baker-Snoqualmie National Forest
ft^2	square feet
GIS	Geographic Information System
IGBC	Interagency Grizzly Bear Committee
LSR	Late-Successional Reserve
LWD	Large Woody Debris
m	meter
murrelet	Marbled Murrelet
NTU	nephelometric turbidity units
NWFP	Northwest Forest Plan
Opinion	Biological Opinion
PCE	Primary Constituent Element
province	western Washington Cascades Province
RPM	Reasonable and Prudent Measures
RPM	Reasonable and Prudent Measures
Service	U.S. Fish and Wildlife Service
SEV	Scale of Severity
SF	South Fork
spotted owl	Northern Spotted Owl
T&C	Terms and Conditions
WDFW	Washington State Department of Fish and Wildlife

Introduction

This document transmits the U. S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the proposed Monte Cristo Mine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) project located in Snohomish County (County), Washington, and its effects on the northern spotted owl (*Strix occidentalis caurina*) (spotted owl) and designated spotted owl critical habitat, the threatened marbled murrelet (*Brachyramphus marmoratus*) (murrelet) and designated murrelet critical habitat, and the bull trout (*Salvelinus confluentus*) and bull trout critical habitat in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). Your request for formal consultation for spotted owls and murrelets was received on November 30, 2010, while your request for formal consultation for bull trout was received on March 11, 2011.

This Opinion is based on information provided in the November 29, 2010, and March 10, 2010, Biological Assessments (BA), field investigations, telephone conversations, email correspondences, and other sources of information. A complete record of this consultation is on file at the Washington Fish and Wildlife Office in Lacey, Washington.

CONSULTATION HISTORY

- September 24, 2009 - Peter Forbes, District Ranger on the Mt. Baker-Snoqualmie National Forest (Forest) sent a letter to the Service containing an engineering evaluation of the proposed action and information on a September 28, 2009, public meeting.

- January 18, 2010 - representatives of the Service and Forest personnel visited the terrestrial portion of the action area, specifically the first 1.7miles of the new road alignment from Mt. Loop Highway. The findings of that trip were recorded in a memo to the file and in photographs that were included in the administrative record of this consultation.

- October 29, 2010 - the Service received a draft BA for terrestrial species via Email.

- November 29, 2010 - the Service received a request for formal consultation for the spotted owl, spotted owl critical habitat, the murrelet, and murrelet critical habitat. The November 16, 2010 Final Draft BA for terrestrial species accompanied this request.

- March 14, 2011 - the Service received a request for formal consultation on bull trout and bull trout critical habitat. The March 1, 2011, Final Draft BA accompanied this request. The submission of this package initiated the formal consultation process on the entire action.

- February 24, 2011 - the Forest sent to the Service an addendum to the BA that clarified road construction elements and murrelet critical habitat acres.

- June 14, 2011 - the Service requested additional information from the Forest regarding the proposed action and effects to bull trout, and Zach Radmer (Service Biologist) and Loren Everest (Forest Biologist) discussed the scope of the questions and the history of the proposed action. On June 21, 2011, the Forest responded to the Service's request for additional information with an email.

- July 7, 2011 - the Forest and the Service discussed aspects of the proposed action concerning bull trout. The Service informally requested addition information on that date. On August 3, 2011, the Forest provided that information.

- August 4, 2011 - the Forest and the Service visited the action area. One team visited the northern portion of the proposed action, specifically the first 1.7miles of the new road alignment from Mt. Loop Highway. Another team visited the southern portion of the proposed action, specifically from the crossing of the South Fork Sauk River by the County road to the mine sites. The findings of both trips were recorded in a memo to the file and photographs that were included in the administrative record of this consultation. The most significant findings of the terrestrial portion of the field trip were 1) a new road alignment overlapped additional trees greater than 30 inches dbh, some with platforms, not yet know to the project biologists, 2) not all of the road alignment had been surveyed for potential nest trees for spotted owls or murrelets, 3) the final alignment will not be known until just before the felling of trees. The most significant findings of the aquatic portion of the field trip were 1) a tributary crossing that had not been addressed in the BA, 2) the Glacier Creek crossing is 300 feet (ft) wide, and 3) Glacier Creek and Seventy-Six Gulch are not currently high quality spawning habitat for bull trout.

- August 8, 2011 - the Forest sent to the Service an addendum to the BA that clarified the number of potential murrelet nest trees likely to be felled for the newest proposed action road alignment, in response to the August 4, 2011 field trip.

- August 12, 2011 - the Forest changed the proposed action for the aquatic portion based on information obtained during the August 4 site visit. Also on August 12, 2011, the Forest amended the proposed action to include a culvert installation on the newly discovered tributary.

- August 17, 2011 - the Forest amended the proposed action to include work area isolation procedures and fish salvage procedures. Those procedures are necessary to avoid adverse effects to bull trout in three tributaries to the South Fork Sauk River and in Glacier Creek.

<u>Level 1 Meetings</u>: Different aspects of the proposed action were discussed during Level 1 meetings on December 3, 2009, on January 14, and 21, April 8, June 3, 2010, and on March 10, 2011.

<u>Various communications</u>: Between January 2010 and August 2011, the Service exchanged numerous emails and telephone calls with the Forest to clarify various details of the proposed action. These communications are part of the record for this consultation.

Concurrence for Insignificant and Discountable Effects to Grizzly Bear and Gray Wolf

The BA included proposed action effects determination of "may affect, not likely to adversely affect" for the grizzly bear (*Ursus arctos horribilis*) and gray wolf (*Canis lupus*). Based on the information provided in the BA and other sources, we concur with this determination based on the rationale described below.

Grizzly Bear

The likelihood that a grizzly bear will be exposed to the proposed action is remote. The Forest is experiencing historical low grizzly bear numbers. This is likely due to a lack of abundant food sources on the Forest. Further, the area between Mountain Loop Highway and Monte Cristo mine site is used by hikers, mountain bikers, backpackers, and people who access cabins within the Monte Cristo mine site. The Forest considers this amount of human use enough to discourage use by grizzly bears.

There are no known grizzly bear den sites on the Forest and there are no recent or current indications of grizzly bear presence within the Monte Cristo Bear Management Unit (BMU) on which the proposed action is located. The closest reported sighting of a grizzly bear (classified as "probable") occurred over 10 miles northeast of the proposed action in 1985 and 1993. A more recent "Class 1" grizzly bear sighting (considered "confirmed") occurred in 1997 in Glacier Peak Wilderness no less than 15 miles northeast. The most recent "Class 1" grizzly bear sighting occurred October 21, 2010, in the upper Cascades River watershed about 36 aerial miles from the action area. While these distances are insignificant to the amount of miles grizzly bears may travel, the time period between sightings reinforces the fact that grizzly bears are rare within the Cascades. Due to these reasons, the likelihood of exposure of grizzly bears to the proposed action is remote.

The amount of impact to grizzly bear habitat as a result of the proposed action will be low. The proposed action will impact grizzly bear security habitat and core habitat. The BMU contains a total of 114,782 acres, 97.5 percent of which is on Federal land. Of this total, 77,600 acres are snow free in the early season. Grizzly bear core habitat is defined as those areas more than 0.3 mile from any open roads and high-use trails. Within the BMU, 98,680 acres are considered early core habitat and 82,610 acres are late core habitat. The new road alignment will reduce core habitat by about 315 acres, which is about 0.3 percent change. However, this reduction will not significantly change the overall percentage of 86 percent early core habitat and 72 percent late core habitat. The North Cascades Technical Committee for the Interagency Grizzly Bear Committee (IGBC) recommends a 70 percent core area goal for BMUs. This threshold would be maintained as a result to the proposed action. Further, the proposed action will not result in a change in connectivity of habitat between BMUs.

For the North Cascades Ecosystem, the IGBC recommends that core areas contain 0.16 to 1.56 miles per square mile of open road density (Interagency Grizzly Bear Committee 2001, p. 7). The Sauk Forks portion of the BMU that includes the North Fork and South Fork of the Sauk River has an open road density of 0.31mile per square mile (USFS 1995, p. 3b-42). However, the portion of the BMU that is on the Skykomish District is within the new Sky Wilderness has a very low road density, which further lowers this road density value.

The loss of core habitat due to the proposed action is small considering the addition of core acres to the BMU as a result of road closures since 1997 due to the designation of the Wild Sky Wilderness. In addition, the calculations of roads considered drivable has shrunk due to deteriorating conditions thus adding to the total for core acres. A total 1,290 additional acres has been added to BMU #7 since 1997 (USFS 2010, p. 19). The addition of the road miles for the proposed action will maintain the recommended road density pursuant to the IGBC. Therefore, the amount of the reduction of core habitat within the BMU due to the slight increase in road density would be so small as to be insignificant.

In summary, given the amount of early- and late-core habitat, the small reduction in the amount of core habitat due to the new road alignment, and the low road density within the BMU, the effects to grizzly bear core habitat would be so small as to be insignificant. For these reasons, and the reasons described above for an unlikely potential disturbance exposure, we concur with the Forest's determination that the proposed action is not likely to adversely affect the grizzly bear.

Gray Wolf

The likelihood that the gray wolf would be affected by the proposed action is remote. Gray Wolves are not currently known to be preset in the project area; no known gray wolf den or rendezvous sites occur on the Forest. Further, the wolf prey population is currently thought to be insufficient to support a resident reproductive wolf population. In addition, there is no indication of resident gray wolves west of the Cascade Crest on the Forest. It is assumed that only transient or dispersing gray wolves might be expected to temporarily utilize areas on the Forest. The most recent report of a gray wolf rendezvous site occurred in 1990 near the Cascade Crest in the North Fork Sauk watershed, 15 aerial miles to the northeast (USFS 2010, p. 12). While this distance is insignificant to the amount of miles wolves may travel, the age of these sightings reinforces the fact that gray wolves are rare within the Cascades. Therefore, given the low population of gray wolves in Washington and thus the low probability that resident gray wolves will be present in the project area, the probability that wolves may be exposed to the proposed action is so low as to be discountable.

The amount of habitat that will be removed that gray wolves may be able to utilize will be permanent, but small. BMUs are often used as a surrogate for gray wolf management. The new road alignment will reduce core habitat by about 315 acres (using a 0.3 mile buffer), which is about 0.3 percent change. This reduction will not significantly change the overall percentage of 86 percent early-core habitat and 72 percent late-core habitat. Therefore, the amount of habitat loss will be so minor as to be considered insignificant. Further, the addition of the new road will not significantly change the road density for the BMU.

Considering the low probability of gray wolves occurring in the action area, the limited effects to habitat, the temporary disturbance caused by road building, and the past road obliterations that helps offset the new proposed permanent road, we concur that the overall effects of the proposed action are not likely to adversely affect the gray wolf.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

A detailed description of the proposed action is contained in the Forest's BA (USFS 2010, pp. 2-7). The following is a summary description of the proposed actions. The proposed action includes conservation measures that are in addition to the Northwest Forest Plan (NWFP) (USDA and USDI 1994) and the Forest's Land and Resource Management Plan Standards and Guidelines (USFS 1990, pp. 4-81 to 4-142). The purpose of the proposed action is to create reliable motorized access to the Monte Cristo Mining Area to accommodate heavy equipment needed for CERCLA clean-up action for up to 10 mine sites and several former mining facilities on National Forest and privately owned land. The proposed CERCLA clean-up includes creating permanent storage facilities (repositories) for contaminated materials created by the historical mining and processing operations.

Current vehicle access to the historical mining site is both limited and unreliable. The Monte Cristo County Road has suffered reoccurring flood damage along several portions of the road prism. Further, a bridge over the South Fork of the Sauk River has been damaged on several occasions and is currently unusable. The Forest has determined that repair to the existing County road is impractical. Due to its placement, the County road would continue to be exposed to future damage and failures from flooding and river migration. The Forest decided that a more practicable alternative is the construction of a new road on higher ground that connects, to the extent practicable, with existing logging roads and the County road to minimize forest impacts.

The Forest reports that road building (Phase 1, starting spring of 2012) will require 13 days of construction work. The following year, the road will be used to access clean-up activities at the Monte Cristo townsite (Phase 2, starting spring of 2013). Clean-up activities will require 21 days of activity (see Figure 1).

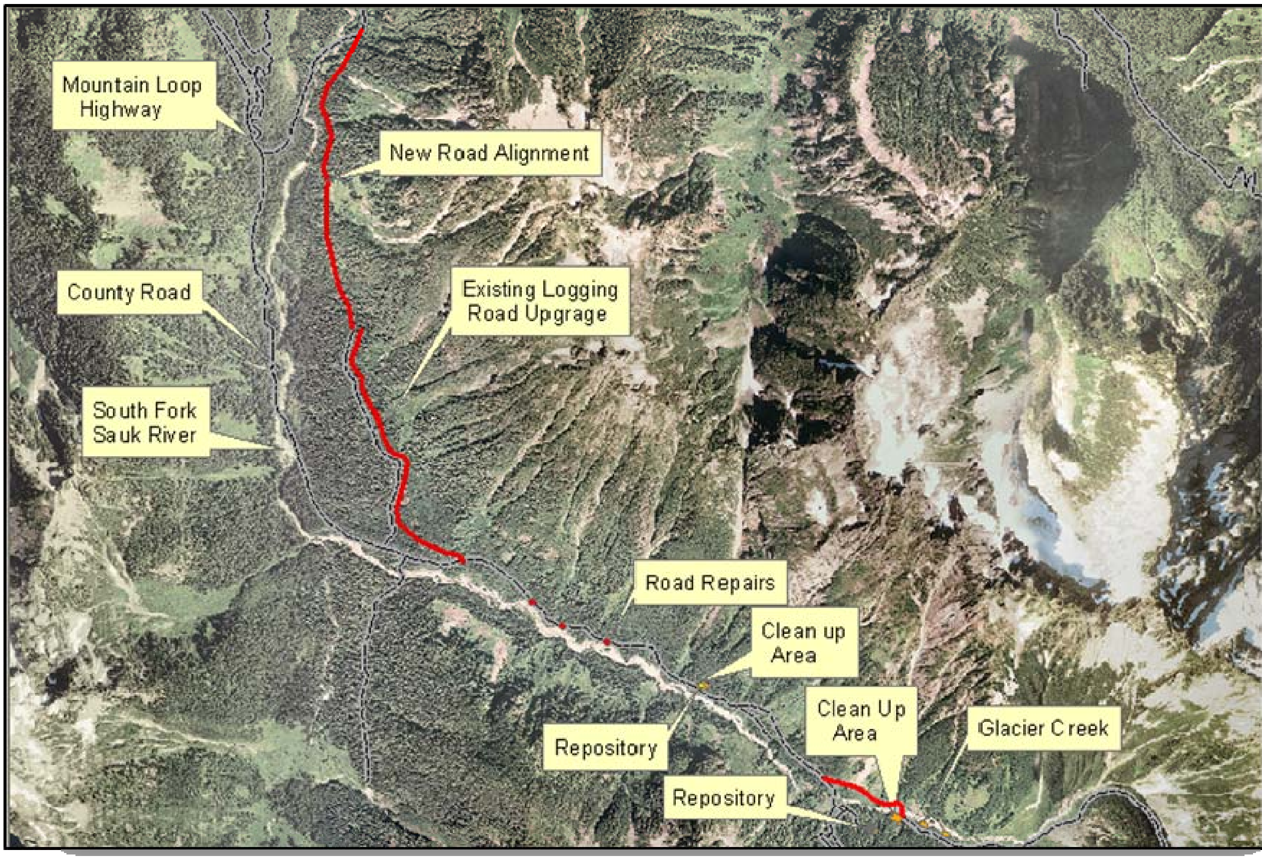

Figure 1. The action area including locations of project activities.

Road Construction

About 75 percent of the new road alignment occurs within Late-Successional Reserve (LSR) RW-116. The entire new road alignment passes through critical habitat for the spotted owl and the murrelet. Construction of the new road would require heavy equipment including graders and a track-mounted hydraulic hammer. Tree felling along the proposed road alignment will occur after the nesting season (i.e., after September 15) to minimize the risk of mortality of nesting spotted owls and murrelets. The remainder of the road construction will occur in a single year during the nesting season of the spotted owl and murrelet. Tree felling will include forest clearing for the new road alignment and the removal of hazard trees anywhere along road alignments.

Road Reconstruction

The proposed action also includes the reconstruction of existing roads that occur closer to the mine sites. The gravel road would be re-constructed for 1.9 miles and constructed for 0.8 mile. The road prism would be located more than 300 ft from the SF Sauk River and its tributaries with 10 exceptions. The road will be within 200 ft of the creek or river at seven crossing sites and three road repair areas where the existing County road will be re-routed around washed out sections adjacent to the river. Existing roads within the townsite of Monte Cristo would also be widened and re-surfaced with gravel. The best management practices associated with road reconstruction can be found in the BA (USFS 2011, pp. 5–9).

Steam Crossings

The Forest is proposing to build seven new stream crossings (Table 1). All stream crossings will be permanent except for the crossing over Glacier Creek. The seven crossings will be on seven different tributaries and creeks (Figure 2).

Tributaries to the SF Sauk River (Permanent Crossings)

The proposed access road will cross six tributaries to the S. Fork Sauk River. Two of the crossings will be bridges, two will be culverts, and two will be fords. Both of the bridges and one of the culverts may be accessible by bull trout. Culverts and bridges will be as wide as bankfull width and designed to pass the 100-year flood event plus 20 percent to accommodate associated debris. The fords will be constructed with concrete or rock. The ford locations do not support surface water except during large rainstorms or quick snow melt.

Glacier Creek (Temporary Crossing)

On August 12, 2011, the Forest changed the proposed action based on information obtained during the August 4, 2011 site visit. The crossing at Glacier Creek is no longer proposed to be a bridge. The Forest was not able to attain possession of the washed out twin bridges from the County, as proposed in the BA, and determined that purchasing or building a bridge would be too expensive. The Forest will use bridges to cross Glacier Creek if bridges become available; however, use of bridges is not reasonably certain to occur at this time and this option is not evaluated in this opinion. The Forest intends to cross Glacier Creek with several culverts and hundreds to thousands of cubic yards of fill. A specific estimate was not provided. The crossing is needed for only 1 year and would be installed in May or June and removed in August or September of the same year. The fill would be native material to the greatest extent practicable, but the fill for the road bed would be 2-inch minus rock. The Forest would use several trucks to complete the work as fast as possible. The Forest would remove as much of the foreign fill and 2-inch minus road bed fill as possible from the site, and attempt to restore the channel to a more natural configuration.

Table 1. Proposed stream crossings of the South Fork Sauk River and Glacier Creek

Stream Crossing	Location	Distance from SF Sauk confluence	BT bearing	Crossing Type	Installation Time	Permanent?
Trib to SF Sauk River	MP* 0.67	850 ft	Maybe	Bridge	May 1–October 31 2012	Yes
Trib to SF Sauk River	MP 0.9	1700 ft	No	Ford	May 1–October 31 2012	Yes
Trib to SF Sauk River	MP 1.0	1250 ft	No	Culvert	May 1–October 31 2012	Yes
Trib to SF Sauk River	MP 1.3	1150 ft	Maybe	Bridge	May 1–October 31 2012	Yes
Trib to SF Sauk River	MP 1.7	640 ft	No	Ford	May 1–October 31 2012	Yes
Trib to SF Sauk River	~MP 4.3	~250 ft	Maybe	Culvert	May 1–October 31 2012	Yes
Glacier Creek	~MP 5.5	1,200 ft	Yes	Multiple Culverts	Installation May 2013 Removal August or September 2013	No

*MP is an abbreviation for mile post that indicates the distance from the beginning of the road to that point.

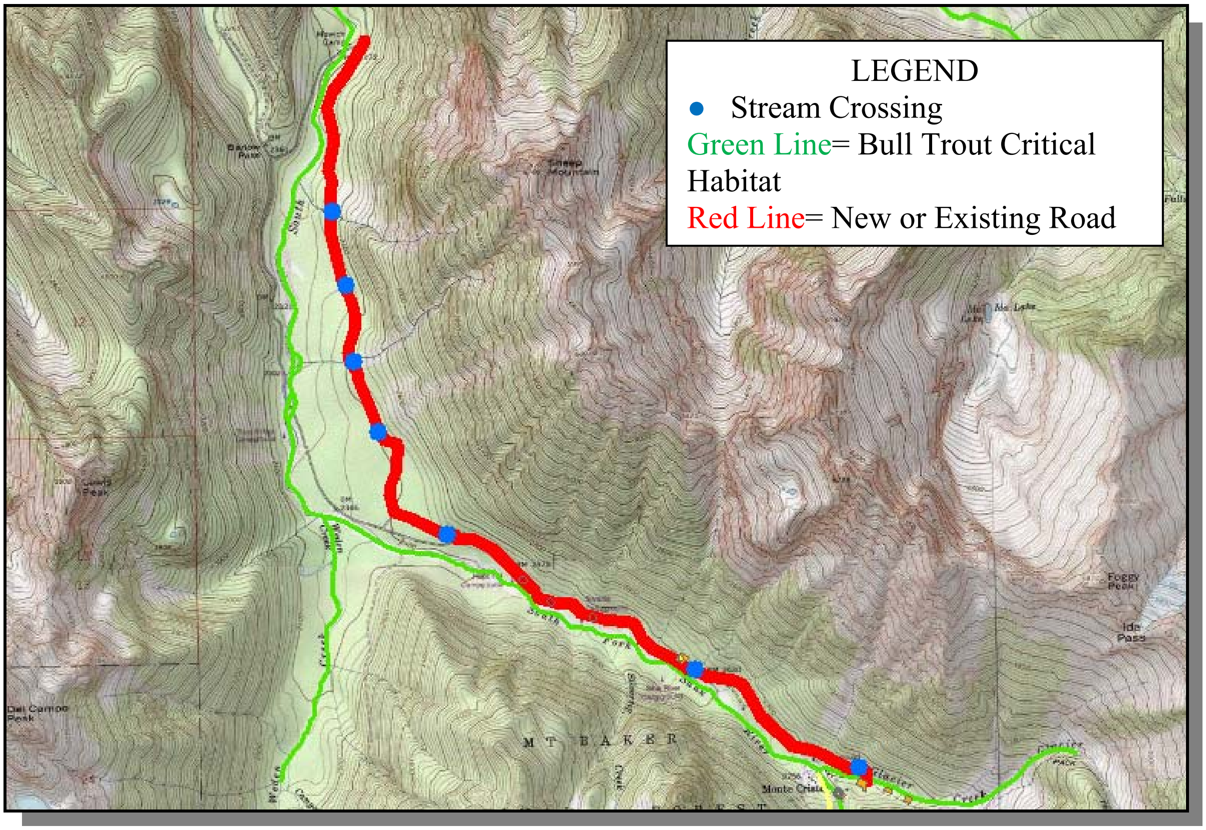

Figure 2. Map of the proposed tributary and creek crossings

Fish Salvage

The Forest proposed the following work area isolation procedures and fish salvage procedures for the three potential fish bearing tributaries and in Glacier Creek:

> “Isolation of construction activities from stream flow will be required at identified fish bearing channels to protect aquatic life and downstream habitat. Work areas will be isolated with a combination of sandbags or supersacks with plastic sheeting incorporated. Temporary plastic culverts may be used to bypass the work site. These structures may be designed to reroute flows around the project site and outside of the channel or simply shift flows within the existing channel. This process will involve removing aquatic organisms from the project site. Aquatic animals will be removed first by placing a block seine at the upper end of the project location, seining in a downstream direction to flush fish from the work area, then isolating the work area and removal of any remaining fish with hand nets. Expected impacts include the temporary isolation of stream habitat from access by fish and aquatic organisms, temporary impairment of fish movement upstream and downstream of the project, removal of riparian vegetation, and exposure of bare ground. Applied conservation measures for isolating the construction from stream flow include using appropriate fish handling and transfer protocols, minimizing heavy equipment use and fuel/oil leakage, minimizing earthmoving related erosion, minimizing

stream crossing sedimentation, and minimizing sedimentation through dewatering. All sandbags, supersacks, plastic sheeting and temporary culverts will be removed and the channel shaped to natural contours when construction is complete."

The Forest (Loren Everest) provided the following work area isolation estimates during a phone conversation with the Service (Zach Radmer) on August 25, 2011. The Forest estimated that 500 square ft (ft^2) of channel would need to be dewatered at each of the three fish bearing tributaries and that 1,600 ft^2 of channel would need to be dewatered at the site of the Glacier Creek crossing. In total, work area isolation and fish salvage procedures are proposed to occur in 3,100 ft^2 of stream channel.

Contaminant Clean-up

The proposed CERCLA clean-up operations include the removal of contaminated rock and soils from up to 10 mine sites and several mining facilities. The contaminated rock and soils would be buried at a new repository site, where the material would be permanently stored. The repository site has two proposed locations, but only one of them will be used. The proposed action also includes water treatment vaults that will be built at several mines shafts and adits that are discharging contaminated water. Clean-up activities occur in second growth forest stands that are not within a LSR and do not contain suitable or critical habitat for the spotted owl or the murrelet. Clean-up operations are within riparian reserves near bull trout critical habitat at Glacier Creek and Seventy-Six Gulch. Those areas will be discussed in the riparian reserves section below. Contaminant cleanup has two elements: removal and capping of mine overburden and tailings in a repository; and water quality remediation at adits with Floc-Logs® and concrete vaults.

Clearing Riparian Trees and Vegetation

The Forest is proposing to clear up to 1.5 acres of riparian reserve vegetation at old mining sites around Seventy-Six Gulch (1 acre) and Glacier Creek (0.5 acre) for access with heavy machinery. The clearing would take place at least 66 to 100 ft from the gulch or creek. These areas would be re-planted with conifers and shrubs after the clean-up is completed at that site.

Removal and Capping of Mine Overburden and Tailings in a Repository

The Forest is proposing to remove piles of mine overburden and tailings from the vicinity of the 10 mining sites. The overburden, tailings, or any other soil deemed contaminated will be placed 20 ft deep in a 3-acre repository and capped with clean soil. The repository will be built at Mile Post 4.25 on the County road, 200 ft from the South Fork Sauk River on the north side.

Water quality remediation at adits with Floc-Logs® and concrete vaults

Vaults and Floc-Logs® will be maintained yearly at eight mine shafts and adits in the Monte Cristo area. Maintenance would involve replacing the old Floc-Logs® with new ones. Access to vaults and Floc-Logs® would be provided by the new permanent road.

Terrestrial Conservation Measures

The Forest intends to minimize potential impacts to terrestrial species through implementing conservation measures that include, but are not limited to, the following:

- Blasting will not be used at any point during the proposed action. Alternative methods, such as chemical fracturing and hydro jacks, will be employed in lieu of blasting.
- Activities using heavy equipment and other noise-generating equipment that will occur between April 1 and September 15, will only occur between 2 hours after sunrise and 2 hours before sunset.
- The road alignment within engineering plans will be adjusted to minimize the removal of large diameter trees, particularly those that contain possible murrelet nesting platforms. To the extent practicable, the road alignment will follow existing Forest roads, logging roads, an old wagon trail, and other existing features.
- The "footprint" of the road will be minimized to reduce the removal of trees. The new road will consist of a 14-ft-wide single lane prism with 2-ft-wide ditches on both sides, pull-outs for passing, and cut/fill areas in steep terrain.
- All aquatic activities will follow standard Washington State Hydraulic Permit Activities requirements.

Aquatic Conservation Measures

The Forest will reduce potential impacts to aquatic resources through implementing conservation measures that include, but are not limited to, the following:

- To avoid and minimize mobilization and transport of course and fine sediments into the active channel:
    - Water will be diverted around project sites if work is required in the active channel.
    - Excess material (spoils) will be disposed of properly in uplands to avoid contamination into flowing waters.
    - Barriers to sediment may include, but are not limited to, straw bales, silt fencing, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas.
    - Operations during heavy precipitation events will cease until weather conditions improve.
    - All disturbed ground shall be stabilized using appropriate best management practices, including revegetation with native species.
    - Wastewater from project activities and water removed from within the work area shall be routed to an area landward of the 100-year floodplain.
    - Disturbed streambeds shall be restored to the natural gradient and bankfull width.
    - Streambanks shall be properly sloped to an angle of stability (natural repose) when removing culverts.

- Measures to protect existing large woody debris already in the stream channel may include:
    - All non-treated wood will be left in the stream/lake/wetland.
    - Large woody material removed from a culvert inlet will be put back in the stream, downstream of the culvert.
- To avoid/minimize the introduction of chemical contaminants associated with machinery (fuel, oil, hydraulic fluid, etc.) used in project implementation:
    - Hazardous spill clean-up materials and trained operators will be available on site.
    - Machinery maintenance will occur outside the Riparian Reserve or at an approved site.
    - Prior to starting work each day, all machinery will be checked for leaks and all necessary repairs made before entering a Riparian Reserve.
- The disposition of downed wood, such as blown down or felled hazard trees, will be determined based on the Forest woody debris policy with priority given to retaining onsite or stockpiled for use in restoration projects.
- In-channel activities will be limited to the approved work windows (Washington State Department of Fish and Wildlife (WDFW) Memorandum of Understanding) unless coordinated with WDFW and consulting agencies. In addition, key holding areas for adult spawners or high-use areas for rearing fish may need special attention when deciding timing of in-channel activities.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The terrestrial action area for the proposed action is based on the area of sound-only impact from road building activities, including heavy equipment and chainsaws. We used a 1 mile-wide buffer area around 2.3 miles of road, both new alignment and existing road alignment. Using Geographic Information System (GIS), we delineated an action area of 7,800 acres

The aquatic action area occurs from each proposed road crossing to 0.5 mile downstream of that road crossing, encompassing ca. 2.16 miles (11,390 ft) of the SF Sauk River and ca. 0.23 mile (1,200 ft) of Glacier Creek. The aquatic and terrestrial action area is therefore approximately 33.5 acres and 2.38 stream miles.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components: 1) the *Status of the Species*, which evaluates the murrelet range-wide condition, the factors responsible for that condition, and its survival and recovery needs; 2) the *Environmental Baseline*, which evaluates the condition of the murrelet in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the murrelet; 3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the murrelet; and 4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the murrelet.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the murrelet and the spotted owl in the wild.

The jeopardy analysis in this Opinion places an emphasis on consideration of the range-wide survival and recovery needs of the species and the role of the action area in the survival and recovery of the species as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Opinion relies on four components: 1) the *Status of Critical Habitat*, which evaluates the rangewide condition of designated critical habitat for the species in terms of Primary Constituent Elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall; 2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; 3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected Critical Habitat Units (CHU); and 4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected CHUs.

For purposes of the adverse modification determination, the effects of the proposed Federal action on spotted owl and murrelet critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the murrelet.

The analysis in this Opinion places an emphasis on using the intended rangewide recovery function of species critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

STATUS OF THE SPECIES: Northern Spotted Owl

Appendix A presents an updated account of the rangewide status of spotted owls.

ENVIRONMENTAL BASELINE: Northern Spotted Owl

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress. Our analyses in this opinion are based on the areas encompassing the measurable (i.e., adverse) effects of the action on listed resources.

Western Washington Cascades Physiographic Province

For analysis and conservation planning purposes, the range of the spotted owl is divided into 12 physiographic provinces that reflect the physical, biological, and environmental factors that shape broad-scale landscape features and natural plant communities (Thomas et al. 1990, p. 61). In the 2010 draft revised recovery plan for the spotted owl, the Service identified the physiographic provinces as individual recovery units essential for the survival and recovery of spotted owls (USFWS 2010b, p. 37). In Washington, there are four physiographic provinces, including the Olympic Peninsula, the western Washington lowlands, the western Washington Cascades, and the eastern Washington Cascades.

The action area occurs with the western Washington Cascades Province (province). During the issuance of the spotted owl recovery plan, there were approximately 197 spotted owl activity centers and 166 confirmed pairs. Of these, 179 activity centers, and 150 pairs are on Federal land. Since that publication, there are far fewer activity centers and pairs. Threats to the spotted owl at the province level include low rates of reproduction in the northern portion (including the action area) and loss of habitat throughout the province. The Province, in general, is highly fragmented by past timber harvest, while the portion in which the proposed action occurs is fragmented by mountainous terrain. Spotted owls and their habitat within the northern half of the province (north of Interstate 90) are now poorly distributed in the area and no large clusters occur here (USFWS 1992, p. 152). However, connectivity there has not appreciably changed from 1994 because the effects to the spotted owl relative to consulted-on actions were minor.

Federal lands in the province include over 1.1 million acres of spotted owl habitat, representing about 15 percent of all spotted owl habitat on Federal lands. Approximately 78 percent of the owl habitat on Federal lands in the Province is located in conservation reserves. The spotted owl recovery team identified several threats to spotted owls within the Province, including fragmented distribution of spotted owl habitat and local populations, and the potential for isolation of spotted owls within the province from populations in adjacent provinces (USFWS 1992, p. 45). Barred owls are common in the western Washington Cascades (Herter and Hicks 2000; Pearson and Livezey 2003), and competition with barred owls (*Strix varia*) poses a significant and complex threat to the spotted owl (USFWS 2010b, p. xi).

Status of Spotted Owls in the Mt. Baker-Snoqualmie National Forest

There are no current spotted owl population estimates for the Forest or the western Washington Cascades Physiographic province. The Forest's spotted owl database (via GIS) indicates a total of 228 spotted owl sites that were documented during the 1980s and 1990s.

There are several estimates of the amount of suitable spotted owl habitat on the Forest. Using GIS, the Service identified a total of 579,584 acres of suitable habitat (defined in Status of the Species of this document, p. 18) throughout the Forest which is 33.9 percent of the total Forest acres (USFWS 2002, p. 98). Additional details of the status of spotted owls in the Forest may be found within the Programmatic Biological Opinion (2003-2007; with extensions) (USFWS 2002).

Status of the Late Successional Reserve

About 75 percent of the new road construction occurs within LSR RW-116. This LSR contains 113,352 federally-owned acres, of which 44,953 acres (40 percent) is considered nesting, roosting, and foraging (suitable) habitat. The general objective for LSRs is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old growth related species. This LSR was designed to include habitat with several murrelet detections and to improve connectivity between areas of suitable owl habitat (USFS 2001, p. 38). This LSR provides connectivity with LSRs 115, 117, and 802. The original U.S. Forest Service Environmental Impact Statement estimated 9 total spotted owl activity centers with 1 spotted owl single and 8 pairs (USDA and USDI 1994, p. G-13). At the time of the 2001 Forest-wide LSR Assessment, it was estimated that 19 spotted owl pairs occurred within LSR 116 with a projected future of 26+ spotted owl pairs. The LSR is currently lacking in habitat quality (USFS 2001, p. 38).

Status of the Riparian Reserves

Some elements of the proposed action are within areas dedicated to riparian reserve management. Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. The objective for treating the Riparian Reserve portions of these stands is to encourage the growth of larger conifers, including increased tree diameter and wide vigorous crowns, increase species diversity, and augment future sources of coarse wood for the riparian forest floor and in streams. Within the action area, Riparian Reserves are currently forested with small trees, and do not contain features of particular value to threatened species such as platforms, snags, or nesting cavities.

Status of Spotted Owls in the Action Area

Spotted owl surveys were conducted in the action area in 2010. While the surveys were not conducted to the 2010 protocol (USFWS 2010a), the Service and the Forest agreed that a survey for one season with 6 survey days and two follow-up survey days would be sufficient given the time constraints of this action. No spotted owls were detected. However, given the limitations of the survey data, we are unable to conclude that spotted owls do not use the action area. It is our opinion that spotted owls may occupy the action area, as explained below.

Using GIS, we determined that the action area currently contains about 2,841 acres of suitable habitat (42.6 percent). A site visit by Service and Forest staff verified that the action area and the proposed road alignment include suitable habitat. Suitable spotted owl habitat is generally mature or old-growth forest that has a moderate to high canopy closure; a multilayered, multi-species canopy dominated by large overstory trees; numerous large snags and down logs; and sufficient open space below the canopy for spotted owls to fly through (Thomas et al. 1990, p. 19). Forests with these characteristics provide nesting and roosting sites for spotted owls and support the highest densities of northern flying squirrels (*Glaucomys sabrinus*) (Carey 1995, p. 657).

Using historical site information and the current distribution of suitable habitat, we approximated home ranges and core areas for spotted owl territories to evaluate the likelihood of owl presence. There are five historical spotted owl territories within 3 miles of the action area. In the Washington Cascades, we use a 1.82-mile radius circle to identify the median annual home-range for spotted owls and a 0.7-mile radius to identify the core area (USFWS 1992). This GIS analysis showed the home range of only one of these five sites—the Barlow Pass territory—overlaps the action area. The home range and core area of this site overlap the proposed action area by 7.9 acres. This territory was known to be occupied by spotted owls in the late 1980s. The Figure 5 (p. 30) and Figure 5 (addendum) in the BA displays a list and the location of historical spotted owl detections (visual and audible) within the home range of the Barlow Pass territory. Fifteen detections between March 1987 and June 1994 occurred within the action area. No surveys were conducted in this part of the Forest between 1995 and 2010. The Service assumes that historical activity centers are likely to be re-occupied by spotted owls in the future. This assumption is based on the findings of LaHaye et al. (2001, p. 691) who found that over 70 percent of dispersing juvenile California spotted owls *(Strix occidentalis occidentalis)* settled in territories that were previously occupied by other California spotted owls. A similar pattern of territorial occupancy by different individuals using the same territory over a period of years or even decades has been observed in the Washington's western (Pearson and Livezey 2003, p. 274) and in eastern Cascades (Hicks et al. 2003, p. 64). Consequently, for purposes of this analysis, we assume this territory is occupied. The historical activity center of the Barlow Pass territory is located approximately 0.5 mile from the area of road construction.

Condition of the Action Area

The project area contains both old-growth stand and second-generation forests. Tree species composition includes Pacific silver fir (*Abies amabilis*), western hemlock (*Tsuga heterophylla*), some western red cedar (*Thuja plicata*) and Alaska yellow cedar (*Chamaecyparis nootkatensis*). Tree ages span 40 to several hundred years old. The information presented below was provided by the Forest during the course of the consultation.

Natural Disturbances

The condition of the action area has been continually influenced by natural events, primarily avalanches, wind throw, landslides, and floods. Blowdown is evident along the proposed road route, as well as avalanche debris fields. The winter of 2010/2011 experienced unusually high snow levels that resulted in several avalanche that downed several mature and old trees in the first 0.5 mile of the proposed road route. Unstable soils and deep-seated landslides also contribute to openings along the South Fork Sauk River valley. Due to slides and floods, the current County road (Monte Cristo Trail Road) to the Monte Cristo townsite is not drivable. The County road crosses a deep-seated landslide where the road was lost to river erosion several times over the last 20 years. Floods also influence the riparian vegetation, undercutting banks and recruiting large woody material, resulting in hardwood and brush growth along the river channels. The two bridges over the S.F. of the Sauk River near Weden Creek trailhead were repaired but washed out in both 2003 and 2006.

Other disturbances in the action area include root rot and insect infestations. Hemlock looper, (*Lambdina fiscellaria lugubrosa*) is a native defoliating insect that periodically reaches epidemic proportions in western hemlock forests. The insect outbreaks cause mortality when defoliation is greater than approximately 75 percent of the tree foliage. Between 1991 and 1993, the Darrington Ranger District experienced heavy outbreaks of hemlock looper. For example, within the Canyon Creek drainage in the South Fork of the Stillaguamish River (10 miles west of the action area), approximately 1,800 acres was impacted by hemlock looper. Other areas within the District, including the action area, were subject to more scattered and spotty infestations and mortality.

Large wildfires swept through much of western Washington in the 1700s, with a portion of the upper S.F. Sauk River drainage having a stand year of origin that is within this time frame. The project area from Barlow Pass to Weden Creek is an older stand between 1,000 and 1,667 years old, and likely did not burn due to the moist conditions along the river valley. Old stands do not necessarily mean that the trees within the stands are all old trees. As the forest stand ages and succumbs to insects, wind throw and other stand disturbances, understory seedlings take advantage of the openings and become a younger–aged cohort within the old forest stands. The

Forest stand-year-of-origin data does identify blocks within the project area that are 1,801 to 1,930 years old as well as younger stands that are 1,668 to 1,801 years old. These stands are on the south facing slopes of Sheep Mountain to Foggy Peak and are likely results of wildfire, as well as more recent human-related fires from the railroad, timber harvesting, and settlement in the valley at the Monte Cristo townsite.

Human Disturbance

Mining from 1890 to 1920 greatly changed the landscape of the action area both directly and indirectly. Construction of the Monte Cristo townsite and mining support buildings resulted in the clearing of many acres of forest. Timber was cut in the Sauk River Valley for mine support structures, building construction, and firewood. Mining operations required the construction of the wagon road on the east side of the South Fork of the Sauk River. Later, a railroad was constructed to connect the Monte Cristo townsite to the South Fork of the Stillaguamish River valley by following the west side of the South Fork of the Sauk River over Barlow Pass. Construction of the wagon road and railroad grades resulted in blasting and grading, with timber cut for puncheons (square timbers for road beds and mine supports) and railroad ties. Historical photos of the mine site show slopes with snags, suggesting escaped settlement fires.

The most recent timber harvest occurred in the 1960's with the Forest's Python Timber Sale along Road 4716 on the east side of the South Fork of the Sauk River, approximately 1 mile south of Barlow Pass. The Monte Cristo townsite and upper valley has regenerated with a second growth forest of western hemlock, Pacific-silver fir, and cedar.

Currently, the townsite includes a mix of Federal and private lands. Residences on private in-holdings are still used, primarily in the summer months. The Forest retains a series of cabins at the townsite. One cabin is used most summers as a base for volunteer rangers working on trails in the area. The Forest is planning to upgrade the trail from Weden Creek to Gothic Basin, while the Monte Cristo Preservation Association is planning reroutes of trails along the river for access to the private property near the townsite. The Forest reports high use of the project area by hikers, climbers, backpackers, and mountain bikers accessing the townsite, Silver Lake, and nearby peaks. During the summer season, over 40 cars are often parked at the junction of the Monte Cristo County Road and Mountain Loop Highway (Reed, pers. comm. 2011). Dispersed camping occurs along the South Fork Sauk River and at the Monte Cristo townsite.

Conservation Role of the Action Area

Habitat in the Forest in general, and in the action area specifically, is important for both spotted owl demographic support and dispersal connectivity within the Washington Cascades.

Threats to Spotted Owls in the Action Area

Competition with Barred Owls

The first study to address competition between spotted owls and their larger congeners—barred owls—was conducted in the Mt. Baker area adjacent to the Mt. Baker-Snoqualmie National

Forest (Hamer et al. 2007; Hamer et al. 1989). Since that time, many other studies in the Pacific Northwest have shown that barred owls compete with spotted owls for prey (Hamer et al. 2001; Livezey 2007; Livezey et al. 2008) and habitat (Dunbar et al. 1991; Herter and Hicks 2000; Pearson and Livezey 2003, 2007; Gremel 2005). In addition, barred owls have been observed physically attacking spotted owls (pers. comm's in Pearson and Livezey 2003) and circumstantial evidence indicates that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998). Consequently, barred owls reportedly have reduced detectability (response behavior) (Crozier et al. 2006; Crozier and Zabel 2006; Olson et al. 2005), reproduction (Glenn et al. 2011; Olson et al. 2004), and survival (Forsman et al. In press [2010]) of spotted owls.

Climate Change

Climate change, and the related warming of global climate, has been well documented in the scientific literature. Evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating, we can no longer assume that climate conditions in the future will resemble those in the past.

Further, increased vulnerability to catastrophic wildfires may occur as climate change alters the structure and distribution of forests. Observations of the direct and indirect effects of global climate change include changes in species ranges and a wide array of environmental trends, including disturbances in the balance of forest insect pests.

Increased occurrences of fire and/or insect damage could decrease potential suitable spotted owl habitat, which would put added importance on the remaining stands that contain suitable spotted owl habitat or potential habitat in the future, such as younger stands that are managed to become suitable habitat. While the proposed action will remove suitable habitat, it is a small, yet incremental decrease in available suitable habitat. However, suitable removal will not necessarily directly exacerbate the threats of climate change.

EFFECTS OF THE ACTION: Northern Spotted Owls

The following aspects of the action are anticipated to result in insignificant or discountable effects to spotted owls: 1) tree felling during road construction, 2) vehicle use, 3) microclimate changes and increased competition with barred owls due to fragmentation; 4) loss of potential nest trees, and 5) noise and human disturbance.

Tree felling during road construction is extremely unlikely to injure or kill spotted owls because the Forest has committed to conducting this activity outside of the spotted owl nesting season, after the young have fledged. If adult or juvenile spotted owls are present while trees are being felled, they would be expected to fly from the area. Spotted owls may also be affected through collisions with vehicles, but this we consider this to be extremely unlikely to occur because 1) spotted owls are rare, 2) most vehicle traffic will occur mid-day when spotted owls are less active, 3) the road will be gated and locked at both ends with access only to official vehicles for infrequent road maintenance and trips to the repositories and water-treatment facilities, and 4) the one-lane road will have many curves that will regulate driving speeds. New forest edges often influence the microclimate within the adjacent forest which could affect nesting spotted owls. However, due to the already fragmented nature of much of the action area and the small width of the new road, we anticipate the effect of the road on the forest microclimate would be so small that effects to spotted owls will be immeasurable. The forests in the action area are suitable for spotted owls and barred owls even though they are artificially fragmented from forest harvest and naturally fragmented due to wind storms and rock slides. These forests will remain suitable for both species after construction of the single-lane road. There is no evidence to indicate that completion of the project would give an advantage to barred owls over spotted owls, and we anticipate that likelihood or magnitude of competition with barred owls will not be measurably affected. The only known potential nest tree within the new road alignment was blown down in the spring of 2011. Therefore, the likelihood that the proposed action will remove another nest tree is so remote as to be considered discountable.

Noise and human activities that generate noise levels of 92 dBA or greater can result in adverse effects to spotted owls by causing an adult or a nestling to flush from its nest, or a fledgling to miss a feeding (USFWS 2003, p. 273). Spotted owls hunt almost exclusively at night (Forsman et al. 1984, p. 51), so human activities conducted during the day, such as those involved in the proposed action, are not expected to measurably disrupt their feeding behavior, but may affect their nesting behavior. Tree felling would occur outside the early nesting season (after September 15) of the project's first year, but log hauling and road building would occur during the early nesting season the following year. Spotted owls are susceptible to disturbance during the early breeding season (March 1 to July 15) when young are in the nest, but are not as susceptible during the late season (July 16 to September 30) when young are able to move away from disturbances without a fitness consequence. For nesting spotted owls, we consider 65 yd (59 m) as the threshold for disturbance from ground-based activities with motorized equipment (USFWS 2011, p. 43). This distance is based on two studies. Delaney et al. (1999, pp. 66-68) reported that Mexican spotted owls *(Strix occidentalis lucida)* flushed from people running chainsaws only 2.8 percent of the time at distances greater than 60 m, but they flushed more than 70 percent of the time at distances less than or equal to 60 m. Delaney and Grubb (2003, p. 22) reported that a spotted owl flushed in response to motorcycles passing within a distance of 220 ft (67 m). Flushing can increase the chance that a spotted owl is preyed upon. Known predators of spotted owls include great horned owls (*Bubo virginianus*) (Forsman et al. 1984) and barred owls (*Strix varia*) (Leskiw and Gutiérrez 1998, p 225). Suspected predators include northern goshawks (*Accipiter gentilis*) and red-tailed hawks (*Buteo jamaicensis*) (Courtney et al. 2004, p. 2-8). Using GIS, we estimated that about 80 acres of suitable habitat would be exposed to disturbance from vehicles and heavy equipment. However, as described above, the activity center of the Barlow Pass territory is located approximately 0.5 mile from the new road, and there are no known potential spotted owl nest trees near the road site. Consequently, we consider it to be extremely unlikely that a spotted owl would be flushed from its nest due to human activity associated with this project.

The remainder of this analysis addresses the stressor that is likely to adversely affect spotted owls: habitat loss and degradation.

Habitat Loss and Degradation

The proposed action will result in the loss of 10 acres of old and mature forest habitat for construction and reconstruction of the access road to the mine clean-up area. However, not all 10 acres of forest scheduled for removal constitutes suitable nesting habitat. Historical and recent avalanches, wind storms, and debris slides have removed portions of the forest stand. However, the exact acreage of non-forested openings has not been calculated. Further, the Service does not consider the openings so large as to constitute non-habitat. Therefore, we used 10 acres of habitat removal for our analyses.

An additional 13 acres of dispersal habitat would be removed due to road construction and reconstruction in second-growth forest closer to the mine clean-up area. After the project has been completed, additional removal of hazard trees would be considered road maintenance, which is an action covered under the existing Forest programmatic biological opinion (Biological Opinion of the Effects of Mt. Baker-Snoqualmie National Forest Program of Activities for 2003–2007 on Marbled Murrelets and Northern Spotted Owl, with amendments (USFWS 2003).

The removal of nesting, roosting, and foraging habitat within a spotted owl's home range may compromise their ability to survive and reproduce. This is the basis for the Service's recommended thresholds for evaluating impacts from habitat removal within a spotted owl home range (60 FR 9491 [Feb. 17, 1995]). The removal of suitable habitat below 40 percent (2,664 acres) of the area within the 1.82-mile radius circle is one of the Service's indicators of impacts that are likely to significantly impair essential behavior for this species (USFWS 1990, p. 10). The Service also uses a 0.7-mile radius circle to identify the core habitat around a spotted owl nesting/roosting site (Forsman et al. 2005, p. 270). The removal of suitable habitat below 50 percent (492 acres) within this core area is also one of the Service's indicators of significant impairment of essential behavior for this species (USFWS 2008, p. 17).

As described above, only the Barlow Pass spotted owl home range overlaps the action area. This home range contains 2,841 acres of mature forest or old growth forest, or 42.6 percent suitable habitat. The 0.7-mile radius core contains 502 acres of suitable habitat, or 51 percent suitable habitat. Consequently, this territory is above both suitable habitat thresholds, and loss of 10 acres of suitable habitat is not anticipated to result in a significant impairment of essential behaviors (Table 2). However, both the home range and core area percentages are very close to their respective thresholds and the loss of 10 acres as a result of the proposed action is likely to measurably and adversely affect spotted owls associated with this territory.

Table 2. Suitable habitat acreages for the Barlow Pass spotted owl home range based on the historical and assumed current location of the activity center.

Spotted Owl Activity Center (Sec. 31)	Territory Acres (1.82-mile radius) = 6,660	Core Acres (0.7-mile radius) = 985
Acres Suitable	3,280 (via MBS) 2,841 (via WDFW)	502 (via WDFW)
Percent Suitable	49.2 % (via MBS) 42.6 % (via WDFW)	51 % (via WDFW)
Expected Project Effects	1.3 miles of road = 7.9 acres	650 ft of road = < 1 acre
Post-Project Habitat Estimate	No significant change 49.1 % (via MBS) 42.5 % (via WDFW) ***Meets 40% minimum threshold***	No significant change 50.8 % ***Meets 50% minimum threshold***

Windthrow can be caused by projects that open new corridors into intact forests and by projects that damage roots and compact soils through the use of heavy equipment. Increased windthrow may result in adverse effects to spotted owl habitat by downing and/or damaging potential nest trees. The action area is already subject to windthrow. Many large trees, including the only potential spotted owl nest tree observed during surveys of the road area by Forest and Service personnel, were blown down in the action area during the spring of 2011. It is reasonable to assume that a small number of additional acres of suitable habitat will be lost due to windthrow as a result of road construction, but we do not expect that this loss will exceed the thresholds discussed above. Nonetheless, the loss of these acres of suitable habitat is anticipated to adversely affect spotted owls.

To summarize, the Service anticipates the following effects to spotted owls and their habitat:

- Injury or death due to felling of trees: discountable
- Collisions with vehicles: discountable
- Lesser quality of habitat due to effects to microclimate: insignificant
- Competition with barred owls: insignificant
- Removal of potential nest trees: discountable
- Disturbance: discountable
- Loss of suitable habitat: adverse

CUMULATIVE EFFECTS: Northern Spotted Owls

Under section 7 of the ESA (16 U.S.C. 1536, *et seq.*), cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. No Tribal or State actions currently occur within the action area, or are planned or likely to occur.

Non-Federal lands occur within the action area. There are about 20 private inholdings near the Monte Cristo townsite, 5 of which contain summer cabins. We expect no future actions on the part of the landowners that would affect spotted owls, or spotted owl habitat. Therefore, we expect no cumulative effects associated with non-Federal activities.

Recreation

The watershed is a popular hiking, mountain biking, and winter snow-skiing destination. The Forest reports up many hikers, mountain bikers, and snow skiers within the South Fork Sauk watershed. The new road is not expected to attract additional use in the area due to parking limitations; however, the recreation use of the area will likely be shifted into the new road alignment, an area heretofore unused due to the current difficult access. We expect discountable effects to spotted owls from this shift in visitor use.

Climate Change

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathé et al. 2010). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littel et al. 2009, p. 15). Additionally, the changing climate will likely alter forest ecosystems as a result of the frequency, intensity, duration and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littel et al. 2009, p. 14).

One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. In general, wet western forests have short dry summers and high fuel moisture levels. This results in very low fire frequencies. However, high fuel accumulations and forest densities create the potential for fires of very high intensity and severity when fuels are dry (Mote et al. 2008, p. 23). Westerling et al. (2006) looked at a much larger area in the western United States including the Pacific Northwest and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period between 1970 and 1986. The total area burned is more than 6.5 times the previous level; and the average length of the fire season during the 1987 to 2003 time period was 78 days longer compared to the 1978 to 1986 time period (Westerling et al. 2006, p. 941). Littel et al. (2009, p. 2) project that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s.

Climate change is likely to further exacerbate some existing threats in the action area such as the projected potential for increased habitat loss from drought related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that spotted owls and spotted owl habitat will be adversely affected, we lack adequate information to quantify the magnitude of effects to these listed resources from climate change (USFWS 2009, p. 34).

INTEGRATION AND SYNTHESIS: Northern Spotted Owls

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The jeopardy analysis in this Opinion emphasizes consideration of the rangewide survival and recovery needs of the species and the role of the action area in the survival and recovery of the species. It is within this context that we evaluate the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Summary of the Status of Northern Spotted Owls

The Western Cascades Province has been highly fragmented due to natural and human factors. Spotted owls and their habitat within the north half are poorly distributed and no large cluster occur there. However, connectivity there has not appreciably changed from 1994 because the effects to the spotted owl relative to consulted-on actions were minor. There are no spotted owl estimates for the Forest or the Province. Threats to the spotted owl at the Province level include low rates of reproduction and loss of habitat. On the Forest, 33.9 percent of the total Forest acres are suitable spotted owl habitat. The LSR RW-166 is lacking in habitat volume and quality from natural and human disturbances. The LSR also provides connectivity with adjacent LSRs.

We do not expect any future State or Tribal actions in the action area. Due to the private inholdings near the mine site, some private actions may occur but we do not expect they will affect the spotted owl. We expect future recreational use of the new road alignment with insignificant consequences to spotted owls. Climate change is likely to further exacerbate some existing threats to the spotted owl such as the projected potential for increased habitat loss from drought related fire, tree mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years), as well as affecting reproduction and survival during years of extreme weather. However, the proposed action does not mitigate nor exacerbate its effect on the spotted owl.

Summary of the Current Status and Conservation Needs of the Northern Spotted Owl

Many spotted owl populations are declining, especially in the northern parts of the species' range, where populations have declined by as much as 40 to 60 percent since 1990 (USFWS 2010b, p. 88). Habitat quality and quantity, annual weather patterns, and the presence of barred owls are all factors that affect spotted owl survival, reproduction, and local population trends (Anthony et al. 2006).

Past habitat loss and current habitat loss are also threats to the spotted owl, even though loss of habitat due to timber harvest has been greatly reduced on Federal lands for the past two decades (USFWS 2010b, p. ix). As presented above, competition from the barred owl poses a significant threat to the spotted owl. Conservation strategies for the spotted owl recognize the importance of maintaining large blocks of suitable habitat to support clusters of spotted owl territories and by providing for demographic exchange (dispersal) between these local populations (USFWS 2010b, p. 13), and reducing impacts associated with barred owl competition (USFWS 2010b, pp. 65-69). Habitat within the Forest is essential for the long-term conservation of the species, while habitat in the action area is important for both spotted owl demographic support and dispersal connectivity within the Washington Cascades. Lack of habitat volume, barred owl pressure, and connectivity functions places additional importance on the conservation of the remaining suitable habitat in the LSR and the critical habitat unit.

Summary of the Effects of the Proposed Action and Cumulative Effects

For adverse effects of the proposed action, we consider the removal of suitable habitat below 50 percent within the core area and 40 percent within the territory to be a threshold for an adverse effect. While the removal of 10 acres as a result of the proposed action maintains these thresholds, the percentages are very close and are likely to measurably adversely affect spotted owls associated with the Barlow Pass territory.

Effects to Spotted Owl Survival and Recovery

Although removal of 10 acres of suitable habitat does not support maintenance of "adequate habitat" for recovery of the spotted owl (USFWS 2008), the small scale of this removal is not expected to appreciably affect recovery of the species at the physiographic province or rangewide scales. Under the proposed action, the amount of habitat in the home range and core area of the only spotted owl territory that overlaps the action area would not drop below our thresholds. The essential conservation role of the action area to support long-term survival and recovery of spotted owls will be diminished by the action. However, the small scale of the effect is not expected to measurably reduce the ability of the physiographic province and range of the species to support long-term survival and recovery of spotted owls.

Given the above analysis, we conclude that the adverse effects to spotted owls that would result from the proposed action is not anticipated to appreciably reduce the likelihood of survival and recovery of the spotted owl in the wild by reducing spotted owl numbers, reproduction, or distribution, at the scale of the Forest, the western Washington Cascades physiographic province, or the range of the species.

CONCLUSION: Northern Spotted Owl

After reviewing the current status of the spotted owl, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Opinion that the Monte Cristo CERCLA clean-up action, as proposed, is not likely to jeopardize the continued existence of the spotted owl.

STATUS OF NORTHERN SPOTTED OWL CRITICAL HABITAT

An updated account of the status of spotted owl critical habitat rangewide is presented in Appendix B.

Mt. Baker-Snoqualmie National Forest Critical Habitat Trends

Between 1994 and 2001, only one CHU in the Forest experienced a removal of suitable habitat. Within WA-34, 924 acres were removed or downgraded as the result of a consulted-on action. This reduced the percent of suitable within CHUs by 0.3 percent. Between 2001 and 2003, the Forest lost an additional 10,215 acres of suitable (a 1 percent change) (USFWS 2004, p. 25) due to consulted-on actions. Depending on where these losses occurred, the ability of the CHUs to function may have changed appreciably since their designation in 1992. However, the ability of critical habitat to function at the Provincial scale would not likely to have changed appreciably.

ENVIRONMENTAL BASELINE: Northern Spotted Owl Critical Habitat

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress.

The Environmental Baseline portion of this consultation documents the approved Federal actions that contribute to the conservation of the spotted owl, as well as those actions that authorized incidental take. The baseline includes adoption of the NWFP. Information relevant to describing the environmental baseline for this action is included in the NWFP and associated documents.

The original 1992 designation of critical habitat for spotted owls (57 FR 1796:1838 [Jan. 15, 1992]) was superseded by the 2008 critical habitat designation (73 FR 47325:47354 [Aug. 13, 2008]). The northern portion of the action area occurs within CHU WA-2 subunit 13. CHU WA-2 (Northwest Washington Cascades) contains 393,500 acres (73 FR 47325:47354 [Aug. 13, 2008]). Subunit 13 contains 22,450 acres, about 62 percent (13,900 acres) of which is suitable nesting habitat. Habitat in the northern half of the province is naturally fragmented due to mountainous terrain, and the fragmentation has been worsened by timber harvest. The role of the CHU is to help ensure connectivity among spotted owls.

Conservation Role of the Critical Habitat

CHU WA-28 was expected to support at least 10 pairs of spotted owls by providing essential suitable habitat, dispersal habitat, and connectivity with adjacent CHUs. CHU WA-28 is important for range-wide distribution of spotted owl habitat within the North Cascades identified in the ISC Plan due to demographic and habitat distribution concerns, and due to low number of existing spotted owl pairs (Tehan 1991, p. 11).

Condition of the Critical Habitat

Spotted owl habitat in the action area varies in quality from late-successional forests with multiple layers, large trees, downed logs, and snags that provide spotted owl nesting, roosting, and foraging habitat, to riparian forests that may provide roosting opportunities. The action area abuts a mountain ridge with several avalanche chutes that fragments forest stands. A damaged 2-mile long County road is within the action area further fragments the forest stand. The current consultation baseline for the CHU is 25,087 acres, of which 10,981 acres are considered suitable.

EFFECTS OF THE ACTION: Northern Spotted Owl Critical Habitat

The proposed action will remove 10 acres of forest habitat to accommodate building a new road to access the mine clean-up area. All 10 acres are considered to be suitable habitat. This removal would result in the loss of 0.04 percent of suitable habitat in the CHU WA-28 (WA-2 subunit 13). PCEs are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the spotted owl critical habitat final rule include those physical and biological features that support nesting, roosting, foraging, and dispersal (57 FR 1796-1838 [Jan. 15, 1992]). The proposed action will directly affect 10 acres of suitable spotted habitat by clearing it for the new road alignment. The proposed action would adversely affect critical habitat due to the removal of PCEs that currently could provide nesting, roosting, and foraging habitat for spotted owls. However, the removal 10 acres of suitable habitat for the new road alignment would not preclude spotted owls from using this stand.

Effects to Northern Spotted Owl Nesting, Roosting, and Foraging Habitat within CHU WA-28

The amount of habitat loss and degradation will be small. The loss of 10 acres of suitable habitat represents a loss of 0.04 percent of the suitable habitat in the CHU, and far less in the action area, and will reduce suitable habitat within CHU WA-28 to 10,971 acres. This contributes to a loss of less than 1 percent of the suitable habitat within CHU WA-28 since 1994. The Service does not expect the proposed action will significantly affect the functional ability of the critical habitat unit to provide for spotted owl nesting, roosting, and foraging.

Effects to Northern Spotted Owl Dispersal and Habitat Connectivity

Due to the small amount of suitable spotted owl habitat that will be removed as a result of the proposed action, the Service does not expect the proposed action will have an appreciable effect to dispersal or connectivity within the action area or the CHU. CHU dispersal and habitat connectivity would be maintained.

Effects to the Western Cascades Province

Since 1994, there has been about 785 acres of spotted owl critical habitat authorized for removal from the Forest (Table 3). Implementation of the proposed action will increase that figure to 795 acres and decrease the suitable habitat within the CHU network on the Forest from 270,408 acres to 270,398 acres. This represents a total loss of less than 0.005 percent of the suitable critical habitat on the Forest since 1994. Due to these small changes, the Service does not expect the proposed action would diminish the ability to attain the critical habitat goals in the CHUs at a Province level for providing well-distributed suitable and dispersal habitats, nor would it appreciably reduce the ability of the CHU or critical habitat within the Province to function as intended or diminish its ability to attain critical habitat goals at the Province Level.

If the critical habitat designation is formally remanded to the 1992 designation, there will be no need to reinitiate consultation to address project effects to CHU WA-49.

Table 3. Approximate acres of spotted owl critical habitat removed, downgraded, or disturbed for all Biological Opinions within the Forest from 1994 to the present

Reference No.	Project Name	Acres Removed	Acres Degraded	Acres Disturbed
96-F-136	Jackman Cr. Rd. No. 14 RUP[1]	34	0	0
96-F-359	Canyon Instream and Lookout Mt.	0	0	190
96-F-511	FR 70 Flood Damage Repair	2	0	225
96-F-580	Huckleberry Land Exchange	747	0	0
96-FW-190	Plum Creek HCP[2]	0	400	0
97-F-007	MBS Programmatic BO	650 trees	0	74,600
97-F-419	Sauk Mountain RUP	0	0	150
98-F-404	Ridley Cr. Trail Reconstruction	0	0	1,200
98-F-537	Biobsud Cr. RUP	0	0	6
1-3-00-F-1542	Greenwater River Channel Relocation	0	0	750
1-3-03-F-2022	Shannon Creek Bridge Const.	0.25/2 trees	0	0
1-3-06-F-0087	Suiattle Road 26 Repair	1	0	0
13410-2009-F-0504	West Fork Foss Trail Flood Repair	2	20	0
13410-2010-F-0453	CY 2010 North Zone Non-commercial Thinning	0	0	958
13410-2010-F-0607	CY 2010 Road 1106 Reroute	0.8	2	0
Totals		785 acres + 652 trees	422	**78,589.8**

The proposed action will result in the permanent removal of 10 acres of spotted owl critical habitat. This removal would adversely affect critical habitat due to the removal of PCEs that currently could provide nesting, roosting, and foraging habitat for spotted owls. However, this removal represents a total percentage change of 0.04 percent for the critical habitat unit (under either the 1992 or 2008 critical habitat designation). The Service determined that the proposed action would:

- Not preclude spotted owls from using this stand
- Not affect the functional ability of the critical habitat unit to provide for spotted owl nesting, roosting, and foraging
- Not appreciably affect dispersal or connectivity within the action area or the CHU
- Not diminish the ability to attain the critical habitat goals in the CHUs at a Province level for providing well-distributed suitable and dispersal habitats.

CUMULATIVE EFFECTS: Northern Spotted Owl Critical Habitat

Under section 7 of the ESA (16 U.S.C. 1536, *et seq.*), cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. No Tribal or State actions currently occur within the action area, or are planned or likely to occur.

Non-Federal lands occur within the action area. There are about 20 private inholdings near the Monte Cristo townsite, 5 of which contain summer cabins. We expect no future actions on the part of the landowners that would affect spotted owls critical habitat. Therefore, we expect no cumulative effects associated with non-Federal activities.

Recreation

The watershed is a popular hiking, mountain biking, and winter snow-skiing destination. We expect discountable effects to spotted owl critical habitat from visitor use.

Climate Change

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathé et al. 2010). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littel et al. 2009, p. 15). Additionally, the changing climate will likely alter forest ecosystems as a result of the frequency, intensity, duration and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littel et al. 2009, p. 14).

One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. In general, wet western forests have short dry summers and high fuel moisture levels. This results in very low fire frequencies. However, high fuel accumulations and forest densities create the potential for fires of very high intensity and severity when fuels are dry (Mote et al. 2008, p. 23). Westerling et al. (2006) looked at a much larger area in the western United States including the Pacific Northwest and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period between 1970 and 1986. The total area burned is more than 6.5 times the previous level; and the average length of the fire season during the 1987 to 2003 time period was 78 days longer compared to the 1978 to 1986 time period (Westerling et al. 2006, p. 941). Littel et al. (2009, p. 2) project that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s.

Climate change is likely to further exacerbate some existing threats in the action area such as the projected potential for increased habitat loss from drought related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that spotted owl critical habitat may be adversely affected, we lack adequate information to quantify the magnitude of effects to these listed resources from climate change (USFWS 2009, p. 34).

INTEGRATION AND SYNTHESIS: Northern Spotted Owl Critical Habitat

CHU WA-28 contains 25,087 acres, of which 10,981 is considered suitable. The CHU is expected to support 10+ pairs of spotted owls. The stand is fragmented from both manmade structures (Forest logging and County roads) and natural events (avalanches and mudslides). The removal of 10 acres required for the proposed action represents a small amount of habitat within the stand and the CHU (0.04 percent). This amount of habitat loss would not preclude spotted owls from using this stand, nor does it have an appreciable effect to dispersal or connectivity within the action area or the CHU.

CONCLUSION: Northern Spotted Owl Critical Habitat

For purposes of the adverse modification determination, the effects of the proposed Federal action on spotted owl critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat rangewide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the spotted owl.

After reviewing the current status of spotted owl critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's Opinion that implementation of the proposed action is not likely to destroy or adversely modify designated spotted owl critical habitat. Little critical habitat has been removed from the CHU since it was designated. The project would remove only 0.04 percent of the suitable habitat in the CHU. We do not expect this removal to impair the ability to provide for the conservation of the spotted owl in this CHU.

Therefore, critical habitat within this CHU and rangewide would remain functional or retain its current ability to become functional to serve its intended recovery role for the spotted owl.

STATUS OF THE SPECIES: Marbled Murrelet

Appendix C presents an updated account of the rangewide status of marbled murrelets.

ENVIRONMENTAL BASELINE: Marbled Murrelet

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area, those already affecting listed species and their habitat. Also included in the environmental baseline are the anticipated impacts of all unrelated proposed Federal projects in the action area which have undergone formal or informal section 7 consultations and the impacts of State and private actions which are contemporaneous with the consultation in progress.

The Environmental Baseline portion of this consultation documents the approved Federal actions which contribute to the conservation of the murrelet, as well as those actions which authorized incidental take. The baseline includes adoption of the NWFP. Information relevant to describing the environmental baseline for this action is included in the NWFP and associated documents. Information used to update the environmental baseline includes the effects of: 1) actions implemented under the NWFP on Federal lands which have undergone section 7 consultation; 2) section 10 incidental take permits with section 7 consultation completed; 3) completed section 7 consultations conducted with other Federal agencies; 4) updated survey data concerning murrelets in the action area; and 5) updated habitat data for murrelets in the action area.

Murrelet Habitat and Population Status in Conservation Zone 1

Zone 1, encompassing the Puget Sound in northwest Washington, contains roughly 1,022,695[1] total acres of suitable habitat; however, roughly 345,521 acres are likely to be occupied. Of this total, 979,424 acres are under Federal ownership, 22,132 aces are under Washington Department of Natural Resources (WDNR) ownership, and the remainder is under non-Federal and Tribal land ownership (McShane, 2004, p. 4-5). In a more recent review of potential suitable habitat on Federal lands (USFWS 2009, p. 34) totals are similar to these 2004 estimates. Zone 1 contains the largest murrelet populations in the species' listed range, and supports an estimated 30 percent of the murrelets in the coterminous United States (Miller et al. 2006, pp. 53-54).

[1] Due to reporting difficulties, some acreage within this totals include acreage in Conservation 2.

The largest contiguous area of potential murrelet nesting habitat remaining in the lower 48 States is within Olympic National Park. The Olympic National Park is characterized by uniform, high-quality habitat. The rate of occupancy is high, and does not appear to be related to how developed the sites are, the number of platforms per tree, or distance to marine waters (USFWS 2003, p. 43).

Washington Department of Fish and Wildlife, in partnership with Federal and State researchers, participated in a program to estimate a more precise marbled murrelet population size and trends since 2000. This monitoring program uses annual at-sea surveys of adult birds on the water. Line transects occur within 8 km of the Washington, Oregon, and northern California coastline in the area of the Northwest Forest Plan to estimate population trends within all Zones. The 2010 population estimate for Zone 1 is 4,393 (SE 0.24), and the estimated annual rate of decline during the 2001–2010 sample period is 7.4 percent (95 percent confidence interval of 3.5 to 11.2 percent decline), which is the highest rate of any Zone (Falxa et al. 2009, p. 12). The current estimate of juvenile-to-adult ratio is assumed to below the level necessary to maintain or increase the murrelet population (Falxa et al. 2011, p. 16).

Murrelet Habitat and Population Status in the Mt. Baker-Snoqualmie National Forest

The total number of occupied murrelet sites within the Forest is unknown. There are approximately 70 sites on the Forest where nests have been located, or occupancy behaviors have been detected. Most of these sites (more than 70 percent) are on reserve lands identified by the NWFP. However, there are no recent, complete surveys of murrelets in the Western Washington Cascades Physiographic Province, the Forest, or the action area.

There are approximately 297,262 acres of potentially suitable murrelet habitat on lands managed by the Forest, with about 280,215 acres (94 percent) occurring in reserves identified in the NWFP (i.e., LSR, Riparian Reserves, Congressionally Reserved Area, and Administratively Withdrawn Areas) (61 FR 26256-2632 [May 24,1996]). Past timber harvest practices by Weyerhaeuser have largely contributed to the highly degraded condition of this watershed. The Huckleberry land exchange between the U. S. Forest Service and Weyerhaeuser consolidated all parcels in the action area into Federal ownership. This will benefit conditions in the watershed over time as a result of ecosystem management under the NWFP.

Current Condition of the Action Area

A history of influences and the physical condition of the action area was described previously in the environmental baseline section for the spotted owl. Our understanding of murrelet habitat within the action area is based on information provided in the BA, and two site visits to a small portion of the action area in January, 2010 and August 2011.

The Service defines a potential murrelet nest tree as a conifer with a live crown, at least 98 ft tall, at least19 inches dbh, and containing platforms. Platforms are defined as relatively flat surfaces at least 4 inches in diameter at least 33 ft above the ground (71 FR 53840; Hamer and Nelson 1995a; Huff et al. 2006). Platforms can be created by a wide, bare branch, or covered with moss or lichen. A platform can also be a mistletoe broom, some other tree deformity, or other structure such a squirrel nest. Trees fitting this description were observed within, and adjacent to, the proposed road alignment. Other important attributes of potentially suitable nest trees are vertical and horizontal platform cover and substrate. Known nest sites have platforms that are generally protected by branches above (vertical cover) or to the side (horizontal cover) (Huff et al. 2006).

During the January 18, 2010, field trip to the action area attended by both the Service and the Forest, it was verified that the portion of the action area visited contained enough structure to support nesting murrelets and should be considered suitable nesting murrelet habitat. Many mature western hemlocks (*Tsuga heterophylla*) contained suitable nesting platforms. The canopy is variable and ranges from 50 to 60 percent, or more. Further, many of the potential nest trees are located with adjacent trees that are close enough to provide cover to the platforms.

Murrelet Habitat and Population Status in the Action Area

The action area occurs within 35 to 38 miles from the marine environment, which is within the distance murrelets will typically commute to a nesting site. No surveys have been conducted in the action area to determine if potentially suitable nesting habitat is currently occupied. Nonetheless, GIS data available to the Service (WDFW 2005) show murrelet detection locations (presence and occupancy behavior) within the watershed. Also, in 1994 and 1995, a survey of the proposed Mountain Loop Highway Project monitored 58 different stations. About 15 of these stations were determined to be occupied (flights below the canopy), while 10 recorded "presence" only. About 13 total detections have been recorded at the northern end of the action area near Mt. Loop Highway at Barlow Pass. These detections are within 0.15 mile of the proposed road alignment. Most of these detections (10) indicated occupancy behavior and not transient behavior.

Evidence suggests murrelets have a high fidelity to nesting areas, most likely at the watershed scale (Nelson 1997b). While there is currently no way to extract from those data the actual number of nest sites or individuals in the action area, or the population trend in the action area, it is reasonable to assume that all murrelet nesting habitat within the action area is occupied. It is also reasonable to assume that reproductive success and population trend within the action area are comparable to those throughout the Conservation Zone.

Conservation Role of the Action Area

The conservation role of the action area is the same as it is rangewide, namely 1) protection of nesting habitat by maintaining and protecting occupied and buffer habitat, and 2) minimizing the loss of unoccupied but suitable habitat (USFWS 1997b, p. 119). More specifically, the short-term actions necessary to stabilize populations include maintaining occupied habitat, maintaining and enhancing buffer habitat, and minimizing nest disturbances to increase reproductive success (USFWS 1997b, p. 138-142). The action area overlaps the LSR allocation under the NWFP, making the conservation emphasis on protection and enhancement of late successional and old-growth forest ecosystem conditions which serve as habitat for late successional and old-growth related species, including the murrelet.

Given the species' precipitous decline over the past 10 years, it is even more imperative that all suitable occupied habitat, including that within the action area, be managed to protect existing habitat quality and ensure reproductive success consistent with the recommendations of the Recovery Plan.

U.S. Forest Service Actions That Have Affected Murrelet Habitat Since 1994

The Forest consults on actions individually, in small batches, or programmatically for projects involving removal, downgrading or degradation of suitable murrelet habitat. Since 1994, the Service has issued 13 opinions to the Forest for actions which have modified suitable murrelet habitat (Appendix A). Two land exchanges during this time have resulted in the exchange and resulting loss of 1,466 acres of suitable or recruitment habitat for 569 acres of suitable habitat and an unquantified amount of recruitment habitat. The Forest acquired approximately 12,000 acres of lands and allocated those lands to LSR during these exchanges, thus a net gain of murrelet habitat is anticipated in the long term.

Threats to Murrelets in the Action Area

Predation

Areas of human recreation attract corvids due to an abundance of discarded and dropped food. Corvids are known nest predators of murrelets. Nest predation appears to be the major cause of nest failure for murrelets (McShane et al. 2004, p. 4-109; Nelson and Hamer 1995a, p. 89; Peery et al. 2004, p. 1095). The watershed is used for recreational activities including hiking, backpacking, mountain-biking. This human use may attract corvids that prey on murrelets in surrounding forests.

Climate Change

Climate change, and the related warming of global climate, has been well documented in the scientific literature. Evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating, we can no longer assume that climate conditions in the future will resemble those in the past.

Further, increased vulnerability to catastrophic wildfires may occur as climate change alters the structure and distribution of forests. Observations of the direct and indirect effects of global climate change include changes in species ranges and a wide array of environmental trends, including disturbances in the balance of forest insect pests.

Increased occurrences of fire and/or insect damage could decrease potential suitable murrelet nesting habitat, which would put added importance on the remaining stands that contain suitable murrelet nesting habitat or potential habitat in the future, such as younger stands that are managed to become suitable habitat. However, the proposed action does not mitigate or exacerbate climate change effect on murrelets.

EFFECTS OF THE ACTION: Marbled Murrelet

The following aspects of the action are anticipated to result in insignificant or discountable effects to murrelets: tree felling for road construction, vehicle use, microclimate changes due to fragmentation, and displacement of nesting murrelets due to removal of potential nest trees. Murrelets are extremely unlikely to be directly injured or killed due to initial tree felling for road construction because the Forest has committed to conducting this tree felling outside of the murrelet nesting season (i.e., after September 15). The risk that murrelets would collide with vehicles is extremely unlikely because 1) murrelets are rare and almost never fly close to the ground, 2) the road will be gated and locked at both ends, with access only to official vehicles for infrequent road maintenance and trips to the repositories and water-treatment facilities, and 3) the one-lane road will have many curves that will regulate driving speeds. New forest edges often influence the microclimate within the adjacent forest which could affect nesting murrelets. However, due to the already fragmented nature of much of the action area and the small width of the new road, we anticipate the effect of the road on murrelet habitat microclimate would be so small as to be insignificant.

Removal of potential nest trees, like the 18 trees with platforms along the road corridor, can displace some returning murrelets that are attempting to nest. Potential effects of this disruption may include a delay in the onset of breeding, nest site abandonment, or failed breeding due to increased predation risk at a marginal nesting location (Divoky and Horton 1995, p. 83; Raphael et al. 2002, p. 232). Each of these outcomes has the potential to reduce the nesting success for individual breeding pairs, and could ultimately result in the reduced recruitment of juvenile birds into the local population (Raphael et al. 2002, pp. 231-233). Several authors report nest site fidelity in murrelets, which is consistent with that of other alcids where birds return to previously occupied, but recently destroyed nest sites, for 2 or more years (Divoky and Horton 1995, p. 86; Nettle and Birkhead 1985 in Nelson 1997a). Nelson and Peck (1995) reported murrelets returning to the same forest stands in successive years. Divoky and Horton (1995, p. 86) documented murrelets returning the same forest stands for a minimum of 20 years in northern California, 18 years in central California, 7 years in Oregon, and 3 years in Washington. Nelson and Peck (1995) reported murrelets use of the same nest platform or tree in subsequent years, although not necessarily by the same pair or individual ($n = 7$ nests). There are more than 15 records of murrelets returning to the same tree, 6 of which returned to the same platform (Nelson 1997a, p. 17). Fidelity to nest sites has adaptive benefits. A long-lived species can increase breeding success and lifetime fitness. It can reduce potential reproductive effort by increasing the chances of breeding with the previous year's mate, eliminating or reducing the need to locate a new suitable nest site each year, and allowing the development of familiarity with the surrounding environment (Divoky and Horton 1995, p. 83). Evidence suggests that the fidelity murrelets exhibit to a previously used breeding area should be related to the rate and magnitude of habitat destruction (Divoky and Horton 1995, p. 83).

The ability of breeding murrelets to prospect for new nest sites also is well documented. Prospecting involves pairs and individuals flying near and landing on tree limbs in the early spring and midsummer. Non-breeding murrelets and subadults also may participate in this activity during the midsummer. Murrelets also visit nesting areas during the winter and may select nest sites during this time (Carter and Erickson 1992, Naslund 1993b in Nelson 1997a, p.

7). We expect that if murrelets nest within the action area, they also prospect and thus have familiarity with the area around their nest site, including potential alternative nest sites. We do not expect permanent displacement of murrelets from the action area as a result of the proposed action. We anticipate that murrelets returning in subsequent nesting seasons will locate new nest trees and would not experience a significant delay in re-nesting. Therefore, we anticipate the proposed action would have immeasurable effects on displacing of nesting murrelets.

The remainder of this analysis addresses the stressors that are likely to adversely affect murrelets. Those stressors are habitat loss and degradation, increased predation risk, and disturbance.

Habitat Loss and Degradation

Habitat Loss

The proposed action will result in the loss of 10 acres of old and mature forest habitat for construction and reconstruction of the access road to the mine clean-up area. However, not all of the 10 acres scheduled for removal constitute suitable nesting habitat. Historical and recent avalanches, wind storms, and debris slides have removed portions of the forest stand. The exact acreage of non-forested openings has not been calculated, but the Service does not consider any of the present openings are large enough to be considered non-habitat. Therefore, we used 10 acres of habitat removal for our analyses.

Forest staff attempted to identify and map all trees containing platforms suitable for nesting by murrelets that would be felled for road construction. The Forest found that, within this stand, trees less than 30 inches dbh did not contain branches large enough to contain platforms. The Forest counted 153 large-diameter trees (at least 30 inches dbh) within 100 ft of the proposed road alignment, about half of which contained potential nesting platforms. This total included trees on the edge of the alignment whose roots (about one half) would be impacted (overlapped) by the road alignment. They estimated that 36 trees over 30 inches dbh would be removed for the road alignment, 11 of which contained branches large enough to be potential nesting platforms.

During an August 4, 2011, visit to the action area by Service and Forest staff, we walked the majority of the proposed alignment within old and mature forest, which was about 1.6 miles in length. After walking the area, we agreed that, due to the nature of the stand, trees smaller than 30 inches dbh did not contain braches large enough to be potential nesting platforms. We learned from Forest staff that the proposed alignment along portions of the southern end had changed, which might increase the total number of large trees to be removed. After walking this southern end, staff from both agencies agreed that a total of 43 (not 36) trees at least 30 inches dbh would be felled for the road, 18 (not 11) of which contained limbs or platforms large enough to serve as nest trees.

Windthrow Loss

Windthrow can be caused by projects that open new corridors into intact forests and by projects that damage roots and compact soils through the use of heavy equipment. Increased windthrow may result in adverse effects to murrelet habitat by downing and/or damaging potential nest trees. Many large trees observed during surveys of the road area by Forest and Service personnel were blown down in the action during the spring of 2011. We expect that windthrow would be increased over a few acres due to construction of this road, and we consider such to be an adverse effect to murrelet habitat.

Increased Predation Risk

Nest predation appears to be the major cause of nest failure for murrelets (Nelson and Hamer 1995a, p. 89; McShane et al. 2004, p. 4-109; Peery et al. 2004a, p. 1095). Possible predators of murrelet eggs and young include a broad suite of animals, including at least 10 mammalian and avian species (Raphael et al. 2002, p. 221). The greatest threat to murrelets from habitat loss and fragmentation is the increased level of risk of nest predation associated with forest edges (McShane et al. 2004, p. 4-109). Nest failure and predation were highest within 50 meters (m) (164 ft) from edges of clearcuts, especially in areas close to human activity, which were defined to be at least as large as "campgrounds or small human settlements" (Raphael et al. 2002, pp. 229–230). Steller's jays (*Cyanocitta stelleri*) and common ravens (*Corvus corvax*) are known predators of murrelet nests (Nelson and Hamer 1995b, p. 65; Peery et al. 2004a, p. 1095; Hebert and Golightly 2007, p. 221), and gray jays (*Perisoreus canadensis*) are suspected predators (Nelson 1997, p. 14). Steller's jays were found to be abundant at "hard-edged sites" (edges of clear cuts 5 to 11 yr old) and "soft-edged sites" (next to regenerating stands 17 to 39 yr old) but rare at "natural-edged sites" (next to rivers and avalanche chutes) (Malt and Lank 2009, p. 1284). Simulated murrelet nests placed in hard edges had 2.5 times the probability of disturbance by avian predators relative to nests placed in adjacent interiors, whereas nests in soft edges were only one-third as likely to be disturbed as nests in adjacent interiors (Malt and Lank 2009, p. 1278). Nests in natural-edged sites showed little difference in risk of avian disturbance between edges and interiors (Malt and Lank 2009, p. 1278).

The above-cited studies indicate that murrelets are at greater risk of predation by corvids when their nests are located in the forest edge adjacent to very young clearcuts, campgrounds, or human settlements. The studies did not address densities of corvids near small roads or likelihood of predation by corvids near such roads. We anticipate that, since roads have more of a hard-edged than a soft- or natural-edged appearance, some increases in densities of corvids and chances of predation would be expected along this new road to Monte Cristo.

The Forest reports moderate use of the action area by hikers and mountain bikers accessing the mine area, Silver Lake, and nearby peaks. As many as 20 cars often are parked at the junction of the Monte Cristo County Road and Mountain Loop Highway (Reed, pers. comm. 2011). A new road would be expected to attract additional recreational use, which may increase the threat of predation to murrelets by attracting corvids coming to the area looking for food. Neatherlin (2002, p. 39) found that common crows (*Corvus brachyrhynchos*), northwestern crows (*Corvus caurinus*), common ravens, and Steller's jays exploited anthropogenic food sources and that annual reproduction doubled for crows nesting within 1 km of human settlement and recreation.

The anticipated increases in corvid densities and therefore, predation, along the Monte Cristo Road contribute to our expectation (below) that disturbances associated with this project could result in a failed nesting attempt by murrelets.

Disturbance

The Service assumes that murrelets are susceptible to disturbance throughout the day in the early breeding season (April 1 to August 5) when adults are incubating, and especially during the early morning and early evening hours in the late breeding season (August 6 to September 15) when adults make most of the trips to and from the ocean to feed their young (USFWS 2003).

Road construction and tree felling activities will introduce increased levels of sound and human activity into the project area that may cause disturbance to murrelets. Tree felling would occur outside the complete marbled murrelet nesting season (after September 15 of the project year); therefore, we expect no disturbance to murrelets during this time. Nevertheless, log hauling, road building, and some chainsaw work to remove fallen trees would occur during the early nesting season the following year for 13 days (2012). A Conservation Measure will ensure that no work is done during the early morning and early evening hours of the late nesting season, so we do not anticipate disturbance during those times. As presented in Description of the Action, approximately 21 days of heavy machinery use is expected during the second year (2013) of this project, so murrelets nesting adjacent to the road alignment will be exposed to about 34 days of noise from heavy machinery. During our August 4, 2011, visit to the action area by Service and Forest personnel, we counted 129 trees within 100 ft of the road alignment that will not be felled, about half of which contain limbs or platforms large enough to serve as nest trees.

The Service expects noise and human activities that generate noise levels of 92 dBA or greater can result in negative effects to marbled murrelets by causing an adult to flush from its nest during food delivery causing a fledgling to miss a feeding (USFWS 2003, p. 273). We generically estimate that sound levels of 92 dBA or higher, coupled with murrelet's reactions to specific activities, extend out to 35 yd for heavy equipment and 45 yd for chainsaws (USFWS 2003, p. 277). We use noise levels from the loudest piece of equipment to calculate an area exposed to noise disturbance which would be, using our 35-yd and 45-yd thresholds, chainsaws. However, new technologies allow sound levels of chainsaws to not exceed those of heavy equipment. Therefore, we anticipate that road construction requiring both heavy equipment and chainsaws will generate noise levels of 92 dBA out to 35 yd (USFWS 2003, p. 277). We used this 35-yd threshold to estimate that about 43 acres of suitable nesting habitat would be exposed to disturbance during the early nesting season. During a field trip on August 4, 2011, Service and Forest staff counted 19 additional trees with platforms within this 35-yard disturbance distance (for a new total of 153 trees not in the road prism) and an additional 9 new trees within the road prism with potential platforms (with 2 previously counted potential nest trees blown down) for a total 18 trees. This survey was done in the southernmost portion of the new road alignment between the second and third stream crossing. Possible responses of murrelets to sound disturbance is an adult or nestling flushing from a nest or a nestling missing a feeding. The effects of these behaviors are described below.

Adults that are flushed from nests are at increased risk to predation. Flushing exposes the adult and chicks to predators in the vicinity when they would otherwise be motionless and cryptic on the nest; this is presumed to be the most important consequence of flushing (Awbrey and Bowles 1990, p. 32). Adults that are flushed from nests by predators may abandon the nest (Nelson and Hamer 1995a, p. 94). Flushing an adult would result in the egg being exposed to predation and/or the egg cooling.

Even with the morning and evening timing restriction in place, murrelets are susceptible to missed feedings during the day. Earlier works reported that very few feedings take place during the daytime (e.g., 6.3 percent between 9 am and 6 pm estimated from Nelson and Hamer 1995, Figure 1). However, newly acquired data from Paul Jones (2001, p. 136-138) indicates that 31 to 46 percent of feedings can take place during daytime outside of the morning/evening periods. Therefore, murrelets would be exposed to disturbance during feeding attempts even with the early morning/early evening timing restriction in place. Missed feedings can reduce the fitness of adults and nestlings. Hull et al. (2001, p. 1036) report that murrelets spend 0.3 hr to 3.5 hr per day (mean 1.2 ± 0.7 hr per day) commuting to nests during the breeding season. During chick rearing, adults return to feed their young an average of 1.2 (Hull et al. 2001, p. 1039) to 3.2 times (Nelson and Hamer 1995, p. 61) daily, so missing even one feeding per day would result in a drop of approximately 33 to 50 percent of the food delivered to the nestling. Nelson and Hamer (1995b, p. 66) state that murrelet chicks grow rapidly compared to most alcids, gaining 5 to 15 grams per day during the first 9 days after hatching. The average daily increase for the first 9 days of murrelet neonate development is 10.9 percent, while the average daily increase for the next 16 days is 2.2 percent (Simons 1980, p. 5). With such a fast growth rate and a low average number of daily feedings, it is reasonable to assume that a few missed feedings could have substantial consequences for nestlings. In addition, missed feedings result in significant disruption of normal behavior to the adults from unfruitful expenditure of energy and expose to predators.

The only test of the effects of use of chainsaws or heavy machinery to nesting marbled murrelets was by that done by Hébert and Golightly (2006). In Redwood National and State Parks in northern California, they conducted 12 tests to document behavior of nesting marbled murrelets due to use of a chainsaw below the nests. They conducted 15-minute tests at a distance of 25 m from the base of the nest trees. Nest trees averaged 61 m in height, and nests averaged 51 m above the ground. Sound levels increased from natural ambient levels between 41 and 45 dB to 66 and 72 dB when the chainsaw was at full throttle. None of the adults flushed from the nest. Incubating murrelets spent significantly less time at rest and significantly more time with "bill up" or "raised head" during the 15-minute tests than during the 30-min tests before or after the tests, and chicks ($n = 4$) spent significantly more time at rest and insignificantly less time with "bill up" and "head raised" both before and after the tests than during the tests. Reproductive success was higher for experimental nests (30%) than for control nests (13percent), but not significantly so. One might assume, judging from the results of this study, that murrelets in the action area would not flush due to use of chainsaws or heavy equipment. However, use of this study to inform anticipated reactions of nesting murrelets in the action area is not straightforward, because the trees in the redwood forests are much taller than those in the action area, and the chainsaws used in that study may be quieter than the heavy equipment and chainsaws that will be used for this project. We have no information to suggest that murrelets flush from the nest due to disturbance unless people are in the nest tree in close proximity to the nest (Long and John 1997; USFWS 2003). However, under a reasonable worst-case scenario, we anticipate that some flushing from nests and missed feedings due to project activities will occur, and that these behaviors could result in a failed nesting attempt due to predation of the egg or young (see "Increased Predation Risk") or missed feedings.

Summary of Effects to Murrelets and Murrelet Habitat

The Service anticipates the following effects to marbled murrelets and their habitat:

- Injury or death due to felling of trees: discountable
- Collisions with vehicles: discountable
- Decreased quality of habitat due to effects to microclimate: insignificant
- Displaced nesting due to loss of potential nest trees: insignificant
- Removal of potential nest trees: adverse effect
- Loss of potential nest trees by windthrow: adverse effect
- Increased predation: possible loss of one nesting attempt (coupled with disturbance)
- Disturbance: adverse effect to murrelets within 43 acres; possible loss of one nesting attempt (coupled with increased predation).

Summary of Effects of the Proposed Action and Cumulative Effects

No more than 18 trees to be removed for road construction have possible suitable nesting platforms. Loss of potential nest trees is considered to have an adverse effect to murrelets. The proposed action will open a new corridor into the intact forest creating the potential for windthrow. Increased windthrow may result in adverse effects to murrelet habitat by damaging potential nest trees, causing them to fall over. The combination of increased numbers of corvids along the road corridor and disturbance from project activities could result in the loss of a murrelet nesting attempt due to predation of the egg or young.

CUMULATIVE EFFECTS: Marbled Murrelets

Under section 7 of the ESA (16 U.S.C. 1536, *et seq.*), cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. No Tribal or State actions currently occur within the action area, or are planned or likely to occur.

Non-Federal lands occur within the action area. There are about 20 private inholdings near the Monte Cristo townsite, 5 of which contain summer cabins. We expect no future actions on the part of the landowners that would affect murrelets. Therefore, we expect no cumulative effects associated with non-Federal activities.

Recreation

The watershed is a popular hiking, mountain biking, and winter snow-skiing destination. The Forest reports many hikers, mountain bikers, and snow skiers using the South Fork Sauk watershed. The new mine clean-up access road is not expected to attract additional use in the area due to parking limitations. However, the new access road is likely to shift a portion of the recreation use into the new road alignment, an area heretofore unused due to difficult access. We expect some adverse effects to murrelets due to the trash and garbage that will likely be generated from hikers, mountain bikers, and skiers. This garbage generation may have an indirect effect on murrelets by attracting corvids into the area that will in turn prey upon murrelet eggs and nestlings.

Climate Change

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathé et al. 2010). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littel et al. 2009, p. 15). Additionally, the changing climate will likely alter forest ecosystems as a result of the frequency, intensity, duration and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littel et al. 2009, p. 14).

One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. In general, wet western forests have short dry summers and high fuel moisture levels. This results in very low fire frequencies. However, high fuel accumulations and forest densities create the potential for fires of very high intensity and severity when fuels are dry (Mote et al. 2008, p. 23). Westerling et al. (2006) looked at a much larger area in the western United States including the Pacific Northwest and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period between 1970 and 1986. The total area burned is more than 6.5 times the previous level; and the average length of the fire season during the 1987 to 2003 time period was 78 days longer compared to the 1978 to 1986 time period (Westerling et al. 2006, p. 941). Littel et al. (2009, p. 2) project that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s.

Climate change is likely to further exacerbate some existing threats in the action area such as the projected potential for increased habitat loss from drought related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that murrelets and murrelet habitat will be adversely affected, we lack adequate information to quantify the magnitude of effects to these listed resources from climate change (USFWS 2009, p. 34).

INTEGRATION AND SYNTHESIS: Marbled Murrelets

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The jeopardy analysis in this Opinion emphasizes consideration of the rangewide survival and recovery needs of the species and the role of the action area in the survival and recovery of the species. It is within this context that we evaluate the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Summary of the Status of Murrelets

Recovery Zone 1 contains roughly 345,000 acres of suitable murrelet habitat, a total that changed little in the last decade. Murrelet numbers in Zone 1 are higher than other Zones. At-sea surveys documented a precipitous decline and determined that the adult ratios suggest the population is not sustainable. However, there are no recent, complete surveys of murrelets in the Western Washington Cascades Physiographic Province, the Forest, or the action area. The action area has numerous historical detections and occupancy is assumed. Climate change is likely to further exacerbate some existing threats to the murrelet such as the projected potential for increased habitat loss from drought related fire, tree mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years), as well as affecting reproduction and survival during years of extreme weather. However, the proposed action does not mitigate nor exacerbate its effect on murrelets. The new road may increase corvid abundance due to their attraction to discarded and dropped food from people using the road for recreation, thus leading to increased nest predation.

Summary of the Current Status and Conservation Needs of the Murrelet

Loss of suitable murrelet habitat has ranged from 10 to 28 percent on Federal lands from 1995 to 2002; however, habitat loss since then has not been substantial. Murrelet numbers have dropped substantially, by about 7.4 percent. Further, the juvenile-to-adult ratio is assumed below levels necessary to maintain or increase murrelet populations. Conservation strategies identified as necessary to stabilize the population include protecting occupied habitat and minimizing the loss of unoccupied but suitable habitat (USFWS 1997b, p. 119). Specific actions include maintaining large blocks of suitable habitat, maintaining and enhancing buffer habitat, decreasing risks of nesting habitat loss due to fire and windthrow, reducing predation, and minimizing disturbance. Habitat within the Forest and the action area is essential for the long-term conservation of the species.

Summary of the Effects of the Proposed Action and Cumulative Effects

For adverse effects of the proposed action we consider the removal of potential nest trees to be an adverse effect, whether from tree cutting, or increases in windthrow from the opening in the stand the new road alignment will create. We also expect increased nest predation in the action area due to disturbance from road construction noise and from the creation of a new permeable forest edge that would attract corvids.

Effects to Marbled Murrelet Survival and Recovery

Murrelet numbers in Zone 1 are higher than other Zones. Considering the relatively small amount of acres affected by the action (20.6 acres) compared to the size of the Zone and the number of murrelets in the Zone, the proposed action would not be expected to appreciably affect the overall number of murrelets occurring within Zone 1.

The area where trees will be felled is in a small patch (10 acres) located in a large, lightly fragmented stand in a watershed with much habitat and distant from rural residences. Such stands are considered to be of high quality in terms of their ability to support successfully nesting murrelets, and will continue to support breeding murrelets in the action area. The new edge will expose 20.6 acres of forest to increased predation. However, trees to be felled in a linear fashion. This is less impacting to a forest stand in terms of its integrity and microclimatic conditions rather than a harvest which removes large patches of trees deep in the middle of the stand, or removing an entire stand which would affect the quality of the stand as nesting habitat. Trees harvested in such a linear manner will not significantly increase existing nest predation to habitat as a result of edge effects at the Zone scale. Conversely, the action area will attract visitors that may indirectly influence murrelet predation on murrelet nestlings, and eggs. While the proposed action would be expected to adversely affect murrelets in the action area, it would not appreciably affect the overall reproduction of murrelets within Zone 1.

The impacts associated with the proposed action do not represent a substantial decrease in the amount of suitable habitat in the action area. Therefore, the effects of building a new road alignment are not expected to appreciably affect the existing distribution of murrelets in the action area, the watershed, or the overall distribution of murrelets within Zone 1.

Given the above analysis, we conclude that the adverse effects to murrelets that would result from the proposed action is not anticipated to appreciably reduce the likelihood of survival and recovery of the murrelet in the wild by reducing murrelet numbers, reproduction, or distribution, at the scale of the Forest, the Conservation Zone, or the range of the species.

STATUS OF MARBLED MURRELET CRITICAL HABITAT

An updated account of the status of marbled murrelet critical habitat rangewide is presented in Appendix D.

Mt. Baker-Snoqualmie National Forest Critical Habitat Trends

Few acres of critical habitat have been removed from the Forest since the designation of critical habitat in 1996. At the time of the programmatic biological opinion (USFWS 2003), the Forest contained 14 CHUs totaling 783,253 acres. Since then, six consultations have resulted in the removal of less than 15 acres of critical habitat. While the Forest also experienced landslides, wind storms, and some forest fires, the overall critical habitat trend is level.

ENVIRONMENTAL BASELINE: Marbled Murrelet Critical Habitat (CHU WA-09b)

Conservation Zone 1 has lost very little critical habitat through consultation under the ESA. Since the last range-wide review of the murrelet, the Service has authorized incidental take associated with the removal of 51 individual trees and 5 acres of suitable nesting habitat within Conservation Zone 1 (USFWS 2009, p.31). Far more critical habitat has been lost through natural events, such wind storms, avalanches, and floods.

The Forest contains 783,253 acres of designated critical murrelet about one-half of which is considered to be suitable murrelet habitat. Some of the habitat is fragmented and some occurs in large blocks. These CHUs serve as part of a network of murrelet habitat, along with blocks of habitat in North Cascades National Park and Wilderness Areas.

The action area occurs in the Independence LSR RW-116 and is completely within Zone 1. This LSR encompasses approximately 113,352 acres. About 40 percent of the LSR has been identified as suitable habitat for murrelets (44,953 acres). This LSR was designed to include habitat with numerous murrelet detections (USFS 2001, p. 38).

The project area overlaps CHU WA-09a which is 108,074 acres in size. Approximately 47,882 acres (44 percent) is mature and old-growth habitat (suitable habitat).

<u>Conservation Role of Critical Habitat in the Action Area</u>

The designation of critical habitat is only one of several measures available to contribute to the conservation of a listed species. Critical habitat helps focus conservation activities by identifying areas that contain essential habitat features called PCEs, thus alerting Federal agencies and the public to the importance of an area in the species' conservation. Critical habitat also identifies area that may require special management or protection. The identification of these areas may be helpful in planning federally regulated land use activities. The added emphasis on these areas for conservation of the species may shorten the time needed to achieve recovery (73 FR 26256:26263 [May 24, 1996]).

To fulfill the objective of stabilizing murrelet population size, the recovery plan focuses on protecting adequate nesting habitat by maintaining and protecting occupied habitat and minimizing the loss of unoccupied but suitable habitat through several means, including the designation of critical habitat (USFWS 1997a, p. 119). As critical habitat, the action area directly contributes to that role.

The murrelets in the action area require: 1) protection of nesting habitat by maintaining and protecting occupied habitat, and 2) minimizing the loss of unoccupied but suitable habitat (USFWS 1997a, p. 119). Since the action area is entirely within LSR allocation under the NWFP, the conservation emphasis is on protection and enhancement of late successional and old-growth forest ecosystems conditions which serve as habitat for late-successional and old growth-related species, including the murrelet. Threats to the CHU are fire, insect infestations, and other climate-change related consequences.

Condition of the CHU

The CHU contains large blocks of late successional habitat (over 1,000 acres) which are bordered by high mountain ranges and is not characterized by a checkerboard pattern of land ownership found in other Forests. There are extensive portions of CHU WA- 09b that have stand-year-of-origin of 400 years of age and greater. However, stands over 400 years of age have been subject to natural mortality due to insect infestations, disease, and wind. Wind throw is a major factor in the Stillaguamish basin because of shallow root systems due to high water tables. Road density within the Darrington Ranger District is low with less than 1 mile per square mile of open road when accounting for the wilderness areas, roadless areas, and an aggressive road closure program. Road density within the CHU is estimated at 0.31 mile per square mile (USFS 1995).

Very few actions have occurred within the CHU WA-09b that resulted in loss of habitat since 1994. Trailhead expansion, trailhead and campground maintenance, several culvert replacements, and the Martin Creek Bridge replacement have resulted in an insignificant of habitat removed (less than 5 acres). Also, reconstruction of the Mt. Loop Highway at the Waldheim Slide area impacted less than 1 acre of CHU. There are currently no timber harvest or habitat removal activities scheduled for the CHU outside of normal trailhead and campground maintenance.

EFFECTS OF THE ACTION: Marbled Murrelet Critical Habitat

The proposed action will remove 10 acres of forest habitat to accommodate building a new road to access the mine clean-up area. All 10 acres is considered suitable habitat. The proposed action would remove PCE 1, which is comprised of trees with potential nesting platforms. The exact number of PCE 1s that will be removed is uncertain until the final alignment is agreed upon. Due to the nature of the landscape that the road will cross, and the need to minimize felling PCE 1s, the final alignment, and thus the total number of PCE 1s, will not be known until tree-felling begins in the fall of 2011. However, the Forest provided a reasonable estimate of 18 trees with platforms to be felled within the proposed road alignment. The Service will receive a final tally of felled PCE 1s after project completion.

The proposed action also would adversely affect PCE 2s by removing 10 acres of forest with a canopy height of at least one-half a site-potential tree height within 0.5 mile of individual trees with potential nesting platforms. The loss of these PCE 1s and PCE 2s will incrementally degrade the quality of the CHU. The amount of habitat to be removed is small relative to the amount of critical habitat or adjacent cover trees in CHU WA-09b (108,074 total acres, 47,882 acres of which are nesting habitat). Given the current condition of critical habitat in the action area and CHU WA-09b and the amount of habitat that would be removed, the Service determined that the proposed action would:

- Not preclude murrelets from using this stand
- Not affect the functional ability of the critical habitat unit to provide for murrelet nesting
- Not reduce or impair the ability of the CHU to provide for the conservation of the murrelet
- Not diminish the ability to attain the critical habitat goals in the CHUs at the Conservation Zone scale or rangewide scale.

CUMULATIVE EFFECTS: Marbled Murrelet Critical Habitat

Under section 7 of the ESA (16 U.S.C. 1536, *et seq.*), cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. No Tribal or State actions currently occur within the action area, or are planned or likely to occur.

Non-Federal lands occur within the action area. There are about 20 private inholdings near the Monte Cristo townsite, five of which contain summer cabins. We expect no future actions on the part of the landowners that would affect murrelet critical habitat. Therefore, we expect no cumulative effects associated with non-Federal activities.

<u>Recreation</u>

The watershed is a popular hiking, mountain biking, and winter snow-skiing destination. The Forest reports up many hikers, mountain bikers, and snow skiers within the South Fork Sauk watershed. We expect discountable effects to murrelet critical habitat from visitor use.

<u>Climate Change</u>

During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathé et al. 2010). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littel et al. 2009, p. 15). Additionally, the changing climate will likely alter forest ecosystems as a result of the frequency, intensity, duration and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littel et al. 2009, p. 14).

One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. In general, wet western forests have short dry summers and high fuel moisture levels. This results in very low fire frequencies. However, high fuel accumulations and forest densities create the potential for fires of very high intensity and severity when fuels are dry (Mote et al. 2008, p. 23). Westerling et al. (2006) looked at a much larger area in the western United States including the Pacific Northwest and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period between 1970 and 1986. The total area burned is more than 6.5 times the previous level; and the average length of the fire season during the 1987 to 2003 time period was 78 days longer compared to the 1978 to 1986 time period (Westerling et al. 2006, p. 941). Littel et al. (2009, p. 2) project that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s.

Climate change is likely to further exacerbate some existing threats in the action area such as the projected potential for increased habitat loss from drought related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that murrelet critical habitat will be adversely affected, we lack adequate information to quantify the magnitude of effects to these listed resources from climate change (USFWS 2009, p. 34).

INTEGRATION AND SYNTHESIS: Marbled Murrelet Critical Habitat

Much of the late successional forest habitat within Conservation Zone 1 has been replaced by urban development (USFWS 1997, p. 142). Opportunities for increasing or protecting suitable additional murrelet habitat are limited, which increases the importance of the remaining habitat in Zones, including critical habitat.

The proposed action will remove 10 acres of critical habitat, much of which is suitable habitat. The Forest made efforts to minimize the removal of PCE 1s through careful adjustments to the road alignment. About 18 PCE 1s (trees with platforms) will be removed for the road alignment along with numerous PCE 2s (trees adjacent to PCE 1s that provide cover). The proposed action occurs within CHU-09b which contains about 108,074 total acres, 47,882 acres (44 percent) of which is suitable nesting habitat.

CONCLUSION: Marbled Murrelet Critical Habitat

For purposes of the adverse modification determination, the effects of the proposed Federal action on murrelet critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat rangewide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the murrelet.

After reviewing the current status of murrelet critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's Opinion that implementation of the proposed action is not likely to destroy or adversely modify designated critical habitat. While the amount of critical habitat that has been lost in the CHU since its listing has not been calculated, we do not expect the removal of 10 acre of critical habitat to impair the ability of this CHU, or the Conservation Zone to provide for the conservation of the murrelet. Therefore, critical habitat within this CHU and rangewide would remain functional or retain its current ability to become functional to serve its intended recovery role for the murrelet.

STATUS OF THE SPECIES: Bull Trout

The rangewide status of the species for bull trout is described in Appendix E, and the status of the species for the Lower Skagit Core Area is presented in Appendix F.

ENVIRONMENTAL BASELINE: Bull Trout

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. The environmental baseline analyses in this opinion are based on the areas encompassing the measurable (i.e., adverse) effects of the action on listed resources.

Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress. The environmental baseline for bull trout in the 5th-field watershed and the action area is best characterized by information learned at the site visit, presence of bull trout in the action area, a discussion of water quality as it relates to the clean-up operations that are proposed, the status of the species in the action area, the status of the matrix "habitat indicators," and the status of the Lower Skagit River Core Area (Appendix F).

Status of Riparian Reserves

Some elements of the proposed action are within areas dedicated to riparian reserve management. Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. The objective for treating the Riparian Reserve portions of these stands is to encourage the growth of larger conifers, including increased tree diameter and wide vigorous crowns, increase species diversity, and augment future sources of coarse wood for the riparian forest floor and in streams. Near the clean-up area, Riparian Reserves are currently forested with small trees which are unlikely to be a significant source of shade or wood for Glacier Creek or Seventy-Six Gulch.

Status of Bull Trout in the Action Area

The following is a description of the local status of bull trout from the 2004 Draft Recovery Plan for Bull Trout (USFWS 2004, p. 80):

> "The Upper South Fork Sauk River local population includes the South Fork upstream from Monte Cristo Lake located at River Mile 4.5 and its tributaries Weeden Creek, Glacier Creek, and Seventy-six Gulch. This area is thought to support fewer than 500 migratory adults, as well as numerous resident fish. Tagging data and scale analysis indicates that the migratory fish are both fluvial and anadromous (Kraemer 1994; Kraemer, *in litt*. 2003). The resident component of this local population is believed to be abundant and stable (likely near historical numbers), and the migratory component appears abundant and is increasing (Kraemer, *in litt*. 2001). Spawning and early rearing habitat is believed to be in near pristine condition."

Adult bull trout return to the action area from lakes, larger rivers, and the ocean from September to November to spawn. The eggs remain in redds until late winter or early spring; at that time, the alevins leave the eggs but stay within the gravel and continue to grow from their yolk sack. The alevins may not emerge from the gravel until as late as July. Fry and juveniles may stay in their natal streams for years. All life history stages are present in the action area during the year at different times and places.

The Forest fish biologist surveyed the six tributaries that the new road will cross. Three of the unnamed tributaries (MP 0.67, 1.3, and 4.3) to the SF Sauk River may be accessible to bull trout. These tributaries are not spawning habitat, but may provide some opportunities for rearing. For this consultation, we will assume that these tributaries are inhabited by juvenile bull trout year-round, but that the presence of adults, eggs, and alevins is discountable.

Glacier Creek and the SF Sauk River in the action area are used by bull trout for spawning and rearing. For this consultation, we assume that all life history stages are present in these streams during the time of year that those stages would usually occur. Table 4 summarizes the presence of each life history stage in each section of the action area during each time of year when the action area is expected to have effects to bull trout.

Table 4. Known and assumed presence of each life history stage in portions of the action area

Location	May, June, July	August	September, October, November	Year-round
SF Sauk River confluences with non-fish bearing tribs	Alevins, juveniles	Fewer alevins and juveniles than May	Eggs, juveniles, adults	All life history stages
Fish-bearing tribs to SF Sauk River	Juveniles	Juveniles	Juveniles	Juveniles
Glacier Creek and upper SF Sauk River	Alevins, juveniles	Fewer alevins and juveniles than May	Eggs, juveniles, adults	All life history stages

Condition of the Action Area

Portions of Glacier Creek contain high-energy alluvial fans with braided channels, ephemeral pools, and some forested islands. The substrate is composed of large rocks with minimal gravels or fines. There is an abundance of woody debris. The channel banks are incised approximately 10 ft on both sides. Glacier Creek and Seventy-Six Gulch are not currently high quality spawning habitat for bull trout, though juvenile and adult bull trout have access to the area and could potential spawn in pockets of gravel between cascades or pools. Riparian reserves adjacent to Seventy-Six Gulch and Glacier Creek are currently forested with small trees that are unlikely to be a significant source of shade or wood.

The Washington State Department of Ecology maintains a water quality monitoring station at Backman Park on the Sauk River. This station is approximately 25 river miles downstream of the confluence of Glacier Creek and the Sauk River (estimated from Google Earth). Suspended sediment data in terms of mg/L and nephelometric turbidity units (NTUs) were collected 12 times between 2004 and 2005. Using a regression equation, the Service calculated that suspended sediment (mg/L) and NTUs followed a linear relationship that could be described by an equation ($y = 0.5412x + 1.2287$). According to this monitoring station data, the average background data during the months of May to November is 15 mg/L (range is 4 to 40 mg/L).

Despite a history of mining and contaminated soils, water quality in the basin is good. The Cascade Earth Sciences 2010 Engineering Evaluation/ Cost Analysis Monte Cristo Mining Area Report (Cascade Earth Sciences, p. 297) showed that water in the SF Sauk River, Glacier Creek, and Seventy-Six Gulch is well under U.S. Environmental Protection Agency and Washington State water quality standards for arsenic, lead, copper, chromium, and cadmium. The Forest further explained by email on June 21, 2011, that mine adits and shafts, as well as pilings of mine tailings, are not directly hydraulically connected to the Sauk River or its tributaries. Any transfer of contaminants from mine sites to bull trout critical habitat occurs through groundwater or subsurface flow. Many bull trout have been documented spawning in the action area (WDFW 2010, p. 1), and there has not been any indication that heavy metals have affected the health of eggs, juveniles, or adults. The Forest and the Service believe that the high water quality can be attributed to the ability of ground water and dilution to sufficiently remediate heavy metal point sources.

Summary of the Environmental Baseline for Bull Trout and Bull Trout Habitat

Table 5 presents a summary of the environmental baseline for the Sauk River Forks fifth-field watershed. The baseline condition qualifier and much of the rationale are from the BA (USFS 2010, pp. 15-39).

Table 5. Environmental baseline for the Sauk River Forks fifth-field watershed using the Matrix of Pathways and Indicators.

Pathway	Indicator	Baseline Conditions	Rationale/Comments
Local Population Conditions	Local Population Size	Functioning Appropriately	Healthy. Results from red surveys in the upper South Fork Sauk River beginning in 1988 show an apparently stable, robust population utilizing that section of the river. Other surveys showed a wide distribution of spawning adults throughout the upper watershed.
	Growth and Survival	Functioning Appropriately	Results from redd surveys, angler surveys, and smolt trapping studies have indicated generally improving trends for bull trout populations in recent years within the lower Skagit fifth-field watershed (WDFW, 1998). Increased restrictions on sport angling have been credited with a "dramatic effect in increasing population size" within the Sauk River drainage.
	Life History Diversity and Isolation	Functioning Appropriately	The lower Skagit stock includes anadromous, resident, and fluvial bull trout. All of these coexist in similar spawning and rearing habitat at some life stages. Potential habitat for bull trout currently includes the entire Sauk River. Genetic analysis since 1995 as well as other information has indicated that the majority of the native charr in the Sauk/Sauk Forks fifth-field watersheds are bull trout rather than Dolly Varden. As part of the lower Skagit stock, the Sauk Forks bull trout subpopulation is accessible to other significant subpopulations in other fifth-field watersheds within the Skagit basin. In addition, there is potential for exposure to stray bull trout from the upper Skagit stock.
	Persistence and Genetic Integrity	Functioning Appropriately	Within the Sauk Forks fifth-field watershed, bull trout are distributed throughout the Sauk Forks and its tributaries. As part of the Skagit River native charr stocks, the Sauk Forks bull trout subpopulation is well-connected to other significant subpopulations throughout the Skagit basin including the Skagit River, Baker River and Baker Lake, and Cascade River. Overall, the lower Skagit bull trout stock status is described as "healthy." No information was found indicating significant threats from hybridization or competition with introduced fish species.

Pathway	Indicator	Baseline Conditions	Rationale/Comments
Water Quality	Temperature	Functioning at Risk	Tributaries in the Sauk/Sauk Forks fifth-field watersheds displayed water temperatures from the upper 40s to upper 50s Fahrenheit in July through September. This overlaps with the beginning of the typical bull trout spawning period (September and October). The sampling period coincides with the probable warmest portion of the year-round juvenile rearing period. The Forest has generally noted "concerns about high water temperatures" (60+° F in the Sauk River) above the Whitechuck River during summer low flows. Based on the information summarized above, it appears that stream temperatures do not typically form thermal barriers to upstream migration of Chinook salmon. However, stream temperatures appear to potentially limit spawning and rearing habitat, possibly rising above the guideline "7-day average" maximum of 9°C (48.2° F) for Chinook and 8 C (46.4° F) for bull trout.
	Sediment/ Turbidity	Functioning Appropriately	No specific water quality monitoring data for sediment or turbidity in the fifth-field watershed was available. Natural sources including high runoff from rain-on-snow events are known to be dominant sources of sediment in this fifth-field watershed. Human activities including road building and logging can also contribute significantly to erosion and sedimentation. Sediment transport in the smaller tributary streams within the fifth-field watershed is generally reported to be adequate, due to the high-gradient channels typical of much of the basin. Much of the sediment eroded within the fifth-field watershed settles out in the lower reach of the mainstem Sauk River (RM 0 to RM 12.8). Bull trout spawn in the upper South Fork Sauk River and in some smaller tributary streams. The Forest believes that the baseline condition for sedimentation in spawning areas is "functioning appropriately" for bull trout (USFS 2011).

Pathway	Indicator	Baseline Conditions	Rationale/Comments
Water Quality (Continued)	Chemical Contamination and Nutrients	Functioning at Risk	Chemical contamination is unlikely because of the relatively low human population and low current levels of industrial and agricultural activity in the fifth-field watershed. Any chemical contamination would be likely to originate from abandoned mining facilities. The most active mining period in the 1890s and 1900s caused severe degradation of water quality in the South Fork Sauk River, with heavy loadings of rock flour and heavy metals. However, aquatic life, including bull trout, has become re-established.
Habitat Access	Physical Barriers	Functioning Appropriately	The Sauk River is free-flowing, with no man-made impoundments. It has been designated a national Wild and Scenic River. Fish habitat access has been limited primarily by the natural barriers imposed on tributary streams by the typically steep topography of this fifth-field watershed. However, a number of tributaries are crossed by forest roads and some impassable or partially impassable culverts limit access to small areas of habitat.
Habitat Elements	Substrate Embeddedness	Functioning At Risk	No specific documentation is available for substrate embeddedness. However, review of stream survey summaries shows that silt was neither dominant nor subdominant substrate texture in any sampled reach in the Sauk Forks watershed. Major floods in 1980 and 1990 contributed significantly to sedimentation throughout the watershed, and many stream reaches are on an improving trend as they continue to recover from those event. Sediment source, delivery, and transport from road failures are being addressed in the watershed by the implementation of a series of road decommissioning, storm proofing, and upgrading treatments.
	Large Woody Debris	Functioning At Risk	Large woody debris (LWD) density varies widely among streams throughout this fifth-field watershed. Most of these streams meet the western Washington standard of 80+ pieces per mile. LWD density is reported to be adequate only in the uppermost reaches of the mainstem above RM 36.2, but bull trout spawn in the smaller headwater streams. LWD recruitment potential also varies widely among streams across the fifth-field watershed.

Pathway	Indicator	Baseline Conditions	Rationale/Comments
			Variation is based primarily on tree size, age and species, with larger older conifers associated with high LWD value and recruitment potential. In the Sauk Forks fifth-field watershed, 50% had high potential, 10% had moderate potential, and 40% had low potential. The large proportion of low potential stream miles in the relatively undisturbed Sauk Forks fifth-field watershed may be attributed to the natural lack of large timber in alpine areas and subalpine parklands.
Habitat Elements (Continued)	Pool Frequency/ Quality	Functioning At Unacceptable Risk	Stream surveys on the South Fork Sauk River indicate that overall pool frequency is poor due to conditions including sparse cover and lack of adequate depth. The degradation or loss of pool frequency and quality in some stream tributaries has been addressed with the installation of LWD and the installation of structures to dissipate energy and increase bank stability. Streams receiving these treatments include Lost Creek in the Sauk Forks fifth-field watershed. This indicator focuses on those streams of over 3 meters wetted width at baseflow. The criterion for large pools is depth, with pools over 1 meter deep considered "large". Sparse information was available for this indicator for larger streams throughout most of the fifth-field watershed. Generally, high inputs of sediment have typically been transported through high-gradient tributaries and accumulated in lower gradient reaches throughout the fifth-field watershed. In addition, a "major historic adult holding pool below the confluence of the Sauk River Forks with the Sauk River filled in with sediment" between 1985 and 1995.
	Large Pools	Functioning At Risk	Information on the quantity of large pools in or near the action area has not been collected. Baseline conditions area assumed to be poor because of low pool frequency and quality in combination with ongoing sedimentation. In addition, a "major historic adult holding pool below the confluence of the Sauk River Forks with the Sauk River filled in with sediment" between 1985 and 1995.
	Off-Channel Habitat	Functioning Appropriately	The Sauk Forks fifth-field watershed is largely composed of high-gradient, high-energy streams with minimal low-energy side channel habitat. Such

Pathway	Indicator	Baseline Conditions	Rationale/Comments
Habitat Elements (Continued)			habitat would be concentrated in the lower-gradient reaches of the mainstem Sauk River and some larger tributaries. In the Sauk River watershed, this lack of off-channel habitat in the watershed is being addressed by constructing or creating off-channel spawning/rearing channel and pond complexes where feasible.
	Refugia	Functioning Appropriately	Refugia habitats are naturally limited in the watershed for the same reasons that off-channel habitat, large pools, and large woody debris are limited. Bull trout are more likely to be seeking refugia in the lower Sauk River.
Channel Conditions and Dynamics	Width/ Depth Ratio	Functioning Appropriately	No specific data is available, but the width/depth ratio of the Sauk River Forks Fifth-Field watershed is likely to be within historic variability because the Sauk River watershed is "hydrologically mature" as explained in the peak/base flows indicator section below.
	Streambank Condition	Functioning At Risk	Mining in the 1890s and early 1900s disrupted large areas of stream banks in the Sauk Forks watershed. Over the intervening years these areas have recovered and stabilized. Today there are some sites where erosion is occurring, mainly due to flooding and the high-gradient high-energy nature of the Sauk River.
	Floodplain Connectivity	Functioning Appropriately	Although the Sauk River is constrained in some places by roads and bridges, it remains relatively unconstrained and has migrated during recent floods. Its status as a national Wild and Scenic River prevents actions such as channelization, impoundment, or other alterations to its free-flowing condition. A number of riparian wetlands are maintained along the mainstem.
Flow/ Hydrology	Peak/Base Flows	Functioning at Risk	The Sauk Forks fifth-field watershed has a history of naturally occurring high peak flow events caused by rain-on-snow events. About 10% of the Sauk Forks fifth-field watershed lies at elevations where heavy snow accumulations are typically followed by heavy rain, rapid snowmelt, and a "hydraulic flush" of stream channels. Forest cover moderates snowmelt and runoff rates significantly, and past clearcut timber harvest in the watershed has altered these processes. However, many previously disturbed but regenerating areas of the watersheds are approaching "hydrological maturity", at which time they will

Pathway	Indicator	Baseline Conditions	Rationale/Comments
Flow/ Hydrology (Continued)			again moderate the hydrologic processes. Presently, there is still some evidence of altered peak flows and possibly base flows.
	Drainage Network	Functioning Appropriately	No specific data for increases in this fifth-field watershed's drainage network are available, but increases in active channel length can be inferred from road density increases. Road density in the Sauk Forks fifth-field watershed is currently 0.31 road miles per square mile. A number of Sauk Forks subdrainages are roadless or nearly so.
Watershed Conditions	Road Density/ Location	Functioning Appropriately	Road density in the Sauk Forks fifth-field watershed is currently 0.31 road miles per square mile. A number of Sauk Forks subdrainages are roadless or nearly so. Road densities for the Sauk drainage as a whole are 1 kilometer per square kilometer (1.6 miles per square mile) (USFS 1996 in 2004 draft recovery plan).
	Disturbance History	Functioning Appropriately	About 18,300 acres of timber were harvested in the Sauk/Sauk Forks fifth-field watersheds between 1900 and 1995. About 56% of the forested National Forest land in the Sauk/Sauk Forks fifth-field watersheds is presently occupied by "late seral" forest. Late Successional Reserve (LSR) designated under the Northwest Forest Plan occupies 50,293 acres in both fifth-field watersheds, 26% of the total area. Approximately 40 percent of the Sauk River drainage has been logged, with about 22 percent of the National Forest System lands consisting of forested stands established after 1920 (USFS 1996 in 2004 draft recovery plan). The hydrologic cumulative effects assessment done as part of the MBSNF Land and Resource Management Plan found the Sauk River Forks watershed to be in an acceptable condition. The Sauk River and Sauk River Forks watersheds have received a number of restoration treatments over the past 15 years. These road, upslope/hillslope, riparian, and in-channel treatments, along with natural recovery, have restored and maintained the upper Sauk system as refugia fish habitat.
	Riparian Areas	Functioning Appropriately	Throughout the National Forest portion of the Sauk/Sauk Forks fifth-field watersheds, 57,262 acres have been designated as Riparian Reserve (USFS 1996). This amounts to over 29% of the total area of the fifth-field watersheds. Riparian reserves were

Pathway	Indicator	Baseline Conditions	Rationale/Comments
Watershed Conditions (Continued)			established along streams based largely on presence of unstable soils and height of site potential trees. National Forest occupies 80% of these fifth-field watersheds. About 77% of the National Forest portion of the fifth-field watersheds is forested with native dominant tree species. Therefore, it can be assumed that there is well over 50% similarity of riparian vegetation to the potential natural vegetation community species composition. Riparian reserves do not apply to non-Federal lands within the fifth-field Sauk/Sauk Forks watersheds. In these areas, however, the national Wild and Scenic River status of the Sauk River protects a 1-quarter mile wide corridor along each bank.
	Disturbance Regime	Functioning at Risk	Channel scouring events and mass wasting including debris torrents occur regularly in the Sauk Forks fifth-field watershed. Factors contributing to the frequency of such events in this fifth-field watershed include rain-on-snow events, past clearcutting and road building, and the steep topography typical of much of the fifth-field watershed. Fifth-field watershed resiliency is moderate, based on the lingering effects of 1980 and 1990 floods.
Integration of Species and Habitat		Functioning Appropriately	Within the Sauk Forks fifth-field watershed, bull trout are distributed throughout the upper fifth-field watershed including the mainstem Sauk Forks and numerous tributaries (WDFW, 1998). As part of the lower Skagit River native charr stocks, the Sauk/Sauk Forks bull trout subpopulation is well-connected to other significant subpopulations throughout the Skagit basin including the Skagit River, Baker River and Baker Lake, and Cascade River. No information was found indicating significant threats from hybridization or competition with introduced fish species. This watershed, as well square ft as upper portions of the Sauk River fifth-field watershed, is "functioning appropriately" for most indicators, and is "functioning at unacceptable risk" only for pool habitat in the South Fork Sauk River. Overall, the Sauk Forks fifth-field watershed serves as an important refuge for bull trout. The baseline condition of the Sauk Forks fifth-field watershed is "functioning appropriately" for bull trout and the status of the bull trout population could be described as "healthy."

Conservation Role of the Action Area for Bull Trout

According to the 2010 critical habitat designation (USFWS 2010a), the SF Sauk River, Glacier Creek, and Seventy-Six Gulch in the action area provide essential spawning and rearing habitat necessary to maintain the Upper SF Sauk River local population. In 2010, the Service designated 10.9 miles of Sauk River, 1.3 miles of Glacier Creek, and 1.0 mile of Seventy-Six Gulch habitat in the action area as critical habitat essential for bull trout recovery. From observations in the field and recent WDFW spawning surveys, it is the professional opinion of Service and Forest biologists that the action area in the SF Sauk River (and downstream of the action area) is some of the best bull trout habitat in the State. The Skagit River population is so healthy that angling for bull trout is legal in some parts of the river. The action area is therefore critically important to the conservation of bull trout.

EFFECTS OF THE ACTION: Bull Trout

Introduction

The Service will analyze the effects of the proposed action on bull trout in this opinion by addressing each effect pathway separately. Within each section, we will address exposure risk and response. Those effects that are found to be adverse will be evaluated in the context of the larger scale the core population and core area. The anticipated effect pathways are 1) sedimentation into bull trout streams from in-stream and ground disturbance at and near stream crossings 2) removal of riparian vegetation, 3) water quality improvements from CERCLA clean-up operations, and 4) fish salvage operations. At the end of the effects of the action section we will analyze and summarize the combined effects of the pathways that were described separately.

Sedimentation into Bull Trout Streams

The potential for increased suspended sediment concentrations and subsequent effects to stream substrate embeddedness is the most significant effect of the proposed action on bull trout and their habitat. Sedimentation may affect water quality, substrate embeddedness, pool depth, quantity and quality, and forage for bull trout. Water quality effects and substrate embeddedness effects are analyzed separately in the paragraphs below. Sediment loading into streams is expected from the following proposed activities:

- Culvert and bridge installation and removal
- Road construction and reconstruction near stream crossings
- Continued road use near stream crossings

<u>Effects on Water Quality</u>

The significance of sediment sources for stream water quality depends upon whether they are connected to the stream by a direct channel such as a roadside ditch, gully, or by overland flow. The Service considers all stream crossings in the consultation to be direct connections between road and stream. If sediment sources are not directly connected, sediments are usually deposited on the forest floor (usually via a relief culvert) without reaching a stream (Gomi et al. 2005, p. 888) (Wemple et al. 1996, p. 1195). The road surface erosion model developed by Dube et al. (2004, p. A-3) assumes that road segments that drain to the forest floor over 200 ft. from a stream do not deliver sediment to streams. This assumption was based on a review of several studies which found a range of sediment transport distances of 30 ft to 550 ft, with sediment moving less than 150 ft in nearly all cases.

In this consultation, the Service used the above data and observation from the site visit to decide whether each ground disturbance was likely to contribute sediment to streams via overland flow. Ground disturbance is anticipated to occur approximately 200 ft from the SF Sauk River at the three locations where the road would be re-routed around the washed out County road. Upon review of site conditions, the Service decided that new road construction was not likely to contribute a significant amount of sediment to the river. At the two areas that are proposed to be cleared and excavated more than 66 ft from Glacier Creek and Seventy-Six Gulch, the 66-ft buffer is anticipated to remove enough sediment such that clearing and excavating would not contribute a significant amount of sediment to the creek or gulch.

Using the assumptions for sediment transport above, sediment from road construction is anticipated to enter bull trout streams in the action area through the following: 1) downstream transport from six tributaries with road crossing sites to the SF Sauk River; and 2) directly into Glacier Creek at the temporary road crossing.

Foltz et al. (2008, p. 329) monitored suspended sediment concentrations at 11 culvert removal projects in small streams in Idaho and Washington. They found that suspended sediment and turbidity was highest within 20 m (66 ft) of the project site, and usually decreased by an order of magnitude at a distance of 100 m (328 ft) downstream. Although there was a significant reduction in turbidity at 100 m (328 ft) downstream, turbidity levels still exceeded water quality standards at this distance. At 810 m (2,657 ft, or 0.5 mile) downstream, suspended sediment concentrations had returned to near background levels. These studies indicate that significant sediment plumes are likely to occur at distances exceeding 100 m (328 ft) downstream from stream crossings, but also that all but the finest sediments fall out of suspension within a distance of 810 m (0.5 mile).

Based on the above data, the Service assumes for this consultation that stream crossings located less than 810 m (0.5 mile) from bull trout waters have a potential to deliver a significant amount of suspended sediment to bull trout habitat. Road crossings will also contribute very fine suspended sediments (< 0.004 mm) to the aquatic system that quickly dilute and are transported through the basin (past 0.5 miles) at concentrations that are not discernable from the background conditions (Bilby 1985, Duncan et al. 1987).

Foltz et al. and the project monitoring reports were from culvert *removals*, but most of the proposed stream crossings are *new* permanent culverts. Culvert removals involve excavating road fill to get to the pipe as well as disturbance to the sediment wedge that usually accumulates upstream of the culvert. Both of those disturbances result in a sedimentation effect that is not generated by installing a *new* culvert. The culverts at Glacier Creek will be removed also, so that action involves more excavation and thus has effects more similar to a culvert replacement. Therefore, the Service assumes that new culvert installations are reasonably likely to generate lower concentrations and quantities of suspended sediment than culvert removals. Our predicted concentrations for this action will be lower than the concentration in Foltz et al. 2008.

Foltz et al. (2008, p. 335) reported that peak sediment concentrations measured at 20 meters (66 ft) below mitigated culvert removal sites ranged from 11 mg/L to 900 mg/L, with an average of 830 mg/L for projects that employed best management practices to minimize turbidity. The sediment concentration diminished rapidly (non-linearly) downstream until the concentration at 100 meters (328 ft) was approximately 83 mg/L. Downstream from 100 meters (328 ft), the sediment concentration diminished slowly (also non-linearly) until immeasurable against background at 0.5 miles (810 meters). These concentrations were reported to return to background several hours to 1 day after construction. Based on best management practices incorporated into the project, and the amount of disturbance required at each site, we have considered that the multiple culvert crossing construction at Glacier Creek may generate concentrations of suspended sediments as high as the mitigated values reported by Foltz et al. (2008, p. 335), but that the six tributary crossings are not likely to generate concentrations as high as 830 mg/L at 20 meters (66 ft). The Service is aware that every culvert project that disturbs the stream channel generates a unique sediment plume.

The Service further acknowledges that bridge, culvert, and ford constructions are reasonably likely to produce suspended sediment plumes with different magnitudes, distances, and durations. Culvert construction plumes are likely to be more severe than bridge construction plumes, and both are likely to be more severe than fords (as designed in this project proposal across drainages without surface water). We do not expect significant suspended sediment effects at the fords until the first rainstorm. However, we do not have available data to predict the differences in plume magnitude, distance, and duration for every crossing construction in this consultation. We will instead make the conservative assumption that each crossing type may produce a plume equal to the most severe construction type, which in this case is a culvert installation. The exception to that assumption is the multiple culvert installation on Glacier Creek. That crossing will involve much greater disturbance to the stream channel and will easily generate greater suspended sediment concentrations than the other crossings. We maintain that the suspended sediment effects from the ford crossings will occur later in time instead of during construction because these fords do not have flowing surface water until rainstorms.

Many other culvert and bridge installations in the Northwest have been monitored for compliance with the ESA by applicants and agencies. The Service compiled some of those monitoring reports in a 2010 guidance document for assessing the biological effects of sediment on bull trout and their habitat (USFWS 2010b). The data sets from all eight culvert replacements recorded peak suspended sediment concentrations less than 830 mg/L (USFWS 2010b, pp. 45-47). However, these monitoring projects did not receive the same level of scientific scrutiny as the Foltz et al. study. There are also not enough data for any of those eight reports to provide a single concentration for this analysis with a high degree of confidence in its accuracy. Instead, the Service averaged those concentrations. At an average distance of 128 ft, the eight monitoring reports averaged a recorded concentration of 107 mg/L above background (USFWS 2010b, pp. 45-47).

For our analysis of effects, we will use the range of possible sediment plume concentrations presented by Foltz and the monitoring data to select predicted concentrations that are reasonably certain to occur. To further analyze the severity and extent of the proposed action, we describe the presence of each life history stage in the action area. The following paragraphs detail the probability of exposure based on the presence of each history stage in the action area.

Suspended sediment plumes from in-water work are direct effects that are proposed to occur from May to September. Sedimentation that occurs thereafter is an indirect effect that is present all year long. Sediment pulses from disturbed ground, fill, and new road surfaces are expected to occur in the first significant rainfall after ground disturbance has occurred (such as at the ford crossings). The Service anticipates tens to hundreds of redds in the action area each fall (WDFW 2010). Accordingly, several hundred adults could be using the action area for spawning habitat each fall (WDFW 2010). The number of juveniles in the action area may number in the thousands. Table 4 describes which life history stage is expected to be present in each part of the action area during each time of year those effects will be occurring.

The Service uses an internal guidance document for analyzing the effects of sedimentation on bull trout that is based on a report by Newcombe and Jensen (1996) (USFWS 2010b). Using the analytical approach described in USFWS 2010b and the anticipated SS/NTU conversion for this watershed, the Service has determined the threshold of adverse suspended sediment effects for each life history stage (Table 4). The effects to habitat (right column) will be described in more detail in the "effects of substrate embeddedness and water quality on forage for bull trout" section of this Opinion. The Service also calculated (using a regression equation) that suspended sediment (mg/L) and NTUs followed a linear relationship that could be described by an equation [$y = 0.5412x + 1.2287$] (WA DOE 2011). We used this equation to calculate the corresponding NTUs to each threshold suspended sediment concentration in the Sauk River (and likely the tributaries to the Sauk River) (Table 6).

Table 6. Adverse effects are expected to each life history group when the suspended sediment (SS) concentration above background exceeds the concentrations listed in this table.

Duration	Eggs and Alevins		Juveniles		Juveniles and Adults		Adults		Habitat	
	SS	NTU	SS	NTU	SS	NTU	SS	NTU	SS	NTU
Instantaneous	20	12.1	403	219.3	148	81.3	403	219.3	1,097	594.9
1 hour	11	7.2	197	107.8	99	54.8	156	85.7	885	480.2
3 hours	1	1.8	67	37.5	40	22.9	78	43.4	345	187.9
7 hours	1	1.8	29	16.9	20	12.1	46	26.1	167	91.6

The thresholds for adverse effects in Table 6 are linked to "severity scores" that have specific effects on bull trout and their habitat. Tables 7, 8, and 9 (Tables 7a-c from USFWS 2010b) present effects that are approximately synonymous with each severity score. The Service considers sublethal and lethal effects to represent significant impacts to bull trout behaviors.

Table 7. Scale of severity (SEV) of ill effects on bull trout associated with excess suspended sediments.

SEV	Description of Effect
	Nil effect
0	No behavioral effects
	Behavioral effects
1	Alarm reaction
2	Abandonment of cover
3	Avoidance response
	Sublethal effects
4	Short-term reduction in feeding rates; short-term reduction in feeding success
5	Minor physiological stress; increase in rate of coughing; increased respiration rate
6	Moderate physiological stress
7	Moderate habitat degradation; impaired homing
8	Indications of major physiological stress; long-term reduction in feeding rate; long-term reduction in feeding success; poor condition
	Lethal and paralethal effects
9	Reduced growth rate; delayed hatching; reduced fish density
10	0–20% mortality; increased predation; moderate to severe habitat degradation
11	>20–40% mortality
12	>40–60% mortality
13	>60–80% mortality
14	>80–100% mortality

Table 8. Scale of the severity (SEV) of ill effects associated with excess suspended sediment on bull trout habitat.

SEV	Description of Effect
3	Measured change in habitat preference
7	Moderate habitat degradation measured by a change in invertebrate community
10	Moderately severe habitat degradation defined by measurable reduction in the productivity of habitat for extended period (months) or over a large area (square kilometers)
12	Severe habitat degradation measured by long-term (years) alterations in the ability of existing habitats to support fish or invertebrates
14	Catastrophic or total destruction of habitat in the receiving environment

Table 9. ESA effect determinations for bull trout life stages in relation to the duration of effect and severity of ill effect. Effect determinations for habitat are provided to assist with analysis of effects to individual bull trout.

	SEV	ESA effect determination
Egg/alevins	1 to 4 5 to 14	Not applicable. Alevins are still in gravel and are not feeding LAA. Any stress to egg/alevin reduces survival
Juvenile	1 to 4 5 to 14	NLAA LAA
Subadult and Adult	1 to 5 6 to 14	NLAA LAA
Habitat	1 to 6 7 to 14	NLAA LAA due to indirect effects to bull trout

We anticipate the following sediment events and severities:

- Sediment exposure events will happen during the four tributary bridge/culvert installations in May to those life history stages that are present. Of those installations, one is not on a bull trout bearing stream, but will have downstream effects on alevins in the SF Sauk River.
- Exposure to sedimentation will also occur below the Glacier Creek crossing once in May/June (installation), once in late August/early September (removal), and once in October/November (when the first high flows re-organize the disturbed channel).
- Less severe exposure events will occur seven times (once at each crossing) to those life history stages that are present during the first rainstorm (likely in September or October) that washes disturbed sediment downstream from the bridges, culverts, and fords.

All totaled, we anticipate 14 sedimentation events, plus very fine sedimentation (< 0.004 mm) from the new road/crossings that will occur year-round for the lifetime of the road/crossings. For all anticipated sedimentation events, suspended sediment concentrations are expected to be above background for 0.5 mile (810 meters).

Based on these analyses, the Service anticipates that the proposed culvert or bridge placement actions on the tributaries east of the SF Sauk River are reasonably certain to cause sediment plumes with less than an instantaneous concentration of 148 mg/L (81.3 NTUs) in the tributary just before that stream's confluence with the SF Sauk River. Additionally, we anticipate that each plume at the stream's confluence will have an average suspended sediment concentration of less than 99 mg/L (54.8 NTUs) for an hour and an average concentration of less than 40 mg/L (22.9 NTUs) for 3 hours.

The Service also anticipates that the installation and removal of the proposed multiple culvert crossing on Glacier Creek is reasonably certain to cause a suspended sediment plume with less than an instantaneous concentration of 148 mg/L (81.3 NTUs) in Glacier Creek just before that stream's confluence with Seventy-Six Gulch (a distance of 1200 ft). Additionally, we anticipate that the plume at the same location will have an average suspended sediment concentration of less than 99 mg/L (54.8 NTUs) for an hour and an average concentration of less than 40 mg/L (22.9 NTUs) for 3 hours.

Exposure to suspended sediment concentrations at or above those values and durations listed in Table 6 are expected to cause sublethal and lethal effects to eggs, alevins, juveniles, and adults. More specifically, if the proposed action generates NTUs above the thresholds in Table 6, then severity scores above 5 (7 for habitat) are anticipated to occur for an unknown distance within 0.5 mile of the crossing. If the proposed action generates NTUs below the thresholds in Table 6 at the locations indicated above, then severity scores above 5 (7 for habitat) are anticipated to occur for an unknown distance from that point upstream to the crossing. Those severity scores for each life history stage are likely to be reduced to zero at a distance of 0.5 miles from installation/removal.

Synthesis of water quality (suspended sediment) effects from the proposed action on bull trout

The 14 sedimentation events (five installations, one removal, seven rain events, and one channel re-alignment) that are anticipated to be generated by the proposed action are likely to adversely affect eggs, alevins, juveniles, adults, and habitat. Potential exposures to increased suspended sediment concentrations would be brief (3 to 24 hours) because suspended sediment concentrations are likely to quickly return to background levels (Foltz et al. 2008). The severity scores of these water quality degrading events depend on the site-specific factors that dictate the NTUs detected downstream of the crossing locations. However, the Service is reasonably certain that the threshold for adverse effects will be exceeded for juveniles and adults in the three bull trout bearing tributaries to the Sauk River during culvert/bridge installation and in the 1,200 ft below the Glacier Creek crossing. The Service also is reasonably certain that threshold effects for eggs/alevins will be exceeded for 0.5 miles below those crossings during installation/removal. We anticipate the following:

- In May/June of the first year, one culvert installation on a non-fish bearing tributary will generate suspended sediment concentrations that will adversely affect alevins in the SF Sauk River, and four bridge/culvert installations will adversely affect alevins and juveniles (Glacier Creek and the three fish bearing streams).

- In September of that first year, removal of the multiple culvert crossing on Glacier Creek will generate suspended sediment concentrations that will adversely affect eggs, juveniles, and adults for 1,200 ft downstream and eggs for 0.5 miles downstream.
- In September/October of the first year, eggs, juveniles, and adults will be adversely affected during the first rainstorm at each of the seven crossing locations. The severity of this effect will be commensurate with the quantity of disturbed ground/fill and the intensity of the rainstorm. While we expect effects to bull trout will be less severe than those predicted for installation/removal, we are unable to predict, with reasonable certainty, the severity of the plume. To give the benefit of the doubt to the species, we assume that the extent and severity of sedimentation during these rainstorms would be equivalent to those predicted for installation/removal.
- In October/November of the first year, eggs, juveniles, and adults also will be adversely affected by suspended sediment concentrations when the first high flows re-organize the disturbed channel in Glacier Creek. The severity of this effect will be commensurate with the quantity of disturbed ground/fill and the intensity of the rainstorm. Effects to bull trout may be less severe than those predicted during installation/removal because background concentrations will be higher during this high flow event. For purposes of this analysis, however, we assume the extent and severity of sedimentation during these rainstorms would be equivalent to those predicted for installation/removal.

Effects on Substrate Embeddedness

Sedimentation from the proposed action is reasonably certain to affect substrate embeddedness in the action area. The deposition of sediment into the substrate can have lethal and sublethal effects on bull trout eggs, alevins, and juveniles. Egg survival depends upon a continuous supply of well oxygenated water through the streambed gravels (Cederholm and Reid1987). Deposition of fine sediments can reduce the water flow through the substrate and, therefore, reduce oxygen to eggs and alevins which can decrease egg survival, decrease fry emergence rates (Bash et al. 2001; Cederholm and Reid 1987; Chapman 1988), and delay the development of alevins (Everest et al. 1987). Juvenile bull trout can be adversely affected by increased substrate embeddedness because forage items are dependent on a clean substrate with interstitial spaces. That pathway of effect will be discussed in the "effects of substrate embeddedness and water quality on forage for bull trout" section of this Opinion.

Relatively few studies have examined the infiltration of fine sediments into the bed of small streams (Gomi et al. 2005, p. 891). Bilby (1985) found that most of the sediment (80 percent) produced from logging roads (big trucks on gravel) in southwest Washington was very fine material (less than 0.004 mm). Sediment deposition occurred only during periods of low flow, and fine sediments were flushed from study sites with small increases in stream discharge. This observation is supported by Duncan et al. (1987), who found that very fine sediments (less than 0.06 mm) are transported efficiently to downstream reaches, while less than 10 percent of the coarser road sediments (0.5 to 2.0 mm) was transported downstream, suggesting that small fines (0.5 to 2 mm) are more likely to become entrained into stream substrates near the source. These results suggest that much of the fine sediment generated from roads passes through a watershed as suspended sediment.

Lachance et al. (2008, p. 1826) quantified fine sediment accumulations in stream substrate downstream of *new* culvert installations in low-gradient trout spawning streams (study sections varied in slope from 0.5 percent to 4.0 percent and in width from 2 to 10 meters). This study found that significant fine sediment (less than 2 mm diameter) accumulations occurred up to 200 m (656 ft) downstream from culvert installations. Peak accumulations occurred directly below the culvert sites (within 20 m (66 ft)). Embedded sediments were lowest in the first weeks after construction, peaked at 1 full year after construction, and gradually decreased at 2 to 3 years post construction. Elevated levels were still present at 3 years post-construction. The downstream distance at which substrate embeddedness was expected to return to background levels varied depending upon site conditions, but ranged from 358 to 1442 m (0.22 to 0.9 mile) below the culvert sites (Lachance et al. 2008, p. 1835). Based on their findings, the authors recommend 500 m (~0.3 miles) as a threshold distance to account for the effects of culvert placements in trout spawning streams (Lachance et al. 2008, p. 1836). These data indicate different culvert installations have a wide range of suspended sediment and substrate embeddedness effects. Suspended sediment and turbidity peaked at culvert installation/removal sites within 24 hours after construction (Foltz et al. 2008, p. 339). Downstream fine sediment embeddedness did not peak until a full year after construction, and was generally 2 to 5 times higher than background levels observed above the culverts (Lachance et al. 2008, p. 1835). The delayed response in substrate embeddedness was attributed to erosion of the road fill and road surface in the immediate vicinity of the culvert. This observation is supported by Rashin et al. (1999, p. 68) who reported an average of 131 cubic m of sediment was delivered directly to streams from newly constructed road surfaces and fill erosion at each stream crossing over the first 11 to 20 months following road construction.

Based on the finding of Lachance et al. (2008), we expect that increased sediment embeddedness and resulting adverse effects to bull trout incubation success is likely to occur for 0.3 mile below the Glacier Creek crossing and at the five stream confluence locations below road crossings. The six tributaries to the SF Sauk River to be crossed by the new permanent road are relatively steep 1st- or 2nd-order streams. Because these streams are steep, we expect that a significant amount of the disturbed sediments will be transported at least downstream to their confluences with bull trout waters, if not farther. For this consultation, the Service estimates that sedimentation in the SF Sauk River will continue downstream for the remainder of the 0.3 mile distance (Table 10). Increases in substrate embeddedness are likely to be more severe at these stream confluence locations than downstream of them. The most severe sedimentation is expected to occur below the temporary multiple culvert crossing of Glacier Creek due to the large scale of the in-stream disturbance and the large quantity of fill. In these areas where chronic deposition of stream crossing and road-generated sediments occurs, we expect that the survival of incubating salmonid eggs and alevins will be reduced. The Service considers any reduction in bull trout incubation success to be a significant impairment of essential behavior (reproduction). As estimated by Lachance et al. (2008), this effect will peak 1 full year after installation/removal and persist for up to 3 years after construction/removal.

Table 10. Extent of anticipated significant substrate sedimentation in Glacier Creek and the SF Sauk River.

Stream Crossing	Location	Distance from SF Sauk confluence	Extent of increased substrate sedimentation in the SF Sauk River	Extent of increased substrate sedimentation in Glacier Creek
Trib to SF Sauk River	MP 0.67	850 ft	734 ft	N/A
Trib to SF Sauk River	MP 0.9	1700 ft	Immediately at confluence, but not farther	N/A
Trib to SF Sauk River	MP 1.0	1250 ft	334 ft	N/A
Trib to SF Sauk River	MP 1.3	1150 ft	434 ft	N/A
Trib to SF Sauk River	MP 1.7	640 ft	944 ft	N/A
Trib to SF Sauk River	~MP 4.3	~250 ft	1,334 ft	N/A
Glacier Creek	~MP 5.5	1,200 ft	384 ft	1,200 ft
Total	N/A	N/A	4,164 ft (0.79 mile)	1,200 ft (0.23 mile)

Synthesis of substrate embeddedness effects from the proposed action on bull trout

The increase in substrate embeddedness generated by the proposed action is reasonably likely to cause lethal effects to alevins and eggs for a distance of 0.3 mile below each proposed crossing. This effect may occur for a total of 1.02 miles (0.79 mile plus 0.23 mile) of habitat (Table 10) and persist for up to 3 years (Lachance et al. 2008). The number of eggs and alevins that will be killed in those 1.02 miles during those 3 years is discussed below.

WDFW (2010) reported that the mean number of redds in two index reaches several miles below the action area between 2005 and 2010 was 132. Those index reaches combined were 3.7 stream miles long. During the site visit, the Service observed that the action area in the SF Sauk River is high quality spawning habitat. If the action area for this consultation was as equally utilized as spawning habitat as those index reaches, it would contain an average of 28 redds each year, based on the density information provided in WDFW 2010. The Service considers bull trout redds in Glacier Creek to be unlikely, but possible. Over the 4-year duration (May “first year” alevins and September “first year” eggs plus 3 more years of eggs and alevins), the estimated number is redds affected would be 112.

Increased substrate embeddedness is likely to reduce the survival rate of eggs and alevins within each of those 28 redds, but the Service does not have available science and data to predict what percent of the individuals in an affected redd would be killed. From the professional opinion of the Service and based on the findings of Newcomb and Jensen (1996), the potential effects range from no mortality of eggs or fry, to delayed fry emergence, or mortality of 0 to 20 percent of eggs in the affected redds. Directly below the Glacier Creek crossing and at the tributary confluences with the SF Sauk River, additional mortality from the effect of this action may be close to 20 percent, but nearly 0.3 mile away, the mortality at each redd may be equal to natural mortality rates. We have no data to estimate bull trout egg to fry survival rates in the SF Sauk River.

Effects on Pool Depth, Quantity and Quality

Natural stream habitat features such as pools and gravel bar deposits are often formed during storm events with associated flows that mobilize sediment in the channel bed (Murphy 1995). The hydrologic regime of a watershed, combined with its geology, hillslope characteristics, and riparian vegetation determines the nature of stream channel morphology (e.g., number and spacing of pools and width-to-depth ratio) (Beschta et al. 1995; Sullivan et al. 1987). Upslope activities (e.g., timber harvest and road development) can change channel morphology by altering the amount of sediment or water contributed to the stream. This, in turn, can disrupt the balance of sediment input, output, and storage in a stream (Madej 1982; Sullivan et al. 1987). A large sediment supply may cause aggradation (i.e., filling and raising the streambed level by sediment deposition) and widening of the stream channel, pool filling, and a reduction in gravel quality (Chamberlin et al. 1991, p. 199). Frequent, deep, cold pools are important habitat for juvenile and adult bull trout because they rely on those pools for resting, hiding, and feeding.

As indicated in this Opinion's discussion of effects on substrate embeddedness, the proposed action is expected to generate road-related and stream crossing related sediment in bull trout habitat. Based on the findings of Bilby (1985) and Duncan et al. (1987), we expect that much of the fine sediment (< 0.004 mm diameter) generated from roads in the action area will pass through subwatersheds as suspended sediment in conjunction with seasonal freshets and storm-flows. However, sediment larger than 0.004 mm is reasonably likely to deposit within 1.02 miles of bull trout habitat, which includes some pool habitats.

The multiple culvert crossing on Glacier Creek in particular is reasonably likely to deposit many cubic yards of sediment and small rock downstream because it would be constructed with many cubic yards of 2-inch-minus rock and other fill. As stated in the sections above, this effect may occur for up to three years, peaking in severity after 1 year.

Sedimentation from the proposed action is also likely to occur in the immediate vicinity of the confluences of the six crossed tributaries and the SF Sauk River. Tributary streams on the north side of the upper SF Sauk River are relatively steep 1st- or 2nd-order ephemeral or small perennial streams. Because these streams are steep, we expect that a significant percentage of displaced sediments will be transported downstream to their confluences with the SF Sauk River. Increases in sediment deposition are likely to occur directly at these stream confluence locations, but the magnitude of these depositions are not likely to be sufficient to significantly alter pool depth or quality within the comparatively much larger SF Sauk River.

To summarize, reduced pool depth and quality for 0.3 mile downstream of the Glacier Creek crossing is reasonably likely have sublethal effects on juvenile and adult bull trout in the action area for as long as the stream crossing generated sedimentation continues to occur, which may be up to 3 years (Lachance et al. 2008).

Effects of substrate embeddedness and water quality on forage for bull trout

Bull trout are apex predators that prey on a variety of species including terrestrial and aquatic insects and fish (Rieman and McIntyre 1993). Fish are common in the diet of individual bull trout that are over 110 mm or longer. Increased sediment inputs can affect the spawning success and population levels of prey species for bull trout. Macroinvertebrates are also a significant food source for salmonids. Salmonids favor certain groups of benthic macroinvertebrates, such as mayflies, caddisflies, and stoneflies. These species prefer large substrate particles in riffles and are negatively affected by fine sediment (Everest et al. 1987; Waters 1995). Any modification of the streambed by deposited sediment will most likely have a profound effect upon the benthic invertebrate community (Waters 1995). The degree to which substrate particles are surrounded by fine material was strongly correlated with macroinvertebrate abundance and composition (Birtwell 1999). At an embeddedness of one-third, insect abundance can decline by about 50 percent, especially for riffle-inhabiting taxa (Waters 1995).

The extent that bull trout prey species will be adversely affected by road and stream-crossing related sediments is unknown, but is expected to be temporally and spatially limited in scale (several days over 2.38 miles for water quality and up to three years over 1.02 miles for substrate embeddedness). The Service does not anticipate that suspended sediment concentrations generated by the proposed action will be higher than the threshold values presented by USFWS (2010b). As described in the effects to water quality section, the anticipated severity score for habitat would be 7 when the concentration of suspended sediment reaches 1,097 mg/L (594.9 NTUs) instantaneously, 885 mg/L (480.2 NTUs) for 1 hour, or 345 mg/L (187.9 NTUs) for three hours. A severity score of 7 is the lowest score that the Service considers to represent a significant adverse effect. A severity score of 7 is synonymous with "moderate habitat degradation measured by a change in the invertebrate community" (USFWS 2010b). Although the Service is reasonably certain that prey species will be adversely affected by degraded habitat conditions, we have insufficient evidence to be able to directly link potential habitat degradation of prey species associated with this action to a significant disruption of normal foraging behaviors for bull trout.

Removal of Riparian Vegetation

Shade

As described in the proposed action, the Forest is proposing to remove 1 acre of riparian vegetation around Seventy-Six Gulch and 0.5 acre of riparian vegetation around Glacier Creek. The potential for riparian vegetation to mediate stream temperatures is greatest for small to intermediate size streams and diminishes as streams increase in size lower in the floodplain (Spence et al. 1996). A number of studies have been conducted to describe the relationship between buffer width and amount of shade provided. These studies have generally found that incremental shade effectiveness diminishes with distance from the stream (Brosofske et al. 1997; Steinblums et al. 1984). Steinblums et al. (1984) identified that shade could be delivered to streams from beyond 75 ft and potentially out to 140 ft. Riparian buffers of 30 m (98 ft) or more in width along small streams provide approximately the same level of shading as an old-growth forest (Beschta et al. 1987). The proposed action would leave a 66-foot buffer on either side of both creeks.

On the August 4, 2011, site visit, the Forest and the Service recorded that the riparian areas to be cleared have very limited opportunity to shade Glacier Creek and Seventy-Six Gulch because of the high mountain ridges around sub-basin and the dense vegetation within the 66-foot buffer. Therefore, the proposed action is anticipated to have insignificant effects on shade (and therefore stream temperatures) for bull trout.

Large wood

As described in the proposed action, the Forest is proposing to remove 1 acre of riparian vegetation around Seventy-Six Gulch and 0.5 acre of riparian vegetation around Glacier Creek. The Forest's BA did not describe the quantity of large wood within the areas that are proposed to be cleared, but on the August 4, 2011, site visit, both the Forest and the Service recorded that the areas are forested with small trees. Large wood is recruited into streams from a variety of processes, including bank erosion, windthrow, chronic tree mortality, and landslides (Benda et al. 2003, p. 49). A recent review of studies by Reeves et al. (2003, p. 1364) found that the majority of the wood found in streams was derived from within a distance equal to the height of streamside trees. Landslides can also contribute substantially to instream large wood accumulations, accounting for more than 40 percent of the total wood volume in small sub-basins (Reeves et al. 2003, p. 1365).

The proposed action is anticipated to have insignificant effects on large wood quantity or quality in bull trout habitat because removed trees were not noticeably taller than the riparian buffer distance (66 ft) and because the creek, gulch, and river already contain a very density of large wood.

Nutrients/Terrestrial Forage

As described in the proposed action, the Forest is proposing to remove 1 acre of riparian vegetation around Seventy-Six Gulch and 0.5 acre of riparian vegetation around Glacier Creek. The Service is reasonably certain that vegetation more than 66 ft from ordinary high water does not provide significant nutrients and terrestrial forage to bull trout habitat. Therefore, riparian clearing as proposed is not likely to measurably affect nutrients and terrestrial forage for bull trout.

Water Quality Improvements from CERCLA Clean-up Operations

The proposed action will remove contaminated soils from the Monte Cristo area at 10 mine sites and several former mining facilities. Floc-logs and vaults at the entrance to eight mine shafts and adits will precipitate and trap some contaminants that are continually discharged from the shaft/adit. Water quality in the action area (as described in the environmental baseline) easily meets U.S. Environmental Protection Agency and State standards for aquatic organisms, and bull trout populations in the local area do not appear to be negatively affected by the heavy metals that leach from contaminated soils (as explained in the environmental baseline section of this Opinion). The Service is reasonably certain that the cleanup will have beneficial effects on water quality in the action area, but that the benefits to bull trout populations and habitats may not be measureable.

Fish Salvage Operations

The proposed action includes fish salvage operations during three bridge/culvert installations on fish bearing streams and fish salvage operations during the installation and removal of the multiple culvert crossing on Glacier Creek. As described in the proposed action, fish salvage operations involve using seining nets and hand nets to remove bull trout from an isolated area before it is dewatered. Work area isolation, flow diversion, and partial dewatering are conservation measures intended to reduce the risk of fish stranding and other forms of injury (e.g., entrainment or exposure to intense turbidity). The Forest is proposing to implement these practices to avoid the more severe effects that bull trout might experience from remaining within the work area. As described in the proposed action, work area isolation and fish salvage procedures would occur in approximately 3,100 ft^2 of stream channel.

It is possible that a small number of bull trout may be injured when the Forest is capturing and removing fish from the work area because of contact with nets and hands. However, the majority of the salvaged juvenile and adult bull trout will only experience increased stress and a temporary disruption to their normal bull trout behaviors. We expect that with careful, full implementation of the proposed conservation measures, and considering the small size of the areas where fish capture operations will or may be conducted, a very small number of juvenile and adult bull trout may be adversely affected by fish capture and handling. Added stress and disruption to their normal behaviors may have measurable short term effects (including interruption to feeding and increased energetic demands). We expect that only the few injured individuals will experience long-term effects. The Service does not have enough data to estimate the exact number of individuals that will be injured or temporarily disrupted from their normal behaviors.

Summary of Effects to Bull Trout

Bull trout in the action area will be adversely affected by sedimentation and fish salvage operations, insignificantly affected by riparian clearing, and beneficially affected by CERCLA water quality improvements. The adverse effects will occur during and after 14 sedimentation events to eggs, alevins, juveniles, and adults over 2.38 stream miles. Adverse effects to eggs and alevins from substrate embeddedness may persist for up to three years over 1.02 stream miles. Fish salvage operations will adversely affect bull trout three times on tributaries and twice on Glacier Creek.

Effects to the Upper Sauk River Bull Trout Local Population

The Upper SF Sauk River bull trout population, as described in the status of the species section of this Opinion, is very healthy and likely to be highly resilient to disturbance at the level of individuals or local populations. The adverse effects of the proposed action will include sublethal and lethal effects to individuals, but population level effects are likely to be minute and difficult to measure against background population dynamics. Adverse water quality effects and fish salvage operations will not have a significant effect on the Upper SF Sauk River population because effects to juveniles and adults will be short-term and sub-lethal. The following paragraph describes the lethal adverse effects to eggs and alevins on a population level because that is the most severe effect of the proposed action on bull trout and their habitat.

Reiman and McIntyre (1993) analyzed population viability for bull trout local populations under several different scenarios. The minimum egg-to-fry survival rate to sustain a local population ranged 3 to 5 percent for populations with fast individual growth rates and early or late maturity (Rieman and McIntyre 1993, p. 9). These life history types are comparable to the adfluvial bull trout population in the SF Sauk River. The authors found that studies of egg-to-fry survival indicate that a survival rate of 25 to 50 percent likely represent the highest potential values for many bull trout streams. The estimated base survival rate of 3 to 5 percent necessary to sustain a local population is a minimal level likely found only in severely degraded streams (Rieman and McIntyre 1993, p. 9). We do not know what egg-to-fry recruitment levels are in the SF Sauk River, but we expect that they are currently above these minimal levels, and that the effects of the action would not reduce fry recruitment to below these minimum levels. Based on the population viability analysis presented by Reiman and McIntyre (1993), we do not expect that the adverse effects to eggs and alevins will measurably affect the Upper SF Sauk River bull trout local population.

Effects to the Lower Skagit River Core Area

The Lower Skagit River Core Area, as described in the status of the species and environmental baseline sections of this Opinion, is very healthy and likely to be highly resilient to disturbance on the scale of single population. Adverse effects to water quality from the proposed action would be short-term (14 events less than 24 hours long), and therefore not likely to reduce the long-term viability populations that comprise the Lower Skagit River Core Area. Short-term and sublethal adverse effects from fish salvage operations are also not likely to reduce the long-term viability populations that comprise the Lower Skagit River Core Area. As described in the effects to the Upper SF Sauk River population above, adverse effects to eggs and alevins are not likely to significantly affect fry recruitment within that population because the egg to fry survival rate is likely to be well above the rate required to sustain the population. Since the action is not likely to significantly affect the Upper SF Sauk River population, we do not expect the effects of the action to influence bull trout metapopulation dynamics within the Lower Skagit River core area.

CUMULATIVE EFFECTS: Bull Trout

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The Forest stated in their BA that "There are no other on-going or planned projects in the watershed" (USFS 2011, p. 38). The only cumulative effects the Service is aware of in the action area are caused by climate change and recreation.

Climate Change

One of the most significant ongoing effects to baseline conditions for bull trout and their associated aquatic habitat throughout the State of Washington is climate change. Climate change, and the related warming of global climate, has been well documented in the scientific literature (Bates et al. 2008; ISAB 2007). Evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (Bates et al. 2008; Battin et al. 2007), we can no longer assume that climate conditions in the future will resemble those in the past.

Climate change has the potential to profoundly alter the aquatic habitat through both direct and indirect effects (Bisson et al. 2003). Direct effects are evident in alterations of water yield, timing and volume of peak flows, and stream temperature. Some climate models predict 10 to 25 percent reductions in late spring, summer, and early fall runoff amounts in coming decades. Indirect effects, such as increased vulnerability to catastrophic wildfires, occur as climate change alters the structure and distribution of forest and aquatic systems. Observations of the direct and indirect effects of global climate change include changes in species ranges and a wide array of environmental trends (Hari et al. 2006; ISAB 2007; Rieman et al. 2007). In the northern hemisphere, ice-cover durations over lakes and rivers have decreased by almost 20 days since the mid-1800s (WWF 2003). For cold-water associated salmonids in mountainous regions, where upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in size of suitable habitat patches and loss of connectivity among patches, which in turn can lead to a population decline (Hari et al. 2006; Rieman et al. 2007).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the snow pack diminishes stream flow timing will change, and peak flows will likely increase. Higher ambient air temperatures will likely cause water temperatures to rise (ISAB 2007). Data from long-term stream monitoring stations in western Washington indicate a marked increasing trend in temperatures in most major rivers over the past 25 years (WDOE 2007).

There is still a great deal of uncertainty associated with predictions of timing, location, and magnitude of climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007). Research indicates that temperatures in many areas will continue to increase due to the effects of global climate change. According to model predictions, average temperatures in Washington State are likely to increase between 1.7° C and 2.9° C (3.1° F and 5.3° F) by 2040 (Casola et al. 2005).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change will cause shifts in timing, magnitude, and distribution of peak flows that are also likely to be most pronounced in these high elevation stream basins (Battin et al. 2007). The increased magnitude of winter peak flows in high elevation areas is likely to affect spawning and incubation habitat for bull trout and Pacific salmon.

Climate change is and will be an important factor affecting bull trout distribution and population dynamics. As distribution contracts, patch size decreases and connectivity is truncated; populations that are currently connected may become thermally isolated, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman et al. 2007). In areas with already degraded water temperatures or where bull trout are at the southern edge of their range, they may already be at risk of impacts from current as well as future climate change. As these trends continue, the conservation role of bull trout populations in headwaters habitats (such as the Upper SF Sauk River) may become more significant. Long-term persistence of bull trout may only be possible in these headwater areas that provide the only suitable habitat refugia.

<u>Recreation</u>

The Monte Cristo area is a popular destination for recreation. Recreational activities include but are not limited to fishing, hiking, exploring the historical sites, camping, and staying at Forest and privately owned cabins. These recreational activities, with the exception of fishing, are not expected to have significant cumulative effects on bull trout.

The majority of impacts to bull trout within the SF Sauk River watershed will be in the form of mortality associated with catch and release sport-fishing and poaching/illegal harvest. The section 4(d) rule published with the listing of bull trout allows incidental catch of bull trout when legally fishing for other species. Currently it is illegal to catch and keep bull trout in the SF Sauk River, but legal to catch and keep them in other parts of the watershed. The level of bull trout mortality associated with incidental sport catch is unknown, but other studies have shown that catch and release fishing can cause mortality ranging from 3.9 percent for fly-caught fish up to 58 percent for bait-caught fish (Pauley and Thomas 1993; Schisler and Bergersen 1996; Warner and Johnson 1978). The Washington Fish and Wildlife Commission have implemented selective gear rules (i.e., artificial lures with single, barbless hooks) for the SF Sauk River. This may reduce the incidental mortality rate of bull trout from angling.

INTEGRATION AND SYNTHESIS OF EFFECTS: Bull Trout

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alteration. Five segments of the coterminous United States population of the bull trout are essential to the survival and recovery of this species and are identified as interim recovery units. The project is located in the Puget Sound interim recovery unit which currently contains 8 core areas and 57 local populations (USFWS 2004). A final Recovery Plan has not yet been completed that would inform this 7(a)(2) analysis, and that has created some uncertainty about the current status of the unit and the potential unit-wide consequences of localized project effects. The proposed action is located within the Lower Skagit River Core Area and will affect the Upper SF Sauk River population. As explained in the analysis above, both the core area and local population are very healthy.

The adverse effects of the proposed action are restricted to 1) the juveniles and adults that are present in a 2.38 mile long section of habitat during 14 sedimentation events, 2) the eggs and alevins within a 1.02 mile long section of habitat for four cohorts (present year plus three years) and 3) fish salvage operations that may injure a small number of captured fish. Although this action will result in a (mostly) temporary degradation of bull trout habitat and the death of individuals, the magnitude and the duration of these effects are limited in scale and will occur to a very healthy bull trout population. Drawing from bull trout population viability analysis and metapopulation theory, we conclude that the effects of the Monte Cristo Mining Area CERCLA Cleanup, considered with cumulative effects, will not appreciably reduce bull trout distribution, numbers, or reproduction within the Lower Skagit River core area, or affect the survival and recovery potential of bull trout within the Puget Sound interim recovery unit, or the coterminous listed range.

CONCLUSION: Bull Trout

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the opinion of the Service that the Monte Cristo Mining Area CERCLA clean-up activities are, as proposed, not likely to jeopardize the continued existence of the bull trout.

STATUS OF BULL TROUT CRITICAL HABITAT

An updated account of the status of bull trout critical habitat rangewide is presented in Appendix G.

ENVIRONMENTAL BASELINE: Bull Trout Critical Habitat

This segment of the South Fork Sauk River provides essential spawning and rearing habitat for fluvial and anadromous forms in the Upper South Fork Sauk River local population. It is essential for maintaining abundance and productivity and maintaining connectivity between spawning and rearing habitats and freshwater and marine foraging, migrating and overwintering habitat. Glacier Creek and Seventy-Six Gulch provide essential habitat used for spawning and rearing in the Upper South Fork Sauk River local population. These areas are essential for maintaining distribution, abundance, and productivity of that population.

EFFECTS OF THE ACTION: Bull Trout Critical Habitat

Anticipated effects of the proposed action on bull trout critical habitat follow.

PCE 1: Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

The proposed action will have beneficial effects on PCE 1. Water quality improvements from contaminant cleanup at 10 former mine sites will improve the quality of hyporheic water that reaches Glacier Creek, Seventy-Six Gulch, and the SF Sauk River as is explained in the effects of the action on bull trout section of this Opinion. However, the benefits to bull trout critical habitat may not be measureable because water quality in the action area is good (as is explained in the environmental baseline section for bull trout in this Opinion).

PCE 2: Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

The proposed action will have short-term adverse effects on PCE 2. Bridge/culvert installations on three fish-bearing tributaries to the Sauk River (MP 0.67, MP 1.3, and ~MP 4.3) and a multiple culvert installation on Glacier Creek will cause brief barriers to migration. The culvert installations on the three fish bearing tributaries will block passage at that crossing for up to 24 hours during in-water work and elevated concentrations of suspended sediments. The construction and removal of a multiple culvert crossing on Glacier Creek will also block passage for up to 24 hours during in-water work and elevated concentrations of suspended sediments. These migration impediments in critical habitat will adversely affect PCE 2 for several non-consecutive days at different locations. The permanent culverts and bridges across the fish bearing tributaries will provide adequate bull trout passage because they will be as wide as bankfull width and designed to pass the 100-year flood event plus 20 percent to accommodate associated debris. The value of PCE 2 to bull trout critical habitat will be not be reduced long-term.

PCE 3: An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

The proposed action will have adverse effects on PCE 3. Stream crossings, new roads, and associated ground disturbance are reasonably likely to cause increased substrate embeddedness in bull trout critical habitat for up to three years and short-term adverse effects on water quality (see effects on PCE 8 and the effects of the action on bull trout section of this Opinion). We anticipate the following will occur.

- Significant substrate embeddedness will occur for up to 0.3 mile downstream of stream crossings (Lachance et al. 2008, p. 1836) for a total of 1.02 miles of affected bull trout critical habitat for spawning and rearing. This effect is likely to persist for up to three years (Lachance et al. 2008, p. 1826).

- Suspended sediment will degrade water quality for up to 0.5 mile downstream of each stream crossings (Foltz et al. 2008, p. 329). That effect will occur during each of the 14 sedimentation events that were described in the effects to bull trout section of this Opinion and last from several hours to 1 day each.
- Fine sediment (< 0.004 mm diameter) will be generated by the new and temporary gravel roads, but that sediment is likely to travel through the watershed to Monte Cristo Lake without settling (Bilby 1985).

As discussed in the "effects of substrate embeddedness and water quality on forage for bull trout" section of this Opinion, the abundance of forage organisms is reasonably certain to be reduced by these effects on sedimentation and water quality until the crossings have been scoured to equilibrium and the disturbed sediments from the proposed activities have been flushed from the substrate (up to three years). However, we have insufficient evidence to directly link adverse effects to PCE 3 with a significant impairment of normal foraging behaviors for bull trout.

PCE 4: Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

The proposed action will have adverse effects on PCE 4. Specifically, the quality of pools and substrates will be degraded by sediment generated on roads and at stream crossings. On the August 4, 2011, field visit to the action area, the Service and the Forest identified several small to medium sized pools below the proposed Glacier Creek crossing. The Service characterized the substrate in Glacier Creek as large cobble and boulders with a great quantity of wood on a moderately steep gradient. The Service also noted that the upper SF Sauk River below the confluence of Glacier Creek and Seventy-Six Gulch there is excellent spawning habitat with un-embedded high quality gravels and a complex channel. We anticipate the following will occur.

- Significant substrate embeddedness will occur for up to 0.3 mile downstream of all stream crossings (Lachance et al. 2008, p. 1836) in critical habitat for spawning and rearing. This effect is likely to persist for three years (Lachance et al. 2008, p. 1826).
- The proposed action will decrease pool quality and depth in the 0.3 mile below the Glacier Creek crossing and at the immediate vicinity of the confluences below the tributaries that would be crossed by the new/rebuilt road. Pools will not be significantly affected downstream of the confluences because of the 1) distance between the crossings and the SF Sauk River and because 2) the larger discharge of the SF Sauk River is likely to quickly remove sediment from those pools. We predict that PCE 4 in the action will continue to function as critical habitat for bull trout, but that the quality will be reduced for up to three years.
- As described in the effects to bull trout section of this Opinion, the proposed action is not likely to adversely affect large wood quantity or quality in bull trout critical habitat because the riparian buffers around proposed clearings are sufficient to protect wood that would have been entrained by the rivers or creeks.

The adverse effects on PCE 4 will be short term (up to three years) and affect only a small part of the critical habitat for spawning and rearing in the upper SF Sauk River. Additionally, the anticipated adverse effects to complex stream features will occur within a relatively pristine critical habitat sub-basin that often experiences high-energy disturbance events due to its geologic nature and dramatic rain on snow events.

PCE 5: Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

The proposed action will have insignificant effects on PCE 5. Roadwork and stream crossings will have no effect on PCE 5. The proposed clearing of vegetation within riparian areas on Glacier Creek and Seventy-Six Gulch would insignificantly reduce shade on those water bodies because 1) a 66-ft buffer would be left intact on either side of the streams and 2) the physical setting of the patch reduces shading opportunities (as is explained in the effects of the action on bull trout in this Opinion). Accordingly, the effect on water temperature would be immeasurable and the effects on PCE 5 are insignificant.

PCE 6: In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

The proposed action will have short term adverse effects on PCE 6. Specifically, the quality of spawning and rearing substrates will be reduced by sedimentation generated on roads and at stream crossings. All of the action area within the upper SF Sauk River, Glacier Creek, and Seventy-Six Gulch is designated spawning and rearing critical habitat for bull trout. Significant adverse effects on substrate embeddedness will occur for up to 0.3 mile downstream of each stream crossing (Lachance et al. 2008, p. 1836). This effect is likely to persist for three years (Lachance et al. 2008, p. 1826) and affect up to 1.02 miles of critical habitat for spawning and rearing. On the August 4, 2011, field visit to the action area, the Service and the Forest characterized the substrate below Glacier Creek as large cobble and boulders with a great quantity of wood on a moderately steep gradient. As explained earlier in this opinion, Glacier Creek is not high quality spawning habitat, but the Service maintains that bull trout can and do spawn in low quality habitats where they can find suitable “pockets” of gravels. The upper reaches of the SF Sauk River, however, are high-quality spawning habitat.

The service expects that PCE 6 in the action will continue to function as spawning and rearing critical habitat for bull trout, but that the quality may be reduced for up to three years in 1.02 miles of the SF Sauk River and Glacier Creek.

PCE 7: A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

The proposed action will have insignificant effects on PCE 3. The only component of the proposed action that will affect the hydrograph is the construction of new road. However, this 0.8 mile addition of road network will not have an effect on the hydrograph that is measureable or meaningful for the quality of bull trout critical habitat because the segment is very small and the upper SF Sauk River basin has very few roads (as is explained in the environmental baseline section of this Opinion. The Forest's best management practices for gravel roads will further reduce potential effects on the hydrograph. Thus, the effects of the proposed action on PCE 7 are insignificant.

PCE 8: Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

The proposed action will have adverse effects on PCE 8. As explained in the effects of the action section on bull trout section of this Opinion, 14 sedimentation events will reduce water quality over a total of 2.38 miles of bull trout critical habitat for spawning and rearing. Each event is expected to last between 3 and 24 hr. In addition to those events, fine sediment (< 0.004 mm diameter) will be generated by the new and temporary gravel roads, but that sediment is likely to travel through the watershed to Monte Cristo Lake without settling (Bilby 1985). Concentrations of fine sediment (< 0.004 mm diameter) will not be high enough to directly reduce the value of the critical habitat to bull trout, but may have trophic effects on bull trout by reducing the abundance of forage items (as is explained in the effects to bull trout section of this Opinion). Adverse effects to PCE 8 from the proposed action will not be long-term enough to reduce the value of PCE 8 in the action area.

PCE 9: Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The proposed action will have no effect on PCE 9. Project components do not have mechanisms for introducing non-native, interbreeding, or competing species.

Summary of Effects to Bull Trout Critical Habitat

The proposed action would have adverse effects on PCEs 2, 3, 4, 6, and 8, insignificant effects on PCEs 5 and 7, beneficial effects on PCEs 1 and 8, and no effect on PCE 9. Only the beneficial effects to PCEs 1 and 8 will be long-term, and the value of designated bull trout critical habitat in the action would be maintained.

Effects to the Lower Skagit CHSU and Puget Sound CHU

The effects of the proposed action on the Lower Skagit CHSU and the Puget Sound CHU would be insignificant and short-term because the value of designated critical habitat in the action area would be maintained after the 14 sedimentation events and three years of increased substrate embeddedness have passed.

CUMULATIVE EFFECTS: Bull Trout Critical Habitat

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. The cumulative effects on designated bull trout critical habitat in the action area are the same as the cumulative effects on bull trout. Those effects (climate change and recreation) are discussed in the bull trout portion of this Opinion.

CONCLUSION: Bull Trout Critical Habitat

After reviewing the current status of bull trout critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's Opinion that the Monte Cristo Mining Area CERCLA Cleanup Activities, as proposed, are not likely to destroy or adversely modify designated critical habitat for bull trout.

We reached our conclusion for bull trout critical habitat based on the following rationale. Critical habitat within the SF Sauk River, Glacier Creek and Seventy-Six Gulch is essential to maintaining the current distribution, abundance, and productivity of bull trout within the Lower Skagit River CHSU. Adverse effects to bull trout critical habitat from the proposed action would be limited to 14 sedimentation events within 2.38 total miles of critical habitat and three years of substrate embeddedness within 1.02 miles of critical habitat. This action would result in the degradation of bull trout critical habitat PCEs, but the magnitude and duration of these effects would be limited in scale. None of the adverse effects associated with this action are expected to be severe enough, permanent enough, and wide-spread enough to alter the essential role that designated critical habitat serves for the conservation and recovery of bull trout in the Lower Skagit River CHSU, Puget Sound recovery unit, or within the listed coterminous range of the species. Critical habitat at these scales would remain functional to serve its intended conservation role for bull trout.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. *Harm* is defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest so that they become binding conditions of any grant or permit issued to any applicants, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest 1) fails to assume and implement the terms and conditions or 2) the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document are not adhered to, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates that murrelets and bull trout could be taken as a result of the proposed action.

Marbled Murrelets

Incidental take of murrelets is difficult to detect because the species is cryptic and murrelet nests are located rarely. However, based on the documented history of murrelet occupancy behaviors in the South Fork Sauk River watershed, and adjacent watersheds, we assume that all suitable murrelet nesting habitat in the project area is occupied habitat. Therefore we estimated the amount of nesting habitat that would be exposed to actions that could result in take as a surrogate measure for this species.

In the accompanying Opinion, we determined that noise and activity associated with use of motorized equipment in the action area during the 2-year construction and clean-up period, coupled with increases in densities of corvids, will result in the incidental take of murrelets nesting within the 43 acres of habitat in proximity to the new road. This take is in the form of harassment through significant disruption of normal nesting behaviors. A likelihood of injury is expected due to decreased fitness of chicks from missed feedings for 2 years, and the increased possibility of predation by corvids in perpetuity. Under a reasonable worst-case scenario, the harassment would indirectly result in a failed nesting attempt each year within the 43 acres exposed to these disturbances.

Bull Trout

We anticipate that the proposed action will result in the incidental take of eggs, alevins, juveniles and adults from the Lower Skagit River bull trout core area. That take will occur from fish salvage events and from sedimentation effects.

Fish Salvage Take

Incidental take from fish salvage procedures is difficult to quantify because the Service does not have sufficient data to estimate the quantity of fish that may be present at the crossing locations during fish salvage. Where this is the case, we use habitat conditions as a surrogate indicator of take.

- Juvenile bull trout will be harmed by fish salvage operations during three culvert/bridge installations in three fish bearing tributaries and one multiple culvert installation and one multiple culvert removal in Glacier Creek.
- Adult bull trout will be harmed by fish salvage operations during one culvert/bridge removal in Glacier Creek.

The extent of take is best described by the total area in which fish will be salvaged. That area includes 500 square feet in each of three bull trout bearing tributaries and 1,600 ft^2 at the Glacier Creek crossing for a total area of 3,100 ft^2. The duration of this take, in each instance, will be less than one day.

Sedimentation Take

Incidental take from sedimentation will be difficult to detect or quantify for the following reasons: 1) the low likelihood of finding dead or injured adults, subadults, or juveniles; 2) delayed mortality; and, 3) the relationship between habitat conditions and the distribution and abundance of individuals is imprecise such that a specific number of affected individuals cannot be practically obtained. Where this is the case, we use habitat conditions as a surrogate indicator of take.

The incidental take from sedimentation is expected to be in the forms of both harm and harassment. Specifically, we expect the following:

- Juvenile bull trout will be harassed by 14 sedimentation events (3-24 hr duration each) in three tributaries, the SF Sauk River, and Glacier Creek for a total of 2.38 stream miles.
- Adult bull trout will be harassed by three sedimentation events in Glacier Creek for 1200 ft. Take will result from these events when levels of turbidity reach or exceed the following:

  1) 81.3 NTUs above background at any time; or
  2) 54.8 NTUs above background for more than 1 hour, continuously; or
  3) 22.9 NTUs above background for more than 3 hours, cumulatively; or
  4) 12.1 NTUs above background for more than 7 hours, cumulatively.

- Eggs and/or alevins will be harmed by 14 sedimentation events (3-24 hr duration each) and 3 years (4 cohorts) of increased substrate embeddedness for a total of 1.02 stream miles.

EFFECT OF THE TAKE: Marbled Murrelets

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the murrelets or result in the destruction of adverse modification of critical habitat for the murrelet.

REASONABLE AND PRUDENT MEASURES: Marbled Murrelets

The Service believes the following Reasonable and Prudent Measures (RPMs) are necessary and appropriate to minimize the incidental take of murrelets.

RPM 1. Minimize the magnitude and likelihood of take to murrelets.

RPM 2. Monitor the nature and extent of activities that are likely to result in incidental take or adversely affect murrelets through habitat impacts. Report the results of such monitoring.

TERMS AND CONDITIONS: Marbled Murrelets

In order to be exempt from the prohibitions of section 9 of the ESA, the Forest must comply with the following terms and conditions (T&Cs), in addition to the conservation measures in the BA listed above, all of which implement the RPMs described above and outline required reporting/monitoring requirements. These T&Cs are non-discretionary.

The following T&Cs are required for the implementation of RPM 1.

T&C 1. To the extent practicable, choose a road alignment that requires felling the least number of "potential nest trees"[2]. Where such trees must be removed, choose those with the lowest quality of nest platforms and where adjacent trees provide the least amount of cover to those potential nest structures.

T&C 2. Ensure that contractors employ effective sanitation practices for proper disposal of food and garbage which may otherwise attract corvids and increase the likelihood of predation on nesting murrelets and/or their chicks.

T&C 3. The Forest (either contract personnel or other Forest staff/volunteers) shall commit to monitoring and removal, as needed, of any refuse that is found during the construction period and for 2 years after, at least once every 45 days during the snow-free period of the marbled murrelet nesting season (April 1 through September 15). Specifications for

[2] "Potential nest tree" used here follows the Forest Service definition of trees currently capable of supporting murrelet nesting due to favorable structures such as broken tops, large cavities, or large branches with overhead cover from branches. It does not include trees currently incapable of supporting nesting.

litter and refuse removal will be part of the contract and a contractor responsibility. This specification will be monitored by the COR and reported in the daily diary during the construction period. For the 2 years following construction, monitoring of the road for refuse shall be part of the clean-up contract and shall be checked and reported by the contractor's representative with spot checks by Forest personnel.

T&C 4. Post-cleanup removal of any potential nest trees that are safety hazards shall occur outside the nesting season. If this is not practicable, coordinate with the Service prior to felling. This T&C supersedes the existing programmatic standards.

The following T&C is required for the implementation of RPM 2.

T&C 5. In order to monitor the impacts of the proposed action and the implementation of the RPMs, the Forest shall prepare a report describing the progress of the proposed action, including implementation of the associated terms and conditions, and impacts to the murrelet (50 CFR 402.14(I)(3)). The report shall be submitted to the consulting biologist or branch manager of the Washington State Office on or before January 31, annually until project completion. Electronic correspondence is acceptable for the reporting. The monitoring report shall:

1) Report the number, species, and estimated dbh of all potential nest trees that are felled during road construction. Report any evidence of nesting material that is incidentally observed.
2) Report to the extent practicable any non-target potential nest trees outside the clearing limit that had nesting structures damaged from tree felling. A description of the non-target tree shall include the species, the estimated dbh, and the extent that nesting structures were damaged, if any.
3) Record sound levels during road construction activities when heavy equipment and/or chainsaws are in use. Sound levels shall be measured in suitable murrelet habitat at a distance of 45 yd from road construction at two locations over 3 days while heavy machinery is operating. If sound levels over 92 dB are recorded at 45 yd, then determine the distance out to which 92 dB sound levels extend. Hand held decibel meters are acceptable.

EFFECT OF THE TAKE: Bull Trout

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the bull trout or result in the destruction of adverse modification of critical habitat for the bull trout.

REASONABLE AND PRUDENT MEASURES: Bull Trout

The Service believes the following Reasonable and Prudent Measures (RPMs) are necessary and appropriate to minimize the incidental take of murrelets.

RPM 3. Minimize, monitor, and report on incidental take resulting from suspended sediment concentrations generated by stream crossing installation and removal.

RPM 4. Minimize and report on incidental take resulting from increased substrate embeddedness downstream of stream crossings.

TERMS AND CONDITIONS: Bull Trout

In order to be exempt from the prohibitions of section 9 of the ESA, the Forest must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

The following T&C is required for the implementation of RPM 3.

T&C 6. The Forest shall monitor turbidity levels in the tributaries and in Glacier Creek during sediment-generating activities at an 'interim' distance from the crossing that is less than the full extent of take. The full extent of take, as described in this Opinion, is different for each stream depending on its distance to the next confluence. The interim distance is 100 ft below the crossing at each of the six tributaries and 300 ft below the crossing over Glacier Creek. The purpose of the interim distance is to warn the Forest that turbidity levels are high before authorized incidental take has been exceeded.

Monitoring shall be conducted at 30-minute intervals from the start of sediment-generating activities. Monitoring is ineffective unless it captures the peak turbidity causing events. In this proposed action, peak turbidities are expected to occur when the stream is first diverted around the work area and when the stream is once again exposed to the work site. If turbidities measured over the course of three consecutive 30-minute sample intervals do not exceed 12.1 NTUs over background, then monitoring of sediment-generating activities will be conducted for the remainder of the workday at a frequency of once every three hours, or if there is a visually appreciable increase in turbidity.

If, at any time, monitoring conducted at those interim distances indicates turbidity in excess of 12.1 NTUs over background, then monitoring shall instead be conducted at the full extent of take downstream of sediment-generating activities. The full extent of take for the tributaries is just upstream of the confluence of those tributaries with the SF Sauk River, and the full extent of take in Glacier Creek is just upstream of the confluence between Glacier Creek and Seventy-Six Gulch. Those distances are enumerated in Table 1. Monitoring shall be conducted at those locations at 30-minute intervals until turbidity falls below 12.1 NTUs over background.

If turbidity levels measured at the full extent of take distances downstream of sediment-generating activities exceed 12.1 NTUs over background for more than 7 hours cumulatively over any 10-hour workday, 22.9 NTUs over background for more than 3 hours cumulatively over any 10-hour workday, or 81.3 NTUs over background at any time, then the amount of take authorized by the Incidental Take Statement will have been exceeded. Sediment-generating activities shall cease, and the Forest shall contact the Service's Washington Fish and Wildlife Office in Lacey, Washington.

Monitoring shall be conducted to establish background turbidity levels away from the influence of sediment-generating activities. Background turbidity shall be monitored at least twice daily during sediment-generating activities. In the event of a visually appreciable change in background turbidity, an additional sample shall be taken.

The Forest shall submit a monitoring report to the Service's consulting biologist by January 31 following the in-water construction season, to include at a minimum, the following: (a) dates and times of construction activities, (b) monitoring results, sample times, locations, and measured turbidities (in NTUs), (c) summary of construction activities and measured turbidities associated with those activities, and (d) summary of corrective actions taken to reduce sediment/turbidity. The monitoring report shall also include a qualitative description of the final condition of the work area. The Forest shall also document any obvious signs of channel bed or bank instability (e.g., headcutting) resulting from the work, any additional actions taken to correct this instability, and the final condition of the work area.

The following T&Cs are required for the implementation of RPM 4.

T&C 7. The Forest shall use native material, or foreign material of the same size as native material, to construct the multiple culvert crossing over Glacier Creek. Two-inch minus rock may only be used for the upper running surface of the road.

T&C 8. The Forest shall fully remove the Glacier Creek crossing no later than August 31. The Forest shall restore the Glacier Creek channel to its pre-project contours, and shall remove all foreign fill material from the Glacier Creek crossing.

T&C 9. The Forest shall submit a monitoring report to the Service by January 31 following the in-water construction season, to include at least the following:

1) Four photographs from each crossing site before work has begun and four photographs from each crossing site after work is complete. The photographs should face the crossing from upstream, downstream, the right bank, and the left bank.
2) A qualitative description of the final condition of the work area. The description shall also document any obvious signs of channel bed or bank instability (e.g., headcutting) resulting from the work, any additional actions taken to correct this instability, and the final condition of the work area.

The RPMs, with their implementing terms and conditions, are designed to minimize the impact of incidental take from the proposed action. If, during the course of the proposed action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The

Forest must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs.

The Service is to be notified within three working days upon locating a dead, injured or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the Services Washington Fish and Wildlife Office at (360) 753-9440.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations (CRs) are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service offers the following conservation recommendations to the Forest to promote the recovery of federally listed species and their habitats. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations. This report may be in the form of email correspondence to the Level 1 Team.

CR 1. Monitor compliance with all conservation measures described in the project description and submit the results of that monitoring to the Service by January 31 annually until project completion.

Marbled Murrelets and Marbled Murrelet Critical Habitat

CR 2. Inspect danger trees that meet the definition of potential nest trees that are felled for 10 years beyond the road construction period. Report the date potential nest tree was felled, the species, the dbh, the specific location, and a description of nesting structure. If the tree contained evidence of murrelet nesting activity, report this evidence.

CR 3. Top or high-stump danger trees, where feasible, to retain as much structure as possible.

CR 4. Design and facilitate a corvid monitoring study to better understand and possibly quantify or qualify the indirect effects of the proposed action on murrelet nests in cooperation with the Service. The goal of such a study would be to accurately predict the magnitude of increased corvid predation within the action area.

CR 5. Ensure availability of visitor outreach information and education that speaks specifically to the effects of predation on murrelets and the role human food plays in attracting predators. While outreach information may currently address food and garbage control for the purpose of aesthetics, attracting nuisance animals such as raccoons, or creating animal dependence on human food, expanding the scope of the reasoning to the potential extirpation of local endangered species may heighten public awareness as to the consequences of their behavior.

Bull Trout and Bull Trout Critical Habitat

CR 6. Build the crossing over Glacier Creek with new or used bridge sections instead of the multiple culvert crossing that is currently proposed. The use of a bridge or bridges would reduce the amount fill and disturbance in Glacier Creek.

CR 7. Obliterate the road between the repository and Glacier Creek and remove the tributary culvert at ~MP 4.3. That section of road is not needed to maintain access to the repository.

CR 8. Continue to study the placement of the repository relative to geologic instability in the sub-basin. Ensure that placement of the repository does not present future risks to aquatic ecosystems in the event of landslides or river migration. Any disturbance that destabilizes the repository could put bull trout at risk from contamination.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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Appendix A: Status of the Species - Northern Spotted Owl

Appendix A
STATUS OF THE SPECIES - NORTHERN SPOTTED OWL

Legal Status

The northern spotted owl (spotted owl) was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (55 FR 26114 [June 26, 1990]). The U.S. Fish and Wildlife Service (Service) recovery priority number for the spotted owl is 12C (USFWS 2011, p. I-6) on a scale of 1C (highest) to 18 (lowest). This number reflects a moderate degree of threat, a low potential for recovery, the spotted owl's taxonomic status as a subspecies and inherent conflicts with development, construction, or other economic activity given the economic value of older forest spotted owl habitat. A moderate degree of threat equates to a continual population decline and threat to its habitat, although extinction is not imminent. While the Service is optimistic regarding the potential for recovery, there is uncertainty regarding our ability to alleviate the barred owl impacts to spotted owls and the techniques are still experimental, which matches our guidelines' "low recovery potential" definition (48 FR 43098 [1983]). The spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USFWS 2004, p. 55) and to 12C in the 2011 Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011, p. I-6).

Life History

Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, pp. 741-742; Barrowclough et al. 1999, p. 928; Haig et al. 2004, p. 1354), morphological (Gutierrez et al. 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, pp. 741-742). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutierrez et al. 1995, p. 2). Recent studies analyzing mitochondrial DNA sequences (Barrowclough et al. 2005, p. 1117; Chi et al. 2004, p. 3; Haig et al. 2004, p. 1354) and microsatellites (Henke et al. 2005, p. 15) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevadas, appears to be stable (Barrowclough et al. 2005, p. 1116).

Physical Description

The spotted owl is a medium-sized owl, approximately 18-19 in (46-48 cm) in length and approximately 1.1-1.9 lbs (490-850 gm) in weight (Gutierrez et al. 1995, p. 2), and is the largest of the three subspecies (Gutierrez et al. 1995, p. 2). It is dark brown with a barred tail and white spots on the head and breast, and has dark brown eyes that are surrounded by prominent facial disks. Three age classes can be distinguished on the basis of plumage characteristics (Moen et al. 1991, p. 493). The spotted owl superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly and Forsman 2004, p. 807). Hybrids exhibit characteristics of both species (Hamer et al. 1994, p. 488).

Current and Historical Range

The current range and distribution of the spotted owl extends from southern British Columbia through western Washington, Oregon, and California as far south as Marin County (55 FR 26115 [June 26, 1990]). The southeastern boundary of its range is the Pit River area of Shasta County, California. The range of the spotted owl is partitioned into 12 physiographic provinces (provinces), based upon recognized landscape subdivisions exhibiting different physical and environmental features (Figure 1) (USFWS 1992, p. 31). These provinces are distributed across the range as follows:

- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands

- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath

- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl has been extirpated or is uncommon in certain areas. For instance, there have only been a few nesting pairs in southwestern Washington for a number of years, although they have persisted there for the past decade. Timber harvest activities have eliminated, reduced, or fragmented spotted owl habitat and decreased overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (USFWS 1992, p. 1799).

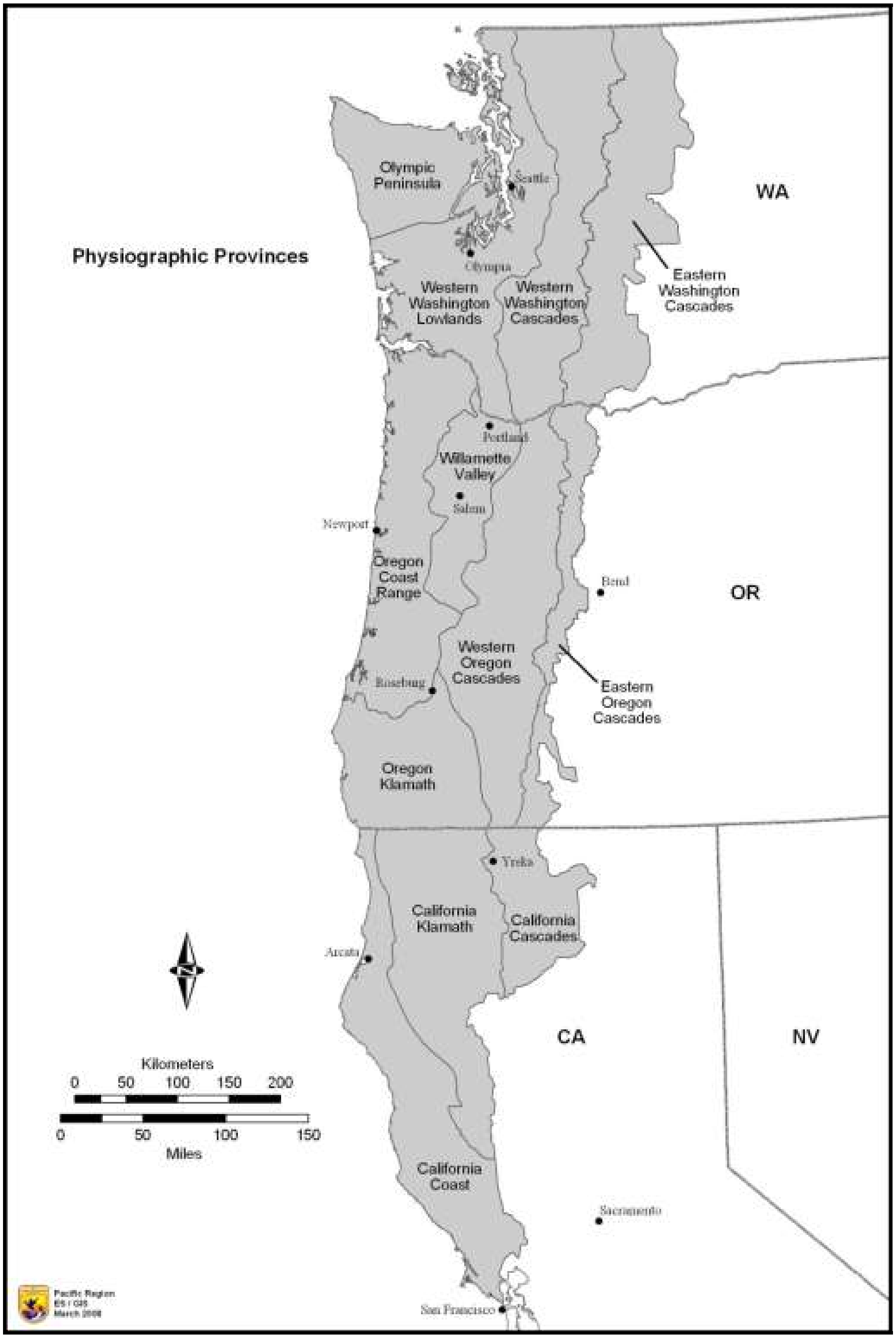

Figure 1. Physiographic provinces in the range of the spotted owl in the United States.

Behavior

Spotted owls are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746) suggesting that the area defended is smaller than the area used for foraging. Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutierrez 1996, p. 4). These birds are referred to as "floaters." Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992, p. 822). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutierrez 1996, p. 4).

Spotted owls are monogamous and usually form long-term pair bonds. "Divorces" occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutierrez et al. 1995, p. 10).

Habitat Relationships

Home Range

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (55 FR 26114:26117 [June 26, 1990]). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal activities (Thomas et al. 1993, p. IX-15) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990, p. 194) to 14,271 acres on the Olympic Peninsula (USFWS 1992, p. 23). Zabel et al. (1995, p. 436) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746), suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (~20 percent of the homerange), often referred to as the core area (Bingham and Noon 1997, pp. 133-135). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997, p. 134) Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, pp. 21-22; Sisco 1990, p. iii).

Although differences exist in natural stand characteristics that influence provincial home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, pp. 98-99; Bart 1995, p. 944).

Habitat Use

Forsman et al. (1984, pp. 15-16) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather(Forsman 1975, p. 27; Forsman et al. 1984, pp. 15-16).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, p. 3; Forsman et al. 1984, pp. 29-30; Solis and Gutiérrez 1990, pp. 742-743). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, p. 30; Hershey et al. 1998, p. 1402). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Buchanan et al. 1995, p.1402; Folliard 1993, p. 40; Hershey et al. 1998, p. 1404).

Foraging habitat is the most variable of all habitats used by territorial spotted owls (USFWS 1992, p. 20). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutierrez 1996, p. 5).

Habitat Selection

Spotted owls generally rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics include the following: 1) a multi-layered, multi-species canopy dominated by large overstory trees, 2) moderate to high canopy closure, 3) a high incidence of trees with large cavities and other types of deformities, especially dwarf mistletoe brooms, 4) numerous large snags, 5) an abundance of large, dead wood on the ground, and 6) open space within and below the upper canopy for spotted owls to fly (Thomas et al. 1990, p. 19). Forested stands with high canopy closure also provide thermal cover, as well as protection from predation (Weathers et al. 2001, p. 686).

Foraging habitat for spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure (Courtney et al. 2004, pp. 5-15; Irwin et al. 2000, p. 180), snag volume, density of snags greater than 20 inches (50 cm) dbh (Courtney et al. 2004, p. 5-15; Irwin et al. 2000, pp. 179-180; North et al. 1999, p. 524), density of trees greater than or equal to 31 inches (80 cm) dbh (North et al. 1999, p. 524), volume of woody debris (Irwin et al. 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey et al. 1992, pp. 245-247; Irwin et al.

2000, pp. 178-179). Northern spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey et al. 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman et al. 2005, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities. Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (USFWS 1992, p. 1798). Forsman et al. (2002, p. 222) found that spotted owls could disperse through highly fragmented forest landscapes. However, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, considerable numbers of spotted owls also occur in younger forest stands, particularly in areas where hardwoods provide a multi-layered structure at an early age (Diller and Thome 1999, p. 275; Thomas et al. 1990, p. 158). In mixed conifer forests in the eastern Cascades in Washington, 27 percent of nest sites were in old-growth forests, 57 percent were in the understory reinitiation phase of stand development, and 17 percent were in the stem exclusion phase (Buchanan et al. 1995, p. 304). In the western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80 years old), and none were found in stands of less than 40 years old (Irwin et al. 2000, p. 41) .

In the Western Washington Cascade Mountains, spotted owls used mature/old forests dominated by trees greater than 20 in (50 cm) diameter-at-breast height with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season and used young forest trees 8 to 20 in (20 to 50 cm) diameter-at-breast height with greater than 60 percent canopy closure) less often than expected based on availability (Herter et al. 2002, p. 437).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected for old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Carey et al. 1990, pp. 14-15; Forsman et al. 1984, pp. 24-25; Forsman et al. 2005, pp. 372-373). Glenn et al. (2004, pp. 46-47) studied spotted owls in young forests in western Oregon and found little preference among age classes of young forest.

Habitat use is influenced by prey availability. Ward (1990, p. 62) found that spotted owls foraged in areas that had lower variance in prey densities (prey were more predictable in occurrence) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1996, p. 436) showed that spotted owl home ranges are larger where flying squirrels are the predominant prey and, conversely, are smaller where woodrats (*Neotoma* spp.) are the predominant prey.

Recent landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Franklin et al. 2000, pp. 573-579; Meyer et al. 1998, p. 43; Zabel et al. 2003, p. 1038). In Oregon Klamath and Western Oregon Cascade provinces, Dugger et al. (2005, p. 876) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger et al. 2005, pp. 873-874). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls.

It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger et al. (2005, p. 876) stated was generally much lower than those in Franklin et al. (2000) and Olson et al. (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony et al. (2006). Olson et al. (2004, pp. 1050-1051) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast Range. Olson et al. (2004, pp. 1049-1050) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area.

Reproductive Biology

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Gutierrez et al. 1995, p. 5). Spotted owls are sexually mature at 1 year of age, but rarely breed until they are 2 to 5 years of age (Forsman et al. 2002, p. 17; Franklin 1992, p. 821; Miller et al. 1985, p. 93). Breeding females lay one to four eggs per clutch, with the average clutch size being two eggs; however, most spotted owl pairs do not nest every year, nor are nesting pairs successful every year(Anthony et al. 2006, p. 28; Forsman et al. 1984, pp. 32-34), and renesting after a failed nesting attempt is rare (Gutierrez 1996, p. 4). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutierrez 1996, p. 4).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984, p. 32). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (Forsman et al. 1984, p. 38). During the first few weeks after the young leave the nest, the adults often roost with them during the day. By late summer, the adults are rarely found roosting with their young and usually only visit the juveniles to feed them at night (Forsman et al. 1984, p. 38). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Forsman et al. 2002, p. 18; Haig et al. 2001, p. 35).

Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Forsman et al. 2002, p. 13). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002, pp. 13-14; Miller et al. 1997, p. 143). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002, p. 16). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Forsman et al. 2002, pp. 18-19; Miller 1989, pp. 41-44). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Forsman et al. 2002, pp. 18-19; Gutierrez 1989, pp. 616-617; Hoberg et al. 1989, p. 249). Successful dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001, pp. 697-698).

There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman et al. 2002, p. 22). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear although radio telemetry data indicate that spotted owls move around large lakes rather than cross them (Forsman et al. 2002, p. 22). Analysis of genetic structure of spotted owl populations suggests adequate rates of gene flow may occur across the Puget Trough between the Olympic Mountains and Washington Cascades and across the Columbia River between the Olympic Mountains and the Coast Range of Oregon (Haig et al. 2001, p. 35).

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman et al. 2002, pp. 20-21). Breeding dispersal distances were shorter than natal dispersal distances and also apparently random in direction (Forsman et al. 2002, pp. 21-22).

Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, p. 51; Sovern et al. 1994, p. 202). The composition of the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984, pp. 40-41; Hamer et al. 2001, p. 224) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, California Klamath, and California Coastal provinces (Forsman et al. 1984, pp.

40-42; Forsman et al. 2004, p. 218; Ward et al. 1998, p. 84). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus, A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 1984, pp. 40-43; Forsman et al. 2004, p. 218; Hamer et al. 2001, p. 224; Ward et al. 1998, p. 84).

Other prey species such as the red tree vole (*Arborimus longicaudus*), red-backed voles (*Clethrionomys gapperi*), mice, rabbits and hares, birds, and insects) may be seasonally or locally important (Courtney et al. 2004, p. 4-27). For example, Rosenberg et al. (2003, p. 1720) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) (r2 = 0.68), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003, p. 1723). Ward (1990, p. 55) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman et al. 2001, p. 148; Forsman et al. 2004, pp. 218-219).

Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Gutierrez 1996, p. 5). The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000, p. 576).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000, p. 581). In coniferous forests, mean fledgling production of the California spotted owl *(Strix occidentalis occidentalis)*, a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000, p. 805), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999, p. 1). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996, p. 74; Zabel et al. 1996, pp. 437-438) and fluctuation in prey abundance (Zabel et al. 1996, pp. 437-438).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000, pp. 581-582). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000, pp. 581-582). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000, p. 583).

Olson et al. (2005, pp. 930-931) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

Reasons for Listing

The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (55 FR 26114-26194). More specifically, significant threats to the spotted owl included the following: 1) low populations, 2) declining populations, 3) limited habitat, 4) declining habitat, 5) distribution of habitat or populations, 6) isolation of provinces, 7) predation and competition, 8) lack of coordinated conservation measures; and (9) vulnerability to natural disturbance (57 FR 1796-1838). These threats were characterized for each province as severe, moderate, low, or unknown. Declining habitat was recognized as a severe or moderate threat to the spotted owl in all 12 provinces, isolation of provinces within 11 provinces, and declining populations in 10 provinces. Together, these three factors represented the greatest concern range-wide to the conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations a severe or moderate concern in eight provinces, suggesting that these factors are a concern throughout the majority of the range. Vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004, pp. 11-8 to 11-9). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, p. 84; Laidig and Dobkin 1995, p. 155). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

New Threats

The Service conducted a 5-year review of the spotted owl in 1994 (USFWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney et al. 2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 are:

- "Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects…In their questionnaire responses…6 of 8 panel member identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat" (Courtney et al. 2004, p. 11-7)

- "Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3 percent of the range-wide habitat base over a 10-year period)" (Courtney et al. 2004, p. 11-8)

- "Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations." (Courtney et al. 2004, p. 11-8)

Barred Owls

With its recent expansion to as far south as Marin County, California (Gutierrez et al. 2004, pp. 7-12 to 7-13), the barred owl's range now completely overlaps that of the spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001, p. 226) or habitat (Dunbar et al. 1991, p. 467; Hamer et al. 1989, p. 55; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998, p. 226). Evidence that barred owls are causing negative effects on spotted owls is largely indirect, based primarily on retrospective examination of long-term data collected on spotted owls (Kelly et al. 2003, p. 46; Olson et al. 2005, p. 921; Pearson and Livezey 2003, p. 267). It is widely believed, but not conclusively confirmed, that the two species of owls are competing for resources. However, given that the presence of barred owls has been identified as a negative effect while using methods designed to detect a different species (spotted owls), it seems safe to presume that the effects are stronger than estimated. Because there has been no research to quantitatively evaluate the strength of different types of competitive interactions, such as resource partitioning and competitive interference, the particular mechanism by which the two owl species may be competing is unknown.

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer 1988, p. 34; Iverson 1993, p. 39). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, p. 270; Schmidt 2006, p. 13). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005, p. 1).

The only study comparing spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with spotted owl diets (Hamer et al. 2001, p. 226). However, barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats, along with more terrestrial and diurnal species (Hamer et al. 2001, pp. 225-226).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005, p. 924) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. The occupancy of historical territories by spotted owls in Washington and Oregon was significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was "only marginally lower" ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003, p. 51). Pearson and Livezey (2003, p. 271) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005, p. 11) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005, p. 928) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area.

Olson et al. (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004, p. 89) was unfounded because of small sample sizes (Livezey 2005, p. 102). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (USFWS 2008, p. 65). Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate.

In a recent analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004, p. 807). Consequently, hybridization with the barred owl is considered to be "an interesting biological phenomenon that is probably inconsequential, compared with the real threat - direct competition between the two species for food and space" (Kelly and Forsman 2004, p. 808).

The preponderance of evidence suggests that barred owls are exacerbating the spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Gutierrez et al. 2004, pp. 7-39 to 7-40; Olson et al. 2005, pp. 930-931). There is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on spotted owls have been already fully realized" (Gutierrez et al. 2004, p. 7-38).

Wildfire

Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. Bond et al. (Bond et al. 2002, p. 1025) examined the demography of the three spotted owl subspecies after wildfires, in which wildfire burned through spotted owl nest and roost sites in varying degrees of severity. Post-fire demography parameters for the three subspecies were similar or better than long-term demographic parameters for each of the three subspecies in those same areas (Bond et al. 2002, p. 1026). In a preliminary study conducted by Anthony and Andrews (2004, p. 8) in the Oregon Klamath Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate.

In 1994, the Hatchery Complex fire burned 17,603 hectares in the Wenatchee National Forest in Washington's eastern Cascades, affecting six spotted owl activity centers (Gaines et al. 1997, p. 125). Spotted owl habitat within a 2.9-kilometer (1.8-mile) radius of the activity centers was reduced by 8 to 45 percent (mean = 31 percent) as a result of the direct effects of the fire and by 10 to 85 percent (mean = 55 percent) as a result of delayed mortality of fire-damaged trees and insects. Direct mortality of spotted owls was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after the fire (Gaines et al. 1997, p. 126). In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1998, pp. 2-3). Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. It appears that, at least in the short term, spotted owls may be resilient to the effects of wildfire—a process with which they have evolved. More research is needed to further understand the relationship between fire and spotted owl habitat use.

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (55 FR 26114: 26183 [June 26, 1990]). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss due to fire has been greater than expected with over 102,000 acres of late-successional forest lost on Federal lands from 1993-2004 (Moeur et al. 2005, p. 110). Currently, the overall total amount of habitat loss from wildfires has been relatively small, and is estimated at 1.2 percent on Federal lands (Lint 2005, p. v). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented throughout the spotted owl's range, in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004, p. 12-11). The Northwest Forest Plan (NWFP) recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77).

West Nile Virus

West Nile Virus (WNV) has killed millions of wild birds in North America since it arrived in 1999 (Caffrey 2003, p. 12; Marra et al. 2004, p. 393). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000, p. 3111). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died (Gancz et al. 2004, p. 2137), but there are no documented cases of the virus in wild spotted owls.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney et al. 2004, p. 8-31) but it is unknown how WNV will ultimately affect owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004, p. 8-33). Owls appear to be quite susceptible. For example, eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (Courtney et al. 2004, p. 8-33). Barred owls, in contrast, showed lower susceptibility (Courtney et al. 2004, p. 8-34).

Courtney et al. (2004, p. 8-35) offer two possible scenarios for the likely outcome of spotted owl populations being infected by WNV. One scenario is that a range-wide reduction in spotted owl population viability is unlikely because the risk of contracting WNV varies between regions. An alternative scenario is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl's current range. WNV remains a potential threat of uncertain magnitude and effect (Courtney et al. 2004, p. 8-34).

Sudden Oak Death

Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney et al. 2004, p. 11-8). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum*, that was recently introduced from Europe and is rapidly spreading. At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 186 miles (300 km) of the central and northern California coast (Rizzo et al. 2002, p. 733). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002, p. 441). It has been found in several different forest types and at elevations from sea level to over 2625 ft (800 m). Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney et al. 2004, p. 11-8).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity

Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, p. 922; Haig et al. 2004, p. 36). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad et al. 2004, p. 13). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004, p. 11-9). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Climate change

Climate change, a potential additional threat to spotted owl populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related biological diversity in Matrix Lands under the NWFP should contribute to the resiliency of the Federal forest landscape related to impacts of climate change (Courtney et al. 2004, p. 9-15).

Based upon a global meta-analysis of climate change data, Parmesan and Yohe (2003, pp. 37-42) discussed several potential implications of global climate change to biological systems, including terrestrial plants and animals. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, climate change trends were manifested in earlier nesting activities. Because the spotted owl exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001, p. 685), subtle changes in climate have the potential to affect spotted owls. However, the specific impacts to the species are unknown.

Disturbance-Related Effects

The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagen 1988, pp. 355-358). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.

Although information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*S. o. lucida*) to vacate otherwise suitable habitat (Swarthout and Steidl 2001, p. 314) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999, p. 70). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (Andersen et al. 1989, p. 296; McGarigal et al. 1991, p. 5; White and Thurow 1985, p. 14).

Spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990, p. 925). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia and Harvey 2000, pp. 517-518; Sapolsky et al. 2000, p. 1). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000, p. 517). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997, p. 1019). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, p.698; Tempel and Gutiérrez 2004, p. 538). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (Tempel and Gutiérrez 2004, p. 544; Wasser et al. 1997, p. 1021).

Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery):

Habitat-specific Needs

1. Large blocks of suitable habitat to support clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range;

2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range to facilitate survival and movement;

3. Suitable habitat distributed across a variety of ecological conditions within the spotted owl's range to reduce risk of local or widespread extirpation;

4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated, research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

2. Monitoring to better understand the risk that West Nile Virus and sudden oak death pose to spotted owls and, for West Nile Virus, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

<u>Conservation Strategy</u>

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. The various efforts began with the Interagency Scientific Committee's Conservation Strategy (Thomas et al. 1990). The efforts continued with the designation of critical habitat (57 FR 1796-1838, the Draft Recovery Plan (USFWS 1992); the Scientific Analysis Team report (Thomas et al. 1993); and the report of the Forest Ecosystem Management Assessment Team (FEMAT 1993). The efforts culminated with the NWFP (USDA and USDI 1994). Each conservation strategy was based upon the reserve design principles first articulated in the Interagency Scientific Committee's report, which are summarized as follows:

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.

- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.

- Blocks of habitat that are close together are better than blocks far apart. Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.

- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

<u>Conservation on Federal Lands</u>

Since it was signed on April 13, 1994, the NWFP has guided the management of Federal forest lands within the range of the spotted owl (1994; USFS and USBLM 1994). The NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl, as well as to produce a predictable and sustainable level of timber sales. The NWFP included land use allocations which would provide for population clusters of spotted owls (i.e., demographic support) and maintain connectivity between population clusters. Certain land use allocations in the plan contribute to supporting population clusters: Late-successional Reserves (LSRs), Managed Late-successional Areas, and Congressionally Reserved areas. Riparian Reserves, Adaptive Management Areas and Administratively Withdrawn areas can provide both demographic support and connectivity/dispersal between the larger blocks, but were not necessarily designed for that purpose. Matrix areas were to support timber production while also retaining biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (1994; USFS and USBLM 1994) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et al. 2006, pp. 279-280): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USFWS 1992) was based on the ISC report.

The Forest Ecosystem Management Assessment Team predicted, based on expert opinion, the spotted owl population would decline in the Matrix land use allocation over time, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas et al. 1993, p. II-31; USFS and USBLM 1994, p. 3&4-229). Based on the results of the first decade of monitoring, Lint (2005, p. 18) could not determine whether implementation of the NWFP would reverse the spotted owl's declining population trend because not enough time had passed to provide the necessary measure of certainty. However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, p. 18; Noon and Blakesley 2006, p. 288). (Courtney et al. 2004, p. 6-34) suggested that more fuels treatments are needed in east-side forests to preclude large-scale losses of habitat to stand-replacing wildfires. Other stressors that occur in suitable habitat, such as the range expansion of the barred owl (already in action) and infection with WNV (which may or may not occur) may complicate the conservation of the spotted owl. Recent reports about the status of the spotted owl offer few management recommendations to deal with these emerging threats. The arrangement, distribution, and resilience of the NWFP land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Courtney et al. 2004, p. 6-34).

Under the NWFP, the agencies anticipated a decline of spotted owl populations during the first decade of implementation. Recent reports (Anthony et al. 2006, pp. 33-34) identified greater than expected spotted owl declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004, p. 9-12; Lint 2005, p. 87). Even with the population decline, Courtney et al (2004, p. 9-15) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

The current scientific information, including information showing spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USFWS 2004, p. 54). That is, populations are still relatively numerous over most of its historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered; even though, in the northern part of its range population trend estimates are showing a decline.

Revised Northern Spotted Owl Recovery Plan

In June 2011, the Service published the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011). The recovery plan identifies that competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and catastrophic fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances are the most important range-wide threats to the spotted owl (USFWS 2011, p. II-2). To address these threats, the revised recovery strategy has identified 33 Recovery Actions which address four basic steps:

1. Development of a range-wide habitat modeling tool;
2. Habitat conservation and active forest restoration
3. Barred owl management;
4. Research and monitoring.

In addition to describing specific actions to address the barred owl threat, the Revised Recovery Plan continues to recognize the importance of maintaining and restoring high value habitat for the recovery and long-term survival of the spotted owl.

To address habitat conservation, the Revised Recovery Plan recommends land managers continue to implement the standards and guidelines of the NWFP throughout the range of the species, as well as fully consider other habitat conservation recommendations listed in the Revised Recovery Plan (USFWS 2011, p. II-3).

Conservation Efforts on non-Federal Lands

In the report from the Interagency Scientific Committee (Thomas et al. 1990, p. 3), the draft recovery plan (USFWS 1992, p. 272), and the report from the Forest Ecosystem Management Assessment Team (Thomas et al. 1993, p. IV-189), it was noted that limited Federal ownership in some areas constrained the ability to form a network of old-forest reserves to meet the conservation needs of the spotted owl. In these areas in particular, non-Federal lands would be important to the range-wide goal of achieving conservation and recovery of the spotted owl. The U.S. Fish and Wildlife Service's primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to Federal lands, or their connectivity with

Federal lands. In addition, timber harvest within each state is governed by rules that provide protection of spotted owls or their habitat to varying degrees.

There are 17 current or completed Habitat Conservation Plans (HCPs) that have incidental take permits issued for spotted owls—eight in Washington, three in Oregon, and four in California (USFWS 2008, p. 55). The HCPs range in size from 40 acres to more than 1.6 million acres, although not all acres are included in the mitigation for spotted owls. In total, the HCPs cover approximately 2.9 million acres (9.1 percent) of the 32 million acres of non-Federal forest lands in the range of the spotted owl. The period of time that the HCPs will be in place ranges from 5 to 100 years; however, most of the HCPs are of fairly long duration. While each HCP is unique, there are several general approaches to mitigation of incidental take:

- Reserves of various sizes, some associated with adjacent Federal reserves.
- Forest harvest that maintains or develops suitable habitat.
- Forest management that maintains or develops dispersal habitat.
- Deferral of harvest near specific sites.

Washington. In 1996, the State Forest Practices Board adopted rules (WFPB 1996) that would contribute to conserving the spotted owl and its habitat on non-Federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Buchanan et al. 1994, p. ii; Hanson et al. 1993, pp. 11-15). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Sweeden 2005, p. 9). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USFWS 1992, p. 272).

Oregon. The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (ODF 2007, p. 64) . In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-Federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades (USFWS 2008, p. 56).

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (CDF 2007, pp. 85-87). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (CDF 2007, pp. 85-87) (California Department of Forestry and Fire Protection 2007, pp. 85-87). The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the U.S. Fish and Wildlife Service took over that review function in 2000. Several large industrial owners operate under spotted owl management plans that have been reviewed by the U.S. Fish and Wildlife Service and that specify basic measures for spotted owl protection. Four HCPs authorizing take of spotted owls have been approved; these HCPs cover more than 669,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands (USFWS 2008, p. 56).

Current Condition of the Spotted Owl

The current condition of a species incorporates the effects of all past human and natural activities or events that have led to the present-day status of the species and its habitat (USFWS and NMFS 1998, pp. 4-19).

<u>Range-wide Habitat Trends</u>

Habitat Baseline

The 1992 Draft Spotted Owl Recovery Plan estimated approximately 8.3 million acres of spotted owl habitat remained range-wide (USFWS 1992, p. 37). However, reliable habitat baseline information for non-Federal lands is not available (Courtney et al. 2004, p. 6-5). The Service has used information provided by the U.S. Forest Service, Bureau of Land Management, and National Park Service to update the habitat baseline conditions on Federal lands for spotted owls on several occasions since the spotted owl was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994, p. G-34) was determined to be representative of the general amount of spotted owl habitat on these lands. This baseline was used to track relative changes over time in subsequent analyses.

In 2005, a new map depicting suitable spotted owl habitat throughout their range was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005, pp. 21-82). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The Service is evaluating the map for future use in tracking habitat trends. Additionally, there are no reliable estimates of spotted owl habitat on other land ownerships; consequently, acres that have undergone ESA section 7 consultation can be tracked, but not evaluated in the context of change with respect to a reference condition on non-Federal lands. The production of the NWFP monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-Federal habitat.

NWFP Lands Analysis 1994 – 2001

In 2001, the Service conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USFWS 2001, p. 1). This range-wide evaluation of habitat, compared to the Final Supplemental Environmental Impact Statement, was necessary to determine if the rate of potential change to spotted owl habitat was consistent with the change anticipated in the NWFP. In particular, the Service considered habitat effects that were documented through the ESA section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals established by the NWFP land-use allocations (USDA and USDI 1994), with effects expressed in terms of changes in suitable spotted owl habitat within those land-use allocations. The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USFWS 2001, p. 32).

Range-wide Analysis 1994 – Present.

This section updates the information considered in U.S. Fish and Wildlife Service (2001), relying particularly on information in documents the Service produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect and disease). To track impacts to spotted owl habitat, the Service designed the Consultation Effects Tracking System database which records impacts to spotted owls and their habitat at a variety of spatial and temporal scales. Data are entered into the database under various categories including, land management agency, land-use allocation, physiographic province, and type of habitat affected.

In 1994, about 7.4 million acres of suitable spotted owl habitat were estimated to exist on Federal lands managed under the NWFP. As of September 13, 2011, the Service had consulted on the proposed removal of approximately 191,301 acres (Table 1) or 2.59 percent of 7.4 million acres of spotted owl suitable habitat on Federal lands. Of the total Federal acres consulted on for removal, approximately 162,886 acres or 2.2 percent of 7.4 million acres of spotted owl habitat were removed as a result of timber harvest. These changes in suitable spotted owl habitat are consistent with the expectations for implementation of the NWFP (USDA and USDI 1994).

April 13, 2004 marked the start of the second decade of the NWFP. Decade specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but can be calculated using the Service's Consultation Effects Tracking system.

Habitat loss from Federal lands due to management activities has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve relative to the Reserve land-use allocations (Table 2). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (78 percent), especially within its Klamath Mountains (39 percent) and Cascades (East and West) (37 percent) Provinces, followed by much smaller habitat losses in Washington (10 percent) and California (12 percent) (Table 2).

From 1994 through April 4, 2011, habitat lost due to natural events was estimated at approximately 215,892 acres range-wide (Table 2). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,451 acres of spotted owl habitat, including habitat within five LSRs. Approximately 18,630 acres of spotted owl habitat were lost due to the B&B Complex and Davis Fires in the East Cascades Province of Oregon. When habitat loss from natural events and timber harvest is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (20.3 percent) and the Cascades East (12.99 percent) provinces have proportional losses greater than the range-wide mean (5.5 percent) (Table 2).

Because there is no comprehensive spotted owl habitat baseline for non-Federal lands, there is little available information regarding spotted owl habitat trends on non-Federal lands. Yet, we do know that internal Service consultations conducted since 1992 have documented the eventual loss of 472,772 acres (Table 1) of habitat on non-Federal lands. Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs. Combining effects on Federal and non-Federal lands, the Service had consulted on the proposed removal of approximately 664,073 acres of spotted owl habitat range-wide, resulting from all management activities, as of September 13, 2011 (Table 1).

Table 1. Range-wide changes in spotted owl NRF[1] habitat (in acres) caused by Federal actions subject to section 7 consultations and natural disturbance events (wildfire, etc.) from May 1994 to present (September 13, 2011).

Land Ownership	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
Northwest Forest Plan (USFS, BLM, NPS)	191,301	513,435	215,892	39,051
Bureau of Indian Affairs/ Tribes	108,210	28,372	2,398	0
Habitat Conservation Plans / Safe Harbor Agreements	295,889	14,430	N/A	N/A
Other Federal, State, County, or Private Lands	68,673	21,894	279	0
TOTAL Changes	664,073	578,131	218,569	39,051

Source: Table A from the Service's Northern Spotted Owl Consultation Effects Tracker (web application and database) September 13, 2011.

1 Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-June 6, 2001. After June 26, 2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

2 Includes both effects reported by U.S. Fish and Wildlife Service (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracker (web application and database).

3 Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

[4] The 'Multi-agency' grouping is used to lump a variety of NWFP mixed agency or admin unit consultations that were reported together prior to June 26, 2001, and cannot be separated out.

[5] Includes lands that are owned or managed by other Federal agencies not included in the NWFP.

[6] Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across U.S. Forest Service and Bureau of Land Management lands are included.

Table 2. Aggregate results of all adjusted, suitable habitat (NRF[1]) acres affected by ESA section 7 consultation for the spotted owl; baseline and summary of effects by state, physiographic province, and land use function from 1994 to present for lands managed under the NWFP (September 13, 2011).

Physiographic Province[2]		Evaluation Baseline[3]	Habitat Removed/Downgraded[4]					% Provincial Baseline Affected	% Range-wide Effects
			NWFP Land Use Allocations			Habitat Loss to Natural Events[7]	Total (Consultation and Natural Event Effects)		
		Total	Reserves[5]	Non-Reserves[6]	Total Consultation Effects				
WA	Eastern Cascades	706,849	4,522	6,392	10,914	14,307	25,221	3.57	6.19
	Olympic Peninsula	560,217	869	1,711	2,580	299	2,879	0.51	0.71
	Western Cascades	1,112,480	1,681	10,870	12,551	3	12,554	1.13	3.08
OR	Cascades East	443,659	2,500	14,249	16,749	40,884	57,633	12.99	14.15
	Cascades West	2,046,472	3,862	65,946	69,808	24,583	94,391	4.61	23.18
	Coast Range	516,577	447	3,844	4,291	66	4,357	0.84	1.07
	Klamath Mountains	785,589	2,631	55,430	58,061	101,676	159,737	20.33	39.23
	Willamette Valley	5,658	0	0	0	0	0	0	0
CA	Cascades	88,237	10	4,820	4,830	329	5,159	5.85	1.27
	Coast	51,494	464	79	543	100	643	1.25	0.16
	Klamath	1,079,866	1,546	9,428	10,974	33,645	44,619	4.13	10.96
	Total	7,397,098	18,532	172,769	191,301	215,892	407,193	5.50	100

Source: Table B from the Service's Northern Spotted Owl Consultation Effects Tracker (web application and database) September 13, 2011.
Notes:

1 Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-June 26, 2001. After June 26, 2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

2 Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3 and 4-1 on page 3 and 4-16 of the Final Supplemental Environmental Impact Statement (FSEIS) (USFS and USBLM 1994).

3 1994 FSEIS baseline (USFS and USBLM 1994).

4 Includes both effects reported by USFWS (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System (web application and database).

5 Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs (LSR, MLSA, CRA).

6 Land-use allocations intended to provide habitat to support movement of spotted owls among reserves (Matrix, AMA, AWA).

7 Acres for all physiographic provinces, except the Oregon Klamath Mountains, are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004, p. 6-5) and subsequent effects entered into the Northern Spotted Owl Consultation Effects Tracking System. Acres for the Oregon Klamath Mountains province are from the biological assessment entitled: Fiscal year 2006-2008 programmatic consultation: re-initiation on activities that may affect listed species in the Rogue-River/South Coast Basin, Medford BLM, and Rogue-Siskiyou National Forest and from subsequent effects entered into the Northern Spotted Owl Consultation Effects Tracking System.

Other Habitat Trend Assessments

In 2005, the Washington Department of Wildlife released the report, "*An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004*" (Pierce et al. 2005). This study estimates the amount of spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005, p. 88) estimated there was 816,000 acres of suitable spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce and others (2005, p. 98) estimated there were less than 2.8 million acres of spotted owl habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56 percent) occurred on Federal lands, and lesser amounts were present on state-local lands (21 percent), private lands (22 percent) and tribal lands (1 percent).

Most of the harvested spotted owl habitat was on private (77 percent) and state-local (15 percent) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million-acre study area, including harvest of 56,400 acres of suitable spotted owl habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005, p. 91). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce and others (2005, p. 80) also evaluated suitable habitat levels in 450 spotted owl management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for spotted owl territories (Pierce et al. 2005, p. 90).

Moeur et al. (2005, p. 110) estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. The net area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres (Moeur et al. 2005, p. 100). The estimates were based on change-detection layers for losses due to harvest and fire and remeasured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subset of Forest Service land types and applied to all Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with spotted owl habitat, the significance of these acres to spotted owl conservation remains unknown.

<u>Spotted Owl Numbers, Distribution, and Reproduction Trends</u>

There are no estimates of the historical population size and distribution of spotted owls, although they are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USFWS 1989, pp. 2-

17). The final rule listing the spotted owl as threatened (55 FR 26114-26194 [June 26, 1990]), estimated that approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on federally managed lands, 1.4 percent on State lands, and 6.2 percent on private lands. The percent of spotted owls on private lands in northern California was slightly higher (Thomas et al. 1990, p. 64; USFWS 1989, pp. 4-11).

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (55 FR 26114 [June 26, 1990]). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (USFWS 1992, p. 31). The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

As of July 1, 1994, there were 5,431 known locations of, or site centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 (53 percent) in Oregon, and 1,687 (31 percent) in California (60 FR 9484:9495 [Feb. 17, 1995]). By June 2004, the number of territorial spotted owl sites recognized by Washington Department of Fish and Wildlife was 1,044 (Buchanan and Sweeden 2005, p. 37). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (USFWS 2008, p. 44). In addition, many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994. The totals listed in 60 FR 9484:9495 [Feb. 17, 1995], represent the cumulative number of locations recorded in the three states, not population estimates.

Because existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, researchers use other indices, such as demographic data, to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the rate and direction of population growth [i.e., lambda (λ)]. A λ of 1.0 indicates a stationary population (i.e., neither increasing nor decreasing), a λ less than 1.0 indicates a declining population, and a λ greater than 1.0 indicates a growing population. Demographic data, derived from studies initiated as early as 1985, have been analyzed periodically (Anderson and Burnham 1992; Anthony et al. 2006; Burnham et al. 1994; Forsman et al. 1996; Forsman et al. 2011) to estimate trends in the populations of the spotted owl.

In January 2009, two meta-analyses modeled rates of population change for up to 24 years using the re-parameterized Jolly-Seber method (λRJS). One meta-analysis modeled the 11 long-term study areas (Table 3), while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Forsman et al. 2011, cited in USFWS 2011, p. A-5).

Table 3. Summary of spotted owl population trends in demographic study areas (Forsman et al. 2011, cited in USFWS 2011, p. A-5).

Study Area	Fecundity	Apparent Survival[1]	λ_{RJS}	Population change[2]
Cle Elum	Declining	Declining	0.937	Declining
Rainier	Increasing	Declining	0.929	Declining
Olympic	Stable	Declining	0.957	Declining
Coast Ranges	Increasing	Declining since 1998	0.966	Declining
HJ Andrews	Increasing	Declining since 1997	0.977	Declining
Tyee	Stable	Declining since 2000	0.996	Stationary
Klamath	Declining	Stable	0.990	Stationary
Southern Cascades	Declining	Declining since 2000	0.982	Stationary
NW California	Declining	Declining	0.983	Declining
Hoopa	Stable	Declining since 2004	0.989	Stationary
Green Diamond	Declining	Declining	0.972	Declining

[1]Apparent survival calculations are based on model average.
[2]Population trends are based on estimates of realized population change.

Point estimates of λRJS were all below 1.0 and ranged from 0.929 to 0.996 for the 11 long-term study areas. There was strong evidence that populations declined on 7 of the 11 areas (Forsman et al. 2011, p. 65), these areas included Rainier, Olympic, Cle Elum, Coast Range, HJ Andrews, Northwest California and Green Diamond. On other four areas (Tyee, Klamath, Southern Cascades, and Hoopa), populations were either stable, or the precision of the estimates was not sufficient to detect declines.

The weighted mean λRJS for all of the 11 study areas was 0.971 (standard error [SE] = 0.007, 95 percent confidence interval [CI] = 0.960 to 0.983), which indicated an average population decline of 2.9 percent per year from 1985 to 2006. This is a lower rate of decline than the 3.7 percent reported by Anthony et al. (2006), but the rates are not directly comparable because Anthony et al. (2006) examined a different series of years and because two of the study areas in their analysis were discontinued and not included in Forsman et al. (2011, p. 65). Forsman et al. (2011, p. 65) explains that the indication populations were declining was based on the fact that the 95 percent confidence intervals around the estimate of mean lambda did not overlap 1.0 (stable) or barely included 1.0.

The mean λRJS for the eight demographic monitoring areas (Cle Elum, Olympic, Coast Range, HJ Andrews, Tyee, Klamath, Southern Cascades and Northwest California) that are part of the effectiveness monitoring program of the NWFP was 0.972 (SE = 0.006, 95 percent CI = 0.958 to 0.985), which indicated an estimated decline of 2.8 percent per year on Federal lands with the range of the spotted owl. The weighted mean estimate λRJS for the other three study areas (Rainier, Hoopa and Green Diamond) was 0.969 (SE = 0.016, 95 percent CI = 0.938 to 1.000), yielding an estimated average decline of 3.1 percent per year. These data suggest that demographic rates for spotted owl populations on Federal lands were somewhat better than elsewhere; however, this comparison is confounded by the interspersion of non-Federal land in study areas and the likelihood that spotted owls use habitat on multiple ownerships in some demography study areas.

The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Olympic, Cle Elum, and Rainier study areas in Washington and the Coast Range study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period through 2006 (Forsman et al. 2011, p. 66). Spotted owl populations on the HJ Andrews, Northwest California, and Green Diamond study areas declined by 20-30 percent whereas the Tyee, Klamath, Southern Cascades, and Hoopa study areas showed declines of 5 to 15 percent.

Decreases in adult apparent survival rates were an important factor contributing to decreasing population trends. Forsman et al.(2011, pp. 65-66) found apparent survival rates were declining on 10 of the study area with the Klamath study area in Oregon being the exception. Estimated declines in adult survival were most precipitous in Washington where apparent survival rates were less than 80 percent in recent years, a rate that may not allow for sustainable populations (Forsman et al. 2011, p. 66). In addition, declines in adult survival for study areas in Oregon have occurred predominately within the last five years and were not observed in the previous analysis by Anthony et al. (2006). Forsman et al. (Forsman et al. 2011, p. 64) express concerns by the collective declines in adult survival across the subspecies range because spotted owl populations are most sensitive to changes in adult survival.

There are few spotted owls remaining in British Columbia. Chutter et al. (2004, p. v) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. So, in 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls (USFWS 2008, p. 48). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. v). The amount of previous interaction between spotted owls in Canada and the United States is unknown.

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Appendix B: Status of Critical Habitat - Northern Spotted Owl

Appendix B
STATUS OF CRITICAL HABITAT - NORTHERN SPOTTED OWL

Legal Status

On January 15, 1992, the Service designated northern spotted owl (spotted owl) critical habitat within 190 critical habitat units (CHUs) which encompassed nearly 6.9 million acres of Federal lands in California, Oregon, and Washington (57 FR 1796-1838). On August 13, 2008, the Service revised spotted owl critical habitat into 29 units, comprised of 174 subunits, on approximately 5,312,300 acres of Federal lands in California, Oregon, and Washington (73 FR 47326-47522).

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the spotted owl critical habitat final rule include forest types that support the spotted owl across its geographic range when they occur in concert with a) nesting, roosting, foraging, and/or dispersal habitat, or b) lands capable of developing one or more of these habitats in the future (73 FR 47347-47348).

Forests

Forest types that support the spotted owl across its geographic range. These forest types are primarily Sitka spruce, western hemlock, mixed conifer and mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir (in coastal California and southwestern Oregon), and the moist end of the ponderosa pine coniferous forests zones at elevations up to approximately 3,000 ft (914m) near the northern edge of the range and up to approximately 6,000 ft (1, 828 m) at the southern edge. These forest types may be in early-, mid-, or late-seral stages. This PCE is essential to the conservation of the species because it provides the biotic communities that are known to be necessary for the spotted owl. This PCE must occur in concert with at least one of the PCEs below. (73 FR 47347)

Nesting, Roosting, and Foraging Habitat

The forest types described above that contain one or more of the habitat types described below to meet the home range needs of territorial pairs of spotted owls throughout the year or that are habitat-capable of developing one or more of these habitat types. Areas that are ‘‘habitat capable’’ of developing an essential habitat component are those forest types described above and that provide the requisite ecological conditions (e.g., moisture regime, soils, aspect, slope, potential vegetative community) for growing and sustaining the structural conditions required for that habitat component. A home range provides the habitat components essential for the survival and successful reproduction of a resident breeding pair of spotted owls. The amount, quality, and configuration of these habitat types required for a home range varies according to local conditions and factors such as the degree of habitat fragmentation, proportion of available nesting habitat, and primary prey species. The core area of the home range is used most intensively and usually includes the nesting area. The remainder of the home range is used for foraging and roosting. The size of home ranges extend from approximately 2,955 acres (1,196 ha) in the Oregon Cascades to approximately 14,271 acres (5,775 ha) on the Olympic Peninsula of Washington. The size of core areas extends from approximately 500 acres (202 ha) in the southern part of the species' range to approximately 4,057 acres (1,642 ha) in the northern part of the range (73 FR 47347). The three habitat types within the home range of a spotted owl are:

Nesting habitat. Nesting habitat is essential to provide structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risks. It includes a moderate to high canopy closure (60 to 80 percent); a multi-layered, multi-species canopy with large (generally greater than 30 inches (76 cm) diameter at breast height (dbh)) overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other platforms); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly. Patches of nesting habitat, in combination with roosting habitat must be sufficiently large and contiguous to maintain spotted owl core areas and home ranges, and must be proximate to foraging habitat. Nesting habitat can also function as roosting, foraging, and dispersal habitat (73 FR 47347).

Roosting habitat. Roosting habitat is essential to provide for thermoregulation, shelter, and cover to reduce predation risk while resting or foraging. It differs from nesting habitat in that it need not contain those specific structural features used for nesting (such as trees with cavities, broken tops, and mistletoe platforms), but does contain moderate to high canopy closure (60 to 80 percent); a multi-layered, multi- species canopy; large accumulations of fallen trees and other woody debris on the ground; and open space below the canopy for spotted owls to fly. Roosting habitat will also function as foraging and dispersal habitat, but not as nesting habitat due to lack of nesting structures (73 FR 47347).

Foraging habitat. Foraging habitat is essential to provide a food supply for survival and reproduction. It contains some roosting habitat attributes but can consist of more open and fragmented forests or, especially in the southern portion of the range where some younger stands may have high prey abundance and structural attributes similar to those of older forests, such as moderate tree density, subcanopy perches at multiple levels, multi-layered vegetation, or residual older trees. Foraging habitat can also function as dispersal habitat (73 FR 47348).

Dispersal Habitat

Forest types described above that provide one or both of the habitat components described below that are essential to the dispersal of juvenile and non-territorial spotted owls, or that are capable of developing one or both of these components. Dispersal habitat can occur in intervening areas between larger blocks of nesting, foraging, and roosting habitat or within blocks of nesting, roosting, and foraging habitat. Dispersal habitat is essential to maintaining stable populations by supporting transient spotted owls which can fill territorial vacancies when resident spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species (73 FR 47348). The two types of dispersal habitat are:

(A) Habitat supporting the transience phase of spotted owl dispersal contains stands with adequate tree size and canopy closure to provide protection from avian predators and minimal foraging opportunities. This may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the movement phase.

(B) Habitat supporting the colonization phase of spotted owl dispersal is generally equivalent to roosting and foraging habitat described above, although it may be in smaller amounts than that needed to support nesting pairs.

The critical habitat designation describes the PCEs essential to support the life history functions of the spotted owl in the amount and configuration required for the species' conservation. Because not all life history functions require all of the PCEs, not all of the critical habitat will contain all of the PCEs. Some units contain all PCEs and support multiple life processes, while some units contain only a portion of the PCEs necessary to support the species' particular use of that habitat. However, all of the critical habitat units in the designation support at least the first PCE described (forest-type) in conjunction with at least one of the other PCEs described above (73 FR 47348).

Conservation Role of Critical Habitat

The conservation role of spotted owl critical habitat is to identify those lands that are essential to the recovery of the species that may require special management considerations or protections (73 FR 47344). Generally, the conservation role of spotted owl critical habitat is to support a viable spotted owl population at the rangewide scale by providing a network of functional units within each physiographic province (73 FR 47358). For a wide-ranging species such as the spotted owl, where multiple CHUs are designated, each unit has a provincial and rangewide role in contributing to the conservation of the species. The size and distribution of the CHUs is the based on the "managed owl conservation areas (MOCAs) recommended in the 2008 *Final Recovery Plan for the Northern Spotted Owl* (USFWS 2008) in the western portion of the species range, and on proposed MOCAs recommended under Option 1 in the *Draft Recovery Plan for the Northern Spotted Owl* (USFWS 2007) in the eastern portion of the species range (73 FR 47330).

The MOCAs comprise a network of both large habitat blocks (capable of supporting 20 or more breeding pairs of owls (MOCA 1s), and small habitat blocks (capable of supporting up to 19 breeding pairs of owls (MOCA 2s). The MOCAs (and subsequent CHUs) form a habitat network designed to support stable and well-distributed populations of spotted owls over time and allow for movement of spotted owls across the landscape (USFWS 2008, p. 13). The Federal lands comprising the MOCA network of the final recovery plan include areas of congressionally reserved lands, such as designated wilderness areas; these areas were therefore included in the recovery plan's assessment that the MOCA network is sufficient to achieve the recovery of the spotted owl. As in the 1992 designation of critical habitat, congressionally-reserved lands such as designated Wilderness areas and National Parks are not included within the boundaries of the critical habitat designation. However, the contribution of these congressionally-reserved areas must be considered in any evaluation of the sufficiency of the overall conservation habitat network for the recovery of the spotted owl (73 FR 47328).

Current Condition of Critical Habitat

Summary of Range-wide Conditions

We designated 29 units as critical habitat for the spotted owl on Federal lands in Washington, Oregon, and California. These areas encompass over 5.3 million acres. Currently we estimate that approximately 98 percent of these lands are "habitat capable" (i.e., lands that are capable of supporting forest types that spotted owls use). Within the CHUs, many habitat areas are currently fragmented primarily due to past timber harvest, wildfire, disease, and wind-throw. Based on the spotted owl habitat data developed for monitoring the Northwest Forest Plan (Davis and Lint 2005), we estimate that approximately 50 percent of the lands within CHUs currently contain spotted owl habitat (2.6 million acres). Given natural events such as fire, windstorms, and insect damage, not all habitat capable lands in a CHU are likely to be high quality habitat at any one time. However, these lands retain the physical and biological features necessary to allow for the regrowth of the habitat characteristics required by spotted owls and are essential to achieving the area, quality, and configuration of habitat blocks required for recovery of the owl (USFWS 2008, p. 13).

Section 7 analyses of activities affecting spotted owl critical habitat consider the effects of proposed actions on the ability of the critical habitat to support a viable spotted owl population at the scale of individual CHUs, the physiographic province, and the rangewide scales (73 FR 47358). Following the revision of critical habitat in August, 2008, the Service has completed section 7 consultations on the removal of approximately 2,491 acres of suitable spotted owl habitat within critical habitat units in Washington, Oregon, and California (Table 1). We have also documented the loss of approximately 11,868 acres of suitable spotted owl habitat from wildfires and other natural events that occurred within designated CHUs (Table 1). The Service concluded that the effect of this habitat loss is not likely to destroy or adversely modify designated critical habitat.

Table 1. Changes in spotted owl suitable habitat within designated critical habitat from August 13, 2008 to present (September 13, 2011), resulting from Federal management actions and natural events by physiographic province.

Physiographic Province[4]		Evaluation Baseline[1]	Suitable[2] Critical Habitat Removed/Downgraded[3]			Percent Provincial Baseline Affected	Percent of Total Effects
		Acres of suitable habitat	Habitat loss to management activities (acres)	Habitat loss to natural events (acres)	Total Acres		
WA	Olympic Peninsula	149,090	6	0	6	<0.01%	0.04%
	Eastern Cascades	188,720	38	45	83	0.04%	0.58%
	Western Cascades	415,620	0	3	3	<0.01%	0.02%
	Western Lowlands	0	0	0	0	0	0.00%
OR	Coast Range	303,680	0	0	0	0	0.00%
	Klamath Mountains	210,430	1,293	0	1,293	0.01%	9.00%
	Cascades East	109,140	873	0	873	0.01%	6.08%
	Cascades West	498,020	4	0	4	<0.01%	0.03%
	Willamette Valley	0	0	0	0	0	0.00%
CA	Coast	53,480	0	0	0	0	0.00%
	Cascades	137,010	189	1,162	1,351	0.01%	9.41%
	Klamath	583,690	88	10,658	10,746	0.02%	74.84%
Total		2,648,880	2,491	11,868	14,359	0.54%	100

1. Revised critical habitat baseline is based on range-wide habitat maps developed by Davis and Lint (2005).
2. Nesting, roosting, foraging (NRF) habitat.
3. Includes effects reported by each field office.
4. Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

Source: Table D from the Service's Northern Spotted Owl Consultation Effects Tracker (web application and database).

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Appendix C: Status of the Species - Marbled Murrelet

Appendix C
STATUS OF THE SPECIES - MARBLED MURRELET

Legal Status

The marbled murrelet (murrelet) was listed as a threatened species[3] on September 28, 1992, in Washington, Oregon, and northern California (57 FR 45328 [October 1, 1992]). Since the species' listing, the U.S. Fish & Wildlife Service (Service) has completed two 5-yr status reviews of the species: September 1, 2004 (USFWS 2004) and June 12, 2009 (USFWS 2009). The legal status of the murrelet remains unchanged from the original designation.

Threats to Murrelet Survival and Recovery

Murrelets are long-lived seabirds that spend most of their life in the marine environment, with breeding adult birds annually nesting in the forest canopy of mature and old-growth forests from April 1 through September 15. Murrelets have a naturally low reproductive rate. Breeding adults lay just one egg and renesting, in the event of nest failure, is thought to be an extremely rare event.

Several threats to murrelets, present in both the marine and terrestrial environments, have been identified. These threats collectively comprise a suite of environmental stressors that, individually or through interaction, have significantly disrupted or impaired behaviors which are essential to the reproduction or survival of individuals. When combined with the species naturally low reproductive rate, these stressors have led to declines in murrelet abundance, distribution, and reproduction at the population scale within the listed-range.

When the murrelet was listed under the Endangered Species Act (57 FR 45333-45336 [October 1, 1992]) and summarized in the Recovery Plan (USFWS 1997a, pp. 43-76), several anthropogenic threats were identified as having caused the dramatic decline in the species.

- habitat destruction and modification in the terrestrial environment from timber harvest and human development caused a severe reduction in the amount of nesting habitat
- unnaturally high levels of predation resulting from forest "edge effects" ;
- the existing regulatory mechanisms, such as land management plans (in 1992), were considered inadequate to ensure protection of the remaining nesting habitat and reestablishment of future nesting habitat; and
- manmade factors such as mortality from oil spills and entanglement in fishing nets used in gill-net fisheries.

[3] The Act defines a threatened species as a species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

There have been changes in the levels of these threats since the 1992 listing (USFWS 2004, pp. 11-12; USFWS 2009, pp. 27-67). The regulatory mechanisms implemented since 1992 that affect land management in Washington, Oregon, and California (for example, the Northwest Forest Plan (NWFP)) and new gill-netting regulations in northern California and Washington have reduced the threats to murrelets (USFWS 2004, pp. 11-12). The threat levels for the other threats identified in 1992 listing (57 FR 45333-45336 [October 1, 1992]) including the loss of nesting habitat, predation rates, and mortality risks from oil spills and gill net fisheries (despite the regulatory changes) remained unchanged following the Service's 2004, 5-year, range-wide status review for the murrelet (USFWS 2004, pp. 11-12).

However, new threats were identified in the Service's 2009, 5-year review for the murrelet (USFWS 2009, pp. 27-67). These new stressors are due to several environmental factors affecting murrelets in the marine environment. These new stressors include:

- Habitat destruction, modification, or curtailment of the marine environmental conditions necessary to support murrelets due to:
    - elevated levels of polychlorinated biphenyls in murrelet prey species;
    - changes in prey abundance and availability;
    - changes in prey quality;
    - harmful algal blooms that produce biotoxins leading to domoic acid and paralytic shellfish poisoning that have caused murrelet mortality; and
    - climate change in the Pacific Northwest.
- Manmade factors that affect the continued existence of the species include:
    - derelict fishing gear leading to mortality from entanglement;
    - energy development projects (wave, tidal, and on-shore wind energy projects) leading to mortality; and
    - disturbance in the marine environment (from exposures to lethal and sub-lethal levels of high underwater sound pressures caused by pile-driving, underwater detonations, and potential disturbance from high vessel traffic).

Detailed discussions of the above-mentioned threats, life-history, biology, and status of the murrelet are presented in the Federal Register, listing the murrelet as a threatened species (57 FR 45328 [October 1, 1992]); the Recovery Plan, Ecology and Conservation of the Marbled Murrelet (Ralph et al. 1995); the final rule designating murrelet critical habitat (61 FR 26256 [May 24, 1996]); the Evaluation Report in the 5-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California (McShane et al. 2004); and the 2004 and 2009, 5-year Reviews for the Marbled Murrelet (USFWS 2004; USFWS 2009).

Nesting Habitat Abundance

The destruction, modification, or curtailment of nesting habitat from logging, urbanization, and land use conversion has generally been regarded as the most influential environmental stressor that led to the 1992 Federal listing of the species under the Act. The Service estimates that over 80 percent of the historic nesting habitat has been rendered unsuitable for nesting (57 FR 45328 [October 1, 1992]). Because of the important role nesting habitat plays in the survival and recovery of the species, significant attention has been given to describing the quality, quantity, and location of the remaining nesting habitat and planning for the restoration of nesting habitat in California, Oregon, and Washington.

Loss of Nesting Habitat Since 1992

The Service has determined that the rate of habitat loss has declined since listing, particularly on Federal lands due to implementation of the NWFP (USFWS 2004, pp. 11 and 13). Between 1992 and 2003, the estimated loss of suitable murrelet habitat totaled 22,398 acres in Washington, Oregon, and California combined, of which 5,364 acres resulted from timber harvest and 17,034 acres resulted from natural events (McShane et al. 2004, pp. 4-64). Those data primarily represented losses on Federal lands, and did not include data for most private or State lands within the murrelets' range.

More recently, (Raphael et al. 2006 in Huff et al. 2006) used habitat models to estimate losses of potential murrelet habitat for the period from 1994-1996 to 2002-2003 on both Federal and non-Federal lands within the five Conservation Zones in the NWFP area. Results indicate that losses of potential nesting habitat may be greater than previously estimated, with losses ranging from 61,000 to 279,000 acres (depending on the model, see discussion below) in the 5-Conservation Zone area, with 10 to 28 percent of habitat loss occurring on Federal lands and 72 to 90 percent on non-Federal lands.

Current Amount of Nesting Habitat

McShane et al. (2004, p. 4-2), reviewed and summarized habitat estimates from 16 sources and estimated the amount of murrelet nesting habitat at 2,223,048 acres distributed throughout Washington, Oregon, and California (McShane et al. 2004, p. 4-5). Washington State contains almost half of all remaining nesting habitat with an estimated 1,022,695 acres or 48 percent of the total. Approximately 93 percent (2,000,000 acres) are reported to occur on Federal lands (McShane et al. 2004, p. 4-10).

In another effort, (Raphael et al 2006 in Huff et al. 2006) produced two spatial models for the NWFP Effectiveness Monitoring (EM) program to predict the amount, location, and distribution of murrelet nesting habitat. Combining vegetation-based maps derived from satellite imagery and prior estimates of habitat on State and private lands from 1994 to 2003, (Raphael et al. 2006, p. 109 in Huff et al. 2006) used a panel of experts to reclassify 22 old-growth forest classes into four classes of murrelet habitat based upon nesting suitability. Referred to as the Expert Judgment Model, the model classifies existing forest structure, based upon percent conifer cover, canopy structure, quadratic mean diameter, and forest patch size, into four classes of suitability for nesting murrelets. (Raphael et al. 2006, p. 116-123 in Huff et al. 2006) found that across the murrelet range, most habitat-capable land (52 percent) is unsuitable nesting habitat (Class 1) and 18 percent is classified as Class 4 habitat (highest suitability), with an estimated 41 percent of the Class 4 habitat (1,620,800 acres) occurring on non-Federal lands.

The second habitat model developed by (Raphael et al. 2006 in Huff et al. 2006) used the Biomapper Ecological Niche-Factor Analysis methodology developed by Hirzel et al. (2002). The resulting murrelet habitat suitability maps are based on both the physical and vegetative attributes adjacent to known murrelet occupied polygons or nest locations for each NWFP province. The maps provide a range of habitat suitability values, each with acreage estimates. In Washington, 2.1 million acres of habitat were rated with a habitat suitability (HS) greater than 60 and captured 82 percent of the stands documented as occupied, while 440,700 acres of habitat were rated as HS >80 habitat and captured 36 percent of the known occupied stands.

The Service believes the Expert Judgment and Ecological Niche Factor Analysis models, which relate known (occupied) murrelet nest stands to habitat abundance, distribution, and quality, represent the best available information on the subject. While not necessarily the best means to describe suitable habitat at the site scale, the Service expects these models have higher reliability for provincial-scale analysis compared to previous efforts.

Population Status

The initial at-sea surveys for murrelets that began during the 1990s in the marine waters of Washington, Oregon, and California were generally independent and sporadic efforts to assess murrelet population status (abundance, trends, distribution, and fecundity). Through a more coordinated effort, researchers developed the EM Program for the NWFP (Bentivoglio et al. 2002) in 2000 that unified the various at-sea monitoring efforts within terrestrial portions of the five Conservation Zones contained within the planning area of the NWFP. At-sea surveys in Conservation Zone 6, are independent of the EM Program, but are conducted using similar survey methods. The at-sea survey data collected prior to the EM Program are generally not suitable for statistical comparisons or trend analyses due to differences in survey methods, (McShane et al. 2004).

<u>Abundance and Distribution</u>

Murrelet abundance during the early 1990s in Washington, Oregon, and California was estimated at 18,550 to 32,000 birds (Ralph et al. 1995). Through the efforts of the EM program, the 2010 murrelet abundance in the listed range of the species (Table 1) is estimated at 16,691 birds (13,075 – 20,307, 95 percent confidence interval (CI); (Falxa 2011). Conservation Zones 3 and 4 support approximately 65 percent (10,981/6,691) of the murrelet population within the U.S., have the highest reported densities and generally the lowest within-zone statistical variation in population size (Falxa 2011). Murrelets occur in the lowest abundance in Conservation Zones 5 and 6.

At the time of listing, the distribution of active nests in nesting habitat was described as non-continuous (USFWS 1997a, p. 14). The at-sea extent of the species currently encompasses an area similar in size to the species historic distribution, but with the extremely low density of murrelets in Conservation Zones 5 and 6, the southern end of the murrelet distribution is sparsely populated compared to Conservation Zones 1-4.

Table 1. Estimates of murrelet density and population size (95 percent confidence interval (CI)) in Conservation Zones 1 through 5 during the 2010 breeding season (Falxa 2011) and in Conservation Zone 6 during the 2009 breeding season (Peery and Henry 2010).

Conservation Zone	**Density** (birds/km^2)	**Coefficient of Variation** (% Density)	**Population Size Estimates with 95% CI**			**Survey Area** (km^2)
			Number of Birds	Lower	Upper	
1	1.26	20.4	4393	2,689	6,367	3,497
2	0.18	25.7	1,286	650	1946	1,650
3	4.53	16.9	7,223	4,605	9,520	1,595
4	3.16	27.3	3,668	2,196	6,140	1,159
5	Not Surveyed	-	-	-	-	-
6	-	-	631	449	885	-
Zones 1-6	-	-	17,322	13,524	21,192	-

The at-sea distribution also exhibits discontinuity within Conservation Zones 1, 2, 5, and 6, where five areas of discontinuity are noted: a segment of the border region between British Columbia, Canada and Washington, southern Puget Sound, WA, Destruction Island, WA to Tillamook Head, OR, Humboldt County, CA to Half Moon Bay, CA, and the entire southern end of the breeding range in the vicinity of Santa Cruz and Monterey Counties, CA (McShane et al. 2004, p. 3-70).

Trend

There are two general approaches that researchers use to assess murrelet population trend: at-sea surveys and population modeling based on demographic data. In general, the Service assigns greater weight to population trend and status information derived from at-sea surveys than estimates derived from population models because survey information generally provides more reliable estimates of trend and abundance.

Marine Surveys

Researchers from the EM Program detected a statistically significant decline ($p \leq 0.05$) in the abundance of the surveyed populations in Conservation Zones 1 through 5 for the 2000-2010 sample period (Falxa 2011). The annual rate of decline was 3.7 percent during the 2001-2010 survey period.

While the 2008 population estimate for Conservation Zone 6 indicated a decline of about 55 percent from the 2007 estimate and a 75 percent decline from the 2003 estimate (Peery et al. 2008), the 2009 estimate was similar to estimates from 1999-2003. Peery and Henry (2010) speculated that their 2009 results may have indicated murrelets in central California moved out of the survey area in 2007 and 2008, then returned in 2009, or the increase may have been due to immigration from larger populations to the north.

At the scale of individual conservation zones, the murrelet population is declining at an estimated rate of 7.4 percent per year in Conservation Zone 1. No statistically significant, zone-specific trends were detected for any of the other four conservation zones (Falxa 2011). With a *p value* estimate of 0.06, it appears the change in murrelet abundance during the 2000-2010 sample period is approaching significance in Conservation Zone 2 (Falxa 2011). For Washington State (Conservation Zones 1 and 2 combined) there was a 7.31 percent (standard error = 1.31 percent) annual rate of decline in murrelet density for the 2001-2010 period (Pearson et al. 2011, p. 10), which equates to a loss of approximately 47 percent of the murrelet population since 2001.

Population Models

Prior to the use of survey data to estimate trend, demographic models were more heavily relied upon to generate predictions of trends and extinction probabilities for the murrelet population (Beissinger 1995; Cam et al. 2003; McShane et al. 2004; USFWS 1997b). However, murrelet population models remain useful because they provide insights into the demographic parameters and environmental factors that govern population stability and future extinction risk, including stochastic factors that may alter survival, reproductive, and immigration/emigration rates.

In a report developed for the 5-year Status Review of the Marbled Murrelet in Washington, Oregon, and California (McShane et al. 2004, p. 3-27 to 3-60), computer models were used to forecast 40-year murrelet population trends. A series of female-only, multi-aged, discrete-time stochastic Leslie Matrix population models were developed for each conservation zone to forecast decadal population trends over a 40-year period with extinction probabilities beyond 40 years (to 2100). The authors incorporated available demographic parameters (Table 2) for each conservation zone to describe population trends and evaluate extinction probabilities (McShane et al. 2004, p. 3-49).

McShane et al. (2004) used mark-recapture studies conducted in British Columbia by Cam et al. (2003) and Bradley et al. (2004) to estimate annual adult survival and telemetry studies or at-sea survey data to estimate fecundity. Model outputs predicted -3.1 to -4.6 percent mean annual rates of population change (decline) per decade the first 20 years of model simulations in murrelet Conservation Zones 1 through 5 (McShane et al. 2004, p. 3-52). Simulations for all zone populations predicted declines during the 20 to 40-year forecast, with mean annual rates of -2.1 to -6.2 percent per decade (McShane et al. 2004, p. 3-52). These reported rates of decline are similar to the estimates of -4 to -7 percent per year reported in the Recovery Plan (USFWS 1997b, p. 5).

Table 2. Rangewide murrelet demographic parameter values based on four studies all using Leslie Matrix models.

Demographic Parameter	Beissinger 1995	Beissinger and Nur 1997*	Beissinger and Peery (2007)	McShane et al. 2004
Juvenile Ratio (Ŕ)	0.10367	0.124 or 0.131	0.089	0.02 - 0.09
Annual Fecundity	0.11848	0.124 or 0.131	0.06-0.12	-
Nest Success	-	-	0.16-0.43	0.38 - 0.54
Maturation	3	3	3	2 - 5
Estimated Adult Survivorship	85 % – 90%	85 % – 88 %	82 % - 90 %	83 % – 92 %

*In U.S. Fish and Wildlife Service (1997b).

McShane et al. (2004, pp. 3-54 to 3-60) modeled population extinction probabilities beyond 40 years under different scenarios for immigration and mortality risk from oil spills and gill nets. Modeled results forecast different times and probabilities for local extirpations, with an extinction risk[4] of 16 percent and mean population size of 45 individuals in 100 years in the listed range of the species (McShane et al. 2004, pp. 3-58).

Reproduction

Generally, estimates of murrelet fecundity are directed at measures of breeding success, either from direct assessments of nest success in the terrestrial environment, marine counts of hatch-year birds, or computer models. Telemetry estimates are typically preferred over marine counts for estimating breeding success due to fewer biases (McShane et al. 2004, p. 3-2). However, because of the challenges of conducting telemetry studies, estimating murrelet reproductive rates with an index of reproduction, referred to as the juvenile ratio (Ŕ),[5] continues to be important, despite the debate over use of this index (see discussion in Beissinger and Peery 2007, p. 296).

Although difficult to obtain, nest success rates[6] are available from telemetry studies conducted in California (Hebert and Golightly 2006; Peery et al. 2004) and Washington (Bloxton and Raphael 2006). In northwest Washington, Bloxton and Raphael (2005, p. 5) documented a nest success rate of 0.20 (2 chicks fledging from 10 nest starts). In central California, murrelet nest success is 0.16 (Peery et al. 2004, p. 1098) and in northern California it is 0.31 to 0.56 (Hebert and Golightly 2006, p. 95). No studies or published reports from Oregon are available.

[4] Extinction was defined by McShane et al. (2004, p. 3-58) as any murrelet conservation zone containing less than 30 birds.

[5] The juvenile ratio (**Ŕ**) for murrelets is derived from the relative abundance of hatch-year (HY; 0-1 yr-old) to after-hatch-year (AHY; 1+ yr-old) birds (Beissinger and Peery 2007, p. 297) and is calculated from marine survey data.

[6] Nest success here is defined by the annual number of known hatchlings departing from the nest (fledging) divided by the number of nest starts.

Unadjusted and adjusted values for estimates of murrelet juvenile ratios suggest extremely low breeding success in northern California (0.003 to 0.008 - Long et al. 2008, pp. 18-19), central California (0.035 and 0.032 - Beissinger and Peery 2007, pp. 299, 302), and in Oregon (0.0254 - 0.0598 - Crescent Coastal Research 2008, p. 13). Estimates for **Ŕ** (adjusted) in the San Juan Islands in Washington have been below 0.15 every year since surveys began in 1995, with three of those years below 0.05 (Raphael et al. 2007, p. 16).

These current estimates of **Ŕ** are assumed to be below the level necessary to maintain or increase the murrelet population. Demographic modeling suggests murrelet population stability requires a minimum reproductive rate of 0.18 to 0.28 (95 % CI) chicks per pair per year (Beissinger and Peery 2007, p. 302; USFWS 1997b). Even the lower level of the 95 percent confidence interval from USFWS (1997b) Beissinger and Peery (2007, p. 302) is greater than the current range of estimates for Ŕ (0.02 to 0.13 chicks per pair) for any of the Conservation Zones (Table 2).

The current estimates for **Ŕ** also appear to be well below what may have occurred prior to the murrelet population decline. Beissinger and Peery (2007, p. 298) performed a comparative analysis using historic data from 29 bird species to predict the historic **Ŕ** for murrelets in central California, resulting in an estimate of 0.27 (95% CI: 0.15 - 0.65). Therefore, the best available scientific information of murrelet fecundity from model predictions and trend analyses of survey-derived population data appear to align well. Both indicate that the murrelet reproductive rate is generally insufficient to maintain stable population numbers throughout all or portions of the species' listed range.

<u>Summary: Murrelet Abundance, Distribution, Trend, and Reproduction</u>

The 2010 estimated abundance for murrelets within Conservation Zones 1-5 was the lowest recorded since inception of the EM program (Falxa 2011)(Falxa et al. 2009, p. 9), with the current population size within the listed range of the species estimated at 17,322 birds (95 percent CI: 13,524 – 21,192) (Table 1). Although murrelets are distributed throughout their historical range, the area of occupancy within their historic range appears to be reduced from historic levels. The distribution of the species also exhibits five areas of discontinuity: a segment of the border region between British Columbia, Canada and Washington; southern Puget Sound, WA; Destruction Island, WA to Tillamook Head, OR; Humboldt County, CA to Half Moon Bay, CA; and the entire southern end of the breeding range in the vicinity of Santa Cruz and Monterey Counties, CA (McShane et al. 2004, p. 3-70).

A statistically significant decline was detected in Conservation Zone 1 for the 2001-2010 period and the decline in Conservation Zone 2 is approaching significance (***p*** = 0.0106) for the 2001-2010 period (Falxa 2011). The overall population trend from the combined 2001-2010 population estimates (Conservation Zones 1 - 5) indicate a statistically significant, rangewide annual rate of decline of 3.7 percent (Falxa 2011).

The current range of estimates for **Ŕ**, the juvenile to adult ratio, is assumed to be below the level necessary to maintain or increase the murrelet population. Whether derived from marine surveys or from population modeling (**Ŕ** = 0.02 to 0.13, Table 2), the available information is in general agreement that the current ratio of hatch year birds to after-hatch year birds is insufficient to maintain stable numbers of murrelets throughout the listed range. The current estimates for **Ŕ** also appear to be well below what may have occurred prior to the murrelet population decline (Beissinger and Peery 2007, p. 298) and model predictions forecast an extinction risk of 16 percent, with a 3-state mean population size of 45 individuals in 100 years in the listed portion of the species' range (McShane et al. 2004, p. 3-58).

Thus, considering the best available data on abundance, distribution, population trend, and the low reproductive success of the species, the Service concludes the murrelet population within the portion of its listed range currently has little or no capability to self-regulate, as indicated by the significant, annual decline in abundance the species is currently undergoing throughout the listed range. The Service expects the species to continue to exhibit further reductions in the distribution and abundance into the foreseeable future, due largely to the expectation that the variety of environmental stressors present in the marine and terrestrial environments (discussed in the *Threats to Murrelet Survival and Recovery* section) will continue into the foreseeable future.

Recovery Plan

The Marbled Murrelet Recovery Plan outlines the conservation strategy with both short- and long-term objectives. The Plan places special emphasis on the terrestrial environment for habitat-based recovery actions due to nesting occurring in inland forests.

In the short-term, specific actions identified as necessary to stabilize the population include protecting occupied habitat and minimizing the loss of unoccupied but suitable habitat (USFWS 1997b, p. 119). Specific actions include maintaining large blocks of suitable habitat, maintaining and enhancing buffer habitat, decreasing risks of nesting habitat loss due to fire and windthrow, reducing predation, and minimizing disturbance. The designation of critical habitat also contributes towards the initial objective of stabilizing the population size through the maintenance and protection of occupied habitat and minimizing the loss of unoccupied but suitable habitat.

Long-term conservation needs identified in the Plan include:

- increasing productivity (abundance, the ratio of juveniles to adults, and nest success) and population size;
- increasing the amount (stand size and number of stands), quality, and distribution of suitable nesting habitat;
- protecting and improving the quality of the marine environment; and
- reducing or eliminating threats to survivorship by reducing predation in the terrestrial environment and anthropogenic sources of mortality at sea.

Recovery Zones

The Plan identified six Conservation Zones (Figure 1) throughout the listed range of the species: Puget Sound (Conservation Zone 1), Western Washington Coast Range (Conservation Zone 2), Oregon Coast Range (Conservation Zone 3), Siskiyou Coast Range (Conservation Zone 4), Mendocino (Conservation Zone 5), and Santa Cruz Mountains (Conservation Zone 6). Recovery zones are the functional equivalent of recovery units as defined by Service policy (USFWS 1997b, p. 115).

Recovery Zones in Washington

Conservation Zones 1 and 2 extend inland 50 miles from marine waters. Conservation Zone 1 includes all the waters of Puget Sound and most waters of the Strait of Juan de Fuca south of the U.S.-Canadian border and the Puget Sound, including the north Cascade Mountains and the northern and eastern sections of the Olympic Peninsula. Conservation Zone 2 includes marine waters within 1.2 miles (2 km) off the Pacific Ocean shoreline, with the northern terminus immediately south of the U.S.-Canadian border near Cape Flattery along the midpoint of the Olympic Peninsula and extending to the southern border of Washington (the Columbia River) (USFWS 1997b, pg. 126).

Lands considered essential for the recovery of the murrelet within Conservation Zones 1 and 2 are 1) any suitable habitat in a Late Successional Reserve (LSR), 2) all suitable habitat located in the Olympic Adaptive Management Area, 3) large areas of suitable nesting habitat outside of LSRs on Federal lands, such as habitat located in the Olympic National Park, 4) suitable habitat on State lands within 40 miles off the coast, and 5) habitat within occupied murrelet sites on private lands (USFWS 1997b).

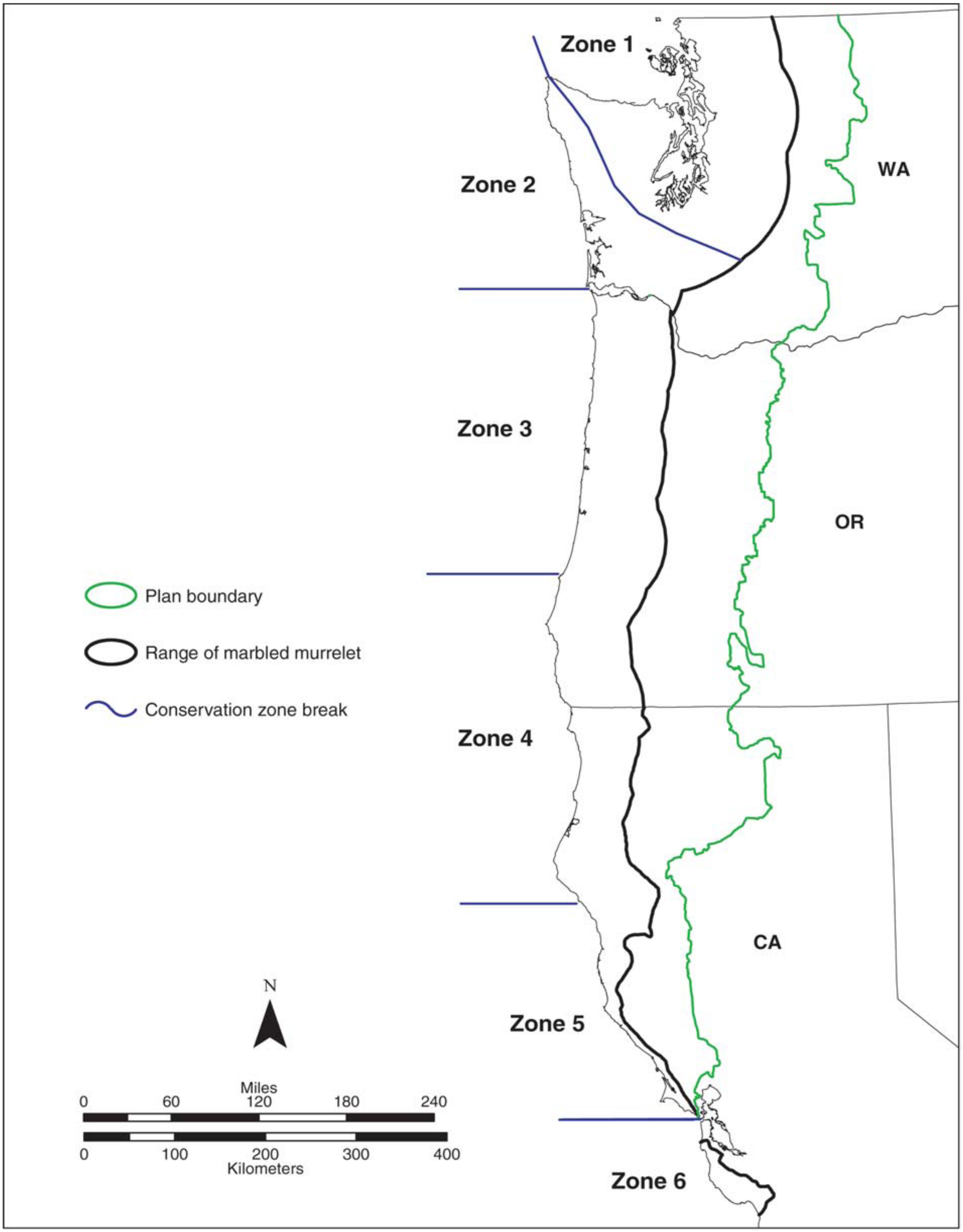

Figure 1. The six geographic areas identified as Conservation Zones in the recovery plan for the marbled murrelet (USFWS 1997b). Note: "Plan boundary" refers to the Northwest Forest Plan. Figure adapted from Huff et al. (2006, p. 6).

Conservation Needs of the Species

Reestablishing an abundant supply of high quality murrelet nesting habitat is a vital conservation need given the extensive removal during the 20th century. However, there are other conservation imperatives. Foremost among the conservation needs are those in the marine and terrestrial environments to increase murrelet fecundity by increasing the number of breeding adults, improving murrelet nest success (due to low nestling survival and low fledging rates), and reducing anthropogenic stressors that reduce individual fitness[7] or lead to mortality.

The overall reproductive success (fecundity) of murrelets is directly influenced by nest predation rates (reducing nestling survival rates) in the terrestrial environment and an abundant supply of high quality prey in the marine environment during the breeding season (improving potential nestling survival and fledging rates). Anthropogenic stressors affecting murrelet fitness and survival in the marine environment are associated with commercial and tribal gillnets, derelict fishing gear, oil spills, and high underwater sound pressure (energy) levels generated by pile-driving and underwater detonations (that can be lethal or reduce individual fitness).

General criteria for murrelet recovery (delisting) were established at the inception of the Plan and they have not been met. More specific delisting criteria are expected in the future to address population, demographic, and habitat based recovery criteria (USFWS 1997b, p. 114-115). The general criteria include:

- documenting stable or increasing population trends in population size, density, and productivity in four of the six Conservation Zones for a 10-year period and
- implementing management and monitoring strategies in the marine and terrestrial environments to ensure protection of murrelets for at least 50 years.

Thus, increasing murrelet reproductive success and reducing the frequency, magnitude, or duration of any anthropogenic stressor that directly or indirectly affects murrelet fitness or survival in the marine and terrestrial environments are the priority conservation needs of the species. The Service estimates recovery of the murrelet will require at least 50 years (USFWS 1997b).

Summary

The level of risk posed by some threats to the murrelet population may have been reduced as a result of the species' listing under the Act, such as the passage of the Oil Pollution Act and implementation of the NWFP. However, the Service is not aware that any threats have been removed since listing and in some portions of the listed range, new threats (identified above) have been identified which affect the species at the local population or listed-entity scales. Currently, the Service expects these threats to continue into the foreseeable future and those that cause direct mortality or reduce individual fitness are likely to contribute to murrelet population declines.

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[7] Fitness is measure of the relative capability of individuals within a species to reproduce and pass its' genotype to the next generation.

Considering the life history characteristics of the murrelet, the species' capability to recover from the mortality or reduced-fitness stressors is extremely low. The low observed reproductive rate causes the murrelet population to be highly sensitive to mortality and fitness-reducing stressors, particularly when they occur at a frequency which exceeds the species' loss-replacement rate. Despite the relatively long life span of murrelets and a reasonably high adult survival rate, the annual replacement rates needed for long-term population maintenance and stability is currently well below the annual rate of individuals being removed from each Conservation Zone.

Therefore, given the interactive effect of an extremely low fecundity and the current threats facing the species, it is reasonable to predict that the murrelet populations (in each Conservation Zone) throughout the listed range are likely to continue to decline. The decline is expected to continue until murrelet fecundity is significantly improved and the anthropogenic stressors affecting fitness, survivorship, and nest success are eliminated or sufficiently reduced.

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Appendix D: Status of Designated Critical Habitat - Marbled Murrelet

Appendix D
STATUS OF DESIGNATED CRITICAL HABITAT - MARBLEDMURRELET

This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat within 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat.

Critical habitat is defined in section 3(5)(A) of the Act as "the specific area within the geographic area occupied by the species on which are found those physical or biological features essential to the conservation of the species, and that may require special management considerations or protection, and specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species." The Act defines conservation as the procedures necessary to bring about the eventual recovery and delisting of a listed species.

Legal Status

The final rule designating critical habitat for the murrelet (61 FR 26256 [May 24, 1996]) became effective on June 24, 1996. Critical habitat was designation for the murrelet to addresses the objective of stabilizing population size. The principle factors affecting the murrelet and the main cause of its population decline has been the loss of older forests and associated nest sites and habitat fragmentation (57 FR 45328:45330 [October 1, 1992]). The selection criteria considered in choosing areas for inclusion in murrelet critical habitat included 1) suitable nesting habitat, 2) survey data, 3) proximity to marine foraging habitat, 4) large, contiguous blocks of nesting habitat, 5) opportunities to maintain current distribution, and 6) adequacy of existing protection and management.

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. In the 1996 final rule designating critical habitat for the murrelet (61 FR 26255:26246 [May 24, 1996]), the Service identified two PCEs essential to provide and support suitable nesting habitat for successful reproduction. These are 1) individual trees with potential nesting platforms (PCE 1), and 2) all forested areas, regardless of contiguity, within 0.5 mile of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height (PCE 2). Areas with just PCE 1, or both PCE 1 and 2 are, by definition, considered to be critical habitat. These PCEs were deemed essential for providing suitable nesting habitat for successful reproduction of the murrelet, and thus its conservation. PCEs require special management considerations.

Conservation Role of Critical Habitat

In some areas, large blocks of Federal land can provide the necessary contribution for recovery of the species. However, in other areas, Federal ownership is limited and Federal lands alone cannot meet the recovery needs of murrelets to reverse the current population decline and maintain a well-distributed population. Critical habitat helps focus conservation activities by identifying area that contain essential habitat features (PCEs) thus alerting Federal agencies and the public to the importance of an area in the species' conservation. Critical habitat also identifies area that may require special management or protection (61 FR 26255:26263 [May 24, 1996]).

Activities that May Affect PCEs

The final rule (61 FR 26255:26271[May 24, 1996]) states that "A variety of ongoing or proposed activities that disturb or remove primary constituent elements may adversely affect, though not necessarily 'adversely modify' murrelet critical habitat as that term is used in section 7 consultations. Examples of such activities include 1) forest management activities which greatly reduce stand canopy closure, appreciably alter the stand structure, or reduce the availability of nesting sites, 2) land disturbance activities such as mining, sand and gravel extraction, construction of hydroelectric facilities and road building, and 3) harvest of certain types of commercial forest products (e.g., moss [Bryophyta] and salal [*Gaultheria shallon*])." Ultimately, actions may alter PCEs if they remove or degrade forest habitat, or prevent or delay future attainment of suitable habitat.

Distribution of Critical Habitat

The designated CHUs are distributed more or less evenly across the range of the species in Washington and Oregon, and less so in California. At the time of listing, designated critical habitat lands included 695 of the over 807 known-occupied sites on Federal lands, and 218 of the 354 known-occupied sites on non-Federal lands. Sites in Redwood National Park in California had not been entered into the database at the time or listing. Further, the Service did not include the marine environment in critical habitat, but instead relied on other existing regulations for protection of this area.

Thirty-two critical habitat units (CHUs) totaling 3,887,800 acres were designated on Federal, state, county, city, and private lands in Washington, Oregon, and California (61 FR 26255:26269[May 24, 1996]) (Table 1). These individual units are coded by the state in which they occur and are individually numbered by unit and sub-unit (e.g., WA-01-a, OR-01-a, CA-01-a). The majority of these CHUs (78 percent) occur on Federal lands. In the selection of CHUs, there was a reliance on lands designated as Late Successional Reserves (LSRs) on Forest Service land. Most LSRs within the range of the murrelet in Washington, Oregon, and California were designated as critical habitat. LSRs, as described in the Northwest Forest Plan, are most likely to develop into large blocks of suitable murrelet nesting habitat given sufficient time.

Table 1. Designated critical habitat by state, ownership, and land allocation

State	Ownership	Land Allocation	Designated Critical Habitat (hectares)	Designated Critical Habitat (acres)
Washington	Federal Lands	Congressionally Withdrawn Lands	740	1,800
		Late Successional Reserves	485,680	1,200,200
		Federal Total	*486,240*	*1,202,000*
	Non-Federal Lands	State Lands	172,720	426,800
		Private Lands	1,020	2,500
		Non-Federal Total	*173,740*	*429,300*
		Washington's Overall Total	*659,980*	*1,631,300*
Oregon	Federal Lands	Late Successional Reserves	541,530	1,338,200
	Non-Federal Lands	State Lands	70,880	175,100
		County Lands	440	1,100
		Private Lands	350	900
California (Northern)	Federal Lands	Late Successional Reserves	193,150	477,300
	Non-Federal Lands	State Lands	71,040	175,500
		Private Lands	16,360	40,400
California (Central)	Non-Federal Lands	State Lands	14,080	34,800
		County Lands	3,200	8,000
		City Lands	400	1,000
		Private Lands	1,720	4,200
		Overall Total	*1,573,392*	*3,887,800*

Although most of the areas designated as murrelet critical habitat occur on Federal lands, the Service designated selected non-Federal lands that met the selection criteria. These lands occurred in areas where Federal lands were insufficient to provide suitable nesting habitat for the recovery of the species. On non-Federal lands, 21 percent of critical habitat acres occur on state lands, 1.2 percent on private lands, 0.2 percent on county lands, and 0.003 percent on city lands. CHUs do not include non-Federal lands covered by a legally operative incidental take permit for murrelets issued under section 10(a) of the Act (61 FR 26255:26278[May 24, 1996]). Therefore, critical habitat designations were excluded on state lands upon completion of the Habitat Conservation Plans that addresses conservation of the murrelet. State lands in Washington, Oregon and California currently operate under approved Habitat Conservation Plans (HCPs).

Critical Habitat in Washington State

Washington contains 11 CHUs that total approximately 1,206,000 acres (Appendix A) (excluding 426,800 acres of State land managed under the WDNR HCP). The acreage of land protected by critical habitat and the WDNR (1997) HCP represents 42 percent of critical habitat within the listed range. Each CHU is made up of between two and seven subunits that range from 191 acres to over 100,000 acres in size. Also, CHUs range between 9 and 53 percent potential nesting habitat.

In Washington State, there is a clear reliance on Federal lands to fulfill the functions for which critical habitat was designated. Eight CHUs contain exclusively Federal lands while one contains both Federal and private lands. These nine CHUs contain 78 percent of the total acreage of CHUs in Washington State. Critical habitat functions are also met by Federal lands not designated as critical habitat in National Parks, Wilderness Areas, and portions of Forest Service lands designated as Adaptive Management Areas and Matrix lands that were found to be occupied by murrelets.

Current Condition of Critical Habitat in Washington

The quality of forests occurring within the boundaries of the CHUs ranges from non-habitat (e.g., young plantations) to high-quality habitat (e.g., large blocks of old-growth forest). While significant amounts of high-quality murrelet habitat are present in some of the CHUs, much of the habitat in CHUs, particularly on non-Federal lands, is of lesser quality due to its occurrence in smaller, more fragmented blocks. Some of the highest quality murrelet habitat occurs in National Parks and designated Wilderness Areas where harvest historically has not occurred. Given the high quality of this habitat and reduced threat of habitat loss or modification due to management objectives, designation of critical habitat was deemed unnecessary in National Parks and Wilderness Areas.

We estimate that an insignificant amount of critical habitat has been removed or downgraded as a result of section 7 consultations. In Washington, there has been almost no loss of critical habitat due to timber harvest or major fires. The majority of critical habitat loss has been through landslides and blow-down. In Washington, section 7 consultations are based on the amounts of critical habitat addressed in the final rule. The Service is currently in the process of assessing the current condition of murrelet critical habitat in Oregon and California.

Summary

Murrelet critical habitat was designated in 1996 due to the high rate of nesting habitat loss and fragmentation. The objective of the designation was to stabilize the murrelet population size. Washington contains 11 CHUs and totals 1,204,000 acres, the majority of which is on Federal land. The Service identified two primary constituent elements for the CHU, specifically 1) individual trees with potential nesting platforms, and 2) forested areas within 0.5 mile of individual trees with potential nesting platforms and a canopy height of at least one-half the site-potential tree height. Most of the areas designated as murrelet critical habitat occur on Federal land. The highest quality critical habitat occurs on National Parks and Wilderness areas where harvest historically has not occurred. Designating critical habitat in these areas was deemed unnecessary.

Appendix A. Murrelet Critical Habitat Units (CHU) and Sub-Units in Washington (excludes land managed under the WDNR HCP)

CHU Name	Total Acres in CHU	Total Acres of Potential MAMU Nesting Habitat (2003)	Percent of CHU with Potential MAMU Habitat	Ownership
WA-01-a	60,454	20,286	34%	LSR
WA-01-b	8,200	3,687	45%	LSR
WA-02-a	15,941	8,373	53%	LSR
WA-02-b	1,982	803	40%	LSR
WA-02-c	46,342	21,821	47%	LSR
WA-02-d	412	125	30%	LSR
WA-03-a	97,834	35,045	36%	LSR
WA-03-b	64,993	18,734	29%	LSR
WA-05-b	401	111	28%	PRIVATE
WA-05-c	297	27	9%	PRIVATE
WA-05-d	327	42	13%	PRIVATE
WA-05-f	191	28	15%	PRIVATE
WA-05-g	218	50	23%	PRIVATE
WA-06-a	71,536	22,002	31%	LSR
WA-06-b	44,195	17,137	39%	LSR
WA-07-a	78,133	19,052	24%	LSR
WA-07-b	1,075	286	27%	PRIVATE
WA-07-c	88,699	35,592	40%	LSR
WA-07-d	24,112	9,290	39%	LSR
WA-08-a	85,202	28,082	33%	LSR
WA-08-b	20,399	7,757	38%	LSR
WA-09-a	1,826	761	42%	CWD (Navy)
WA-09-b	108,074	47,882	44%	LSR
WA-09-c	6,918	3,018	44%	LSR
WA-09-d	13,051	4,039	31%	LSR
WA-09-e	48,827	16,488	34%	LSR
WA-10-a	76,586	23,874	31%	LSR
WA-10-b	41,953	14,391	34%	LSR
WA-10-c	25,706	11,033	43%	LSR
WA-11-a	72,196	13,665	19%	LSR
WA-11-b	11,139	1,375	12%	LSR
WA-11-c	37,572	7,029	19%	LSR
WA-11-d	51,360	9,320	18%	LSR
Totals	**1,206,153**	**401,204**	**Average: 33%**	

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Appendix E: Status of the Species - Bull Trout

Appendix E
STATUS OF THE SPECIES (Bull Trout)

Listing Status

The coterminous United States population of the bull trout (Salvelinus confluentus) was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout generally occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 2; Brewin and Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 716-719).

Throughout its range, the bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (64 FR 58910). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin et al. 2007, pp. 6672-6673; Rieman et al. 2007, p. 1552). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647; 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs with the Columbia and Klamath population segments into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58910):

> Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

Current Status and Conservation Needs

In recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: 1) Jarbidge River, 2) Klamath River, 3) Columbia River, 4) Coastal-Puget Sound, and 5) St.

Mary-Belly River (USFWS 2002a, pp. iv, 2, 7, 98; 2004a, Vol. 1 & 2, p. 1; 2004b, p. 1). Each of these interim recovery units is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these interim recovery units is provided below and a comprehensive discussion is found in the Service's draft recovery plans for the bull trout (USFWS 2002a, pp. vi-viii; 2004a, Vol. 2 p. iii-x; 2004b, pp. iii-xii).

The conservation needs of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations (a local population is a group of bull trout that spawn within a particular stream or portion of a stream system). The recovery planning process for bull trout (USFWS 2002a, pp. 49-50; 2004a, Vol 1 & 2 pp. 12-18; 2004b, pp. 60-86) has also identified the following conservation needs: 1) maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each interim recovery unit, 2) preservation of the diversity of life-history strategies, 3) maintenance of genetic and phenotypic diversity across the range of each interim recovery unit, and 4) establishment of a positive population trend. Recently, it has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit (Rieman et al. 2003).

Central to the survival and recovery of bull trout is the maintenance of viable core areas (USFWS 2002a, pp. 53-54; 2004a, Vol. 1 pp. 210-218, Vol 2. pp. 61-62; 2004b, pp. 15-30, 64-67). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat. Each of the interim recovery units listed above consists of one or more core areas. There are 121 core areas recognized across the coterminous range of the bull trout (USFWS 2002a, pp. 6, 48, 98; 2004a, Vol. 1 p. vi, Vol. 2 pp. 14, 134; 2004b, pp. iv, 2; 2005, p. ii).

Jarbidge River Interim Recovery Unit

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawning adults, are estimated to occur in the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, incidental mortalities of released bull trout from recreational angling, historic angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004b). The draft bull trout recovery plan (USFWS 2004b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout within the core area, 2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, 3) restore and maintain suitable habitat conditions for all life history stages and forms, and 4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning bull trout per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004b).

Klamath River Interim Recovery Unit

This interim recovery unit currently contains three core areas and seven local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes (USFWS 2002a). Bull trout populations in this interim recovery unit face a high risk of extirpation (USFWS 2002a). The draft Klamath River bull trout recovery plan (USFWS 2002a) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and strategies, 4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 2,400 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (USFWS 2002a).

Columbia River Interim Recovery Unit

The Columbia River interim recovery unit includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997, p. 1177). This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The Columbia River interim recovery unit has declined in overall range and numbers of fish (63 FR 31647). Although some strongholds still exist with migratory fish present, bull trout generally occur as isolated local populations in headwater lakes or tributaries where the migratory life history form has been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (IDFG, in litt. 1995). The draft Columbia River bull trout recovery plan (USFWS 2002c) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of the bull trout within core areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange.

This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good. All core areas have been subject to the combined effects of habitat degradation and fragmentation caused by the following activities: dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The Service completed a core area conservation assessment for the 5-year status review and determined that, of the 97 core areas in this interim recovery unit, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, 2 are at low risk, and 2 are at unknown risk (USFWS 2005, pp. 2, Map A, pp. 73-83).

Coastal-Puget Sound Interim Recovery Unit

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this interim recovery unit. This interim recovery unit currently contains 14 core areas and 67 local populations (USFWS 2004a). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this interim recovery unit. Bull trout continue to be present in nearly all major watersheds where they likely occurred historically, although local extirpations have occurred throughout this interim recovery unit. Many remaining populations are isolated or fragmented and abundance has declined, especially in the southeastern portion of the interim recovery unit. The current condition of the bull trout in this interim recovery unit is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, poaching, incidental mortality from other targeted fisheries, and the introduction of non-native species. The draft Coastal-Puget Sound bull trout recovery plan (USFWS 2004a) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of bull trout within existing core areas, 2) increase bull trout abundance to about 16,500 adults across all core areas, and 3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River Interim Recovery Unit

This interim recovery unit currently contains six core areas and nine local populations (USFWS 2002b). Currently, bull trout are widely distributed in the St. Mary-Belly River drainage and occur in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (USFWS 2002b). The current condition of the bull trout in this interim recovery unit is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (USFWS 2002b). The draft St. Mary-Belly River bull trout recovery plan (USFWS 2002b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and forms, 4) conserve genetic diversity and provide the opportunity for genetic exchange, and 5) establish good working relations with Canadian interests because local bull trout populations in this interim recovery unit are comprised mostly of migratory fish, whose habitat is mostly in Canada.

Life History

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, pp. 1-18) . Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, pp. 135-137; Goetz 1989, pp. 22-25), or saltwater (anadromous form) to rear as subadults and to live as adults (Cavender 1978, pp. 139, 165-68; McPhail and Baxter 1996, p. 14; WDFW et al. 1997, pp. 17-18, 22-26). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, pp. 135-137; Leathe and Graham 1982, p. 95; Pratt 1992, p. 6; Rieman and McIntyre 1996, p. 133).

The iteroparous reproductive strategy of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Goetz 1989, pp. 29-32; Pratt 1984, p. 13) The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 7). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989, pp. 137, 141; Goetz 1989, pp. 19-26; Bond in Hoelscher and Bjornn 1989, p. 57; Howell and Buchanan 1992, p. 1; Pratt 1992, p. 6; Rich 1996, pp. 35-38; Rieman and McIntyre 1993, pp. 4-7; Rieman and McIntyre 1995, pp. 293-294; Sedell and Everest 1991, p. 1; Watson and Hillman 1997, pp. 246-250). Watson and Hillman (1997, pp. 247-249) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, p. 7), bull trout should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997, p. 1560).

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Gilpin, in litt. 1997, pp. 4-5; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1114). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993, p. 7; Spruell et al. 1999, pp. 118-120). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under "Diet."

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams (below 15 °C or 59 °F), and spawning habitats are generally characterized by temperatures that drop below 9 °C (48 °F) in the fall (Fraley and Shepard 1989, p. 133; Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Baxter et al. 1997, pp. 426-427; Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C (35 °F to 39 °F) whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (46 °F to 50 °F) (Buchanan and Gregory 1997, pp. 121-122; Goetz 1989, pp. 22-24; McPhail and Murray 1979, pp. 41, 50, 53, 55). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C (46 °F to 48 °F), within a temperature gradient of 8 °C to 15 °C (4 °F to 60 °F). In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C (52 °F to 54 °F).

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, pp. 121-122; Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2; Rieman and McIntyre 1995, p. 288; Rieman et al. 1997, p. 1114). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002). For example, in a study in the Little Lost River of Idaho where bull trout were found at temperatures ranging from 8 °C to 20 °C (46 °F to 68 °F), most sites that had high densities of bull trout were in areas where primary productivity in streams had increased following a fire (Gamett, pers. comm. 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, pp. 135-137; Goetz 1989, pp. 22-25; Hoelscher and Bjornn 1989, p. 54; Pratt 1992, p. 6; Rich 1996, pp. 35-38; Sedell and Everest 1991, p. 1; Sexauer and James 1997, pp. 367-369; Thomas 1992, pp. 4-5; Watson and Hillman 1997, pp. 247-249). Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993, p. 7). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 367-369). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, pp. 135-137; Pratt 1992, p. 6; Pratt and Huston 1993, pp. 70-72). Pratt (1992, p. 6) indicated that increases in fine sediment reduce egg survival and emergence.

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 135). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, p. 15; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 8). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Ratliff and Howell 1992 in Howell and Buchanan 1992, pp. 10, 15; Pratt 1992, pp. 5-6).

Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (WDOE 2002) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). In a laboratory study conducted in Canada, researchers found that low oxygen levels retarded embryonic development in bull trout (Giles and Van der Zweep 1996, pp. 54-55). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Migratory forms of bull trout may develop when habitat conditions allow movement between spawning and rearing streams and larger rivers, lakes or nearshore marine habitat where foraging opportunities may be enhanced (Brenkman and Corbett 2005, pp. 1073, 1079-1080; Frissell 1993, p. 350; Goetz et al. 2004, pp. 45, 55, 60, 68, 77, 113-114, 123, 125-126). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 15-16; MBTSG 1998, pp. iv, 48-50; Rieman and McIntyre 1993, pp. 18-19; USFWS 2004a, Vol. 2, p. 63). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger fish with higher fecundity is lost (Rieman and McIntyre 1993, pp. 1-18).

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, because this strategy can change as the fish progresses from one life stage to another (i.e., juvenile to subadult). Fish growth depends on the quantity and quality of food that is eaten (Gerking 1994), and as fish grow, their foraging strategy changes as their food changes, in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 239-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout feed on various fish species (Brown 1994, p. 21; Donald and Alger 1993, p. 242; Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95). Bull trout of all sizes other than fry have been found to eat fish up to half their length (Beauchamp and VanTassell 2001). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004, p. 114; WDFW et al. 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. Optimal foraging theory can be used to describe strategies fish use to choose between alternative sources of food by weighing the benefits and costs of capturing one source of food over another. For example, prey often occur in concentrated patches of abundance ("patch model") (Gerking 1994). As the predator feeds in one patch, the prey population is reduced, and it becomes more profitable for the predator to seek a new patch rather than continue feeding on the original one. This can be explained in terms of balancing energy acquired versus energy expended. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, p. 1079; Goetz et al. 2004, pp. 36, 60).

Changes in Status of the Coastal-Puget Sound Interim Recovery Unit

Although the status of bull trout in Coastal-Puget Sound interim recovery unit has been improved by certain actions, it continues to be degraded by other actions, and it is likely that the overall status of the bull trout in this population segment has not improved since its listing on November 1, 1999. Improvement has occurred largely through changes in fishing regulations and habitat-restoration projects. Fishing regulations enacted in 1994 either eliminated harvest of bull trout or restricted the amount of harvest allowed, and this likely has had a positive influence on the abundance of bull trout. Improvement in habitat has occurred following restoration projects intended to benefit either bull trout or salmon, although monitoring the effectiveness of these projects seldom occurs. On the other hand, the status of this population segment has been adversely affected by a number of Federal and non-Federal actions, some of which were addressed under section 7 of the Act. Most of these actions degraded the environmental baseline; all of those addressed through formal consultation under section 7 of the Act permitted the incidental take of bull trout.

Section 10(a)(1)(B) permits have been issued for Habitat Conservation Plans (HCP) completed in the Coastal-Puget Sound population segment. These include: 1) the City of Seattle's Cedar River Watershed HCP, 2) Simpson Timber HCP (now Green Diamond Resources), 3) Tacoma Public Utilities Green River HCP, 4) Plum Creek Cascades HCP, 5) Washington State Department of Natural Resources (WSDNR) State Trust Lands HCP, 6) West Fork Timber HCP, and 7) WSDNR Forest Practices HCP. These HCPs provide landscape-scale conservation for fish, including bull trout. Many of the covered activities associated with these HCPs will contribute to conserving bull trout over the long-term; however, some covered activities will result in short-term degradation of the baseline. All HCPs permit the incidental take of bull trout.

Changes in Status of the Columbia River Interim Recovery Unit

The overall status of the Columbia River interim recovery unit has not changed appreciably since its listing on June 10, 1998. Populations of bull trout and their habitat in this area have been affected by a number of actions addressed under section 7 of the Act. Most of these actions resulted in degradation of the environmental baseline of bull trout habitat, and all permitted or analyzed the potential for incidental take of bull trout. The Plum Creek Cascades HCP, Plum Creek Native Fish HCP, Storedahl Daybreak Mine HCP, and WSDNR Forest Practices HCP addressed portions of the Columbia River population segment of bull trout.

Changes in Status of the Klamath River Interim Recovery Unit

Improvements in the Threemile, Sun, and Long Creek local populations have occurred through efforts to remove or reduce competition and hybridization with non-native salmonids, changes in fishing regulations, and habitat-restoration projects. Population status in the remaining local populations (Boulder-Dixon, Deming, Brownsworth, and Leonard Creeks) remains relatively unchanged. Grazing within bull trout watersheds throughout the recovery unit has been curtailed. Efforts at removal of non-native species of salmonids appear to have stabilized the Threemile and positively influenced the Sun Creek local populations. The results of similar efforts in Long Creek are inconclusive. Mark and recapture studies of bull trout in Long Creek indicate a larger migratory component than previously expected.

Although the status of specific local populations has been slightly improved by recovery actions, the overall status of Klamath River bull trout continues to be depressed. Factors considered threats to bull trout in the Klamath Basin at the time of listing – habitat loss and degradation caused by reduced water quality, past and present land use management practices, water diversions, roads, and non-native fishes – continue to be threats today.

Changes in Status of the Saint Mary-Belly River Interim Recovery Unit

The overall status of bull trout in the Saint Mary-Belly River interim recovery unit has not changed appreciably since its listing on November 1, 1999. Extensive research efforts have been conducted since listing, to better quantify populations of bull trout and their movement patterns. Limited efforts in the way of active recovery actions have occurred. Habitat occurs mostly on Federal and Tribal lands (Glacier National Park and the Blackfeet Nation). Known problems due to instream flow depletion, entrainment, and fish passage barriers resulting from operations of the U.S. Bureau of Reclamation's Milk River Irrigation Project (which transfers Saint Mary-Belly River water to the Missouri River Basin) and similar projects downstream in Canada constitute the primary threats to bull trout and to date they have not been adequately addressed under section 7 of the Act. Plans to upgrade the aging irrigation delivery system are being pursued, which has potential to mitigate some of these concerns but also the potential to intensify dewatering. A major fire in August 2006 severely burned the forested habitat in Red Eagle and Divide Creeks, potentially affecting three of nine local populations and degrading the baseline.

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Appendix F: Status of the Species - Bull Trout: Lower Skagit River Core Area

Appendix F
STATUS OF THE SPECIES - BULL TROUT: LOWER SKAGIT RIVER CORE AREA

Lower Skagit Core Area

The Lower Skagit core area comprises the Skagit basin downstream of Seattle City Light's Diablo Dam, including the mainstem Skagit River and the Cascade, Sauk, Suiattle, White Chuck, and Baker River including the lake systems (Baker Lake and Lake Shannon) upstream of upper and lower Baker Dams.

Bull trout, which occur throughout the Lower Skagit core area, include fluvial, adfluvial, resident, and anadromous life history forms. Resident life history forms, found in several locations in the core area, often occur with migratory life history forms. Adfluvial bull trout occur in Baker, Shannon, and Gorge Lakes. Fluvial bull trout forage and overwinter in the larger pools of the upper portion of the mainstem Skagit River and, to a lesser degree, in the Sauk River (Kraemer 2003; WDFW et al. 1997).

Many bull trout extensively use the lower estuary and nearshore marine areas for extended rearing and subadult and adult foraging. Key spawning and early rearing habitat, found in the upper portion of much of the basin, is generally on federally protected lands, including North Cascades National Park, North Cascades Recreation Area, Glacier Peak Wilderness, and Henry M. Jackson Wilderness Area.

The status of the bull trout core area population is based on four key elements necessary for long-term viability: 1) number and distribution of local populations, 2) adult abundance, 3) productivity, and 4) connectivity (USFWS 2004, Vol. I p. 215, Vol. II p. 135).

<u>Number and Distribution of Local Populations</u>

Nineteen local populations were identified in the draft recovery plan (USFWS 2004, Vol. II p. 76) 1) Bacon Creek, 2) Baker Lake, 3) Buck Creek, 4) Cascade River, 5) Downey Creek, 6) Forks of Sauk River, 7) Goodell Creek, 8) Illabot Creek, 9) Lime Creek, 10) Lower White Chuck River, 11) Milk Creek, 12) Newhalem Creek, 13) South Fork Cascade River, 14) Straight Creek, 15) Sulphur Creek, 16) Tenas Creek, 17) Upper South Fork Sauk River, 18) Upper Suiattle River, and 19) Upper White Chuck River. Although initially identified as potential local populations in the draft recovery plan (USFWS 2004, p. 76, 84), Sulphur Creek (Lake Shannon) and Stetattle Creek each now meets the definition of local population based on subsequent observations of juvenile bull trout and prespawn migratory adult bull trout (R2 Resource Consultants and Puget Sound Energy 2005, p. 3-7; Jim Shannon in litt. 2004). With 21 local populations, the bull trout in the Lower Skagit core area is at diminished risk of extirpation and adverse effects from random naturally- occurring events (see "Life History").

Adult Abundance

The Lower Skagit core area, with a spawning population of migratory bull trout that numbers in the thousands, is probably the largest population in Washington (Kraemer 2001). Consequently, the bull trout population in this core area is not considered at risk from genetic drift.

Based upon snorkel strip-count surveys, researchers from the University of Washington have provided an estimate for the approximate number of adult bull trout that reside in the 26-mile section of the mainstem Skagit between the Sauk River and the town of Newhalem. Most of these adults are fluvial fish which spawn in tributaries, including Newhalem Creek, Goodell Creek, Bacon Creek, Diabsud Creek, Illabot Creek, and the Cascade River. These surveys indicate that between 1,600 and 5,000 adult bull trout reside in the 26-mile section of the mainstem Skagit River between the Sauk River and the town of Newhalem (E. Lowery, UW, pers. comm. 2008 in USFWS 2008, p. 1638). Genetic analyses completed in conjunction with these surveys found that bull trout were genetically diverse, with statistically significant differences in genetics observed on a longitudinal basis along this section of the river (Smith, UW, unpublished data 2008 in USFWS 2008, p. 1643). This finding, in conjunction with migration data from acoustic tag studies, suggests that the local bull trout populations situated along the mainstem Skagit River, including Bacon Creek, Goodell Creek, Illabot Creek, Diabsud Creek, and the Cascade River are genetically distinct even though adult fish freely migrate among these areas (E. Connor, Seattle City Light, unpublished data 2008 in USFWS 2008, p. 1643).

Primary snorkeling indexes include locations along Goodell, Downey, and Bacon Creeks, and the South Fork Sauk River. Snorkeling indexes also now include locations on Illabot Creek and the Cascade River. Numbers of holding adult bull trout and bull trout redds increased from 2006 to 2007 in Goodell, Bacon, and Illabot Creeks, and the South Fork Sauk River (Downen 2009, p. 2). In Downey Creek and the Cascade River, live adult counts were up while redd counts were down. Live adult counts rose in Goodell Creek despite continued absence of passage above the 2003 slide to historic spawning habitat (Downen 2009, p. 2).

Overall numbers of adult bull trout in the Skagit basin appear to have increased from 2006 to 2008 based on both live adult counts and redd counts (Figures 1 and 2)(Downen 2009, p. 2). The Sauk River and Illabot Creek populations are still significantly depressed compared to levels observed in 2002 through 2004. However, overall, the currently monitored Sauk River population is larger than it has been throughout the decade of the 1990's (Figure 3)(Downen 2009, p. 2).

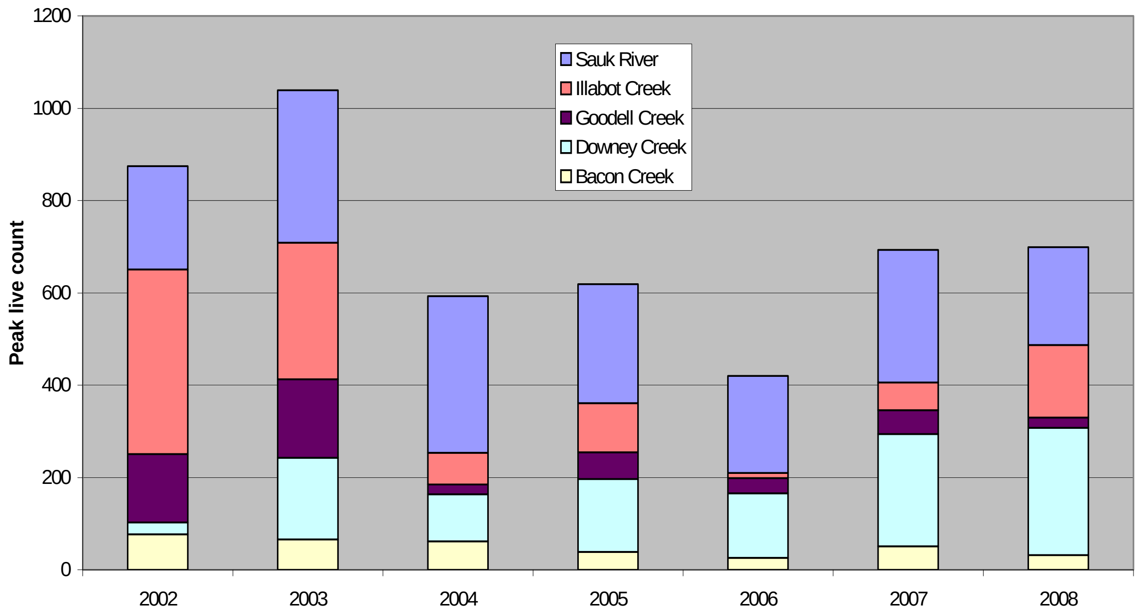

Figure 1: Trends in peak adult index counts from 2002 through 2008 (Downen 2009, p. 3).

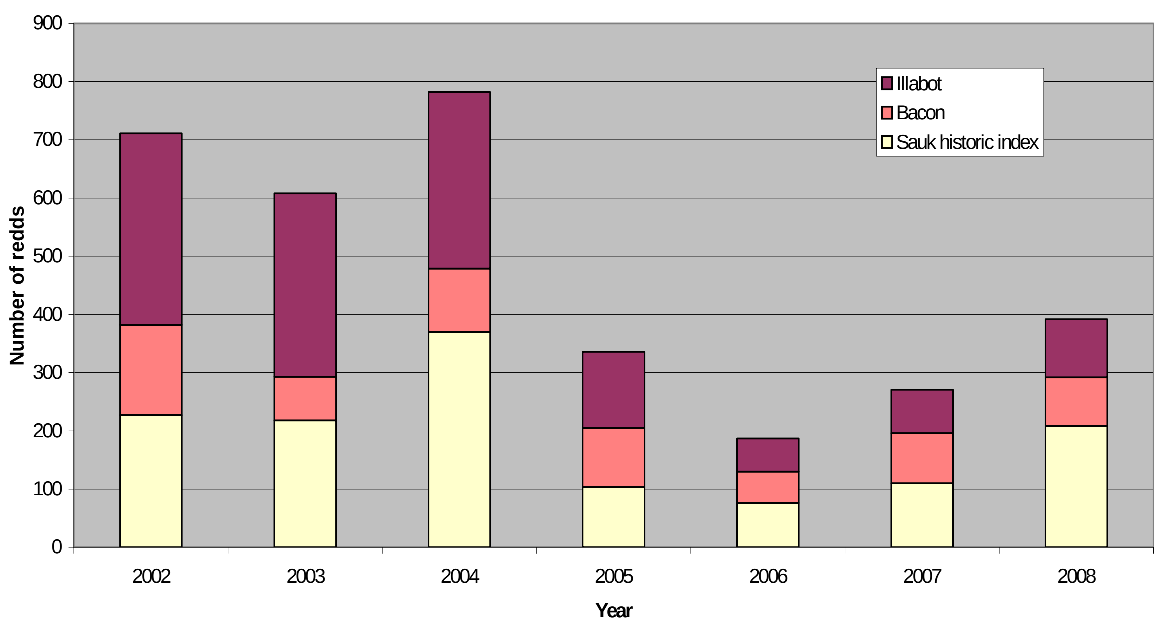

Figure 2. Trends in cumulative redd counts from 2002 through 2008 (Downen 2009, p. 3).

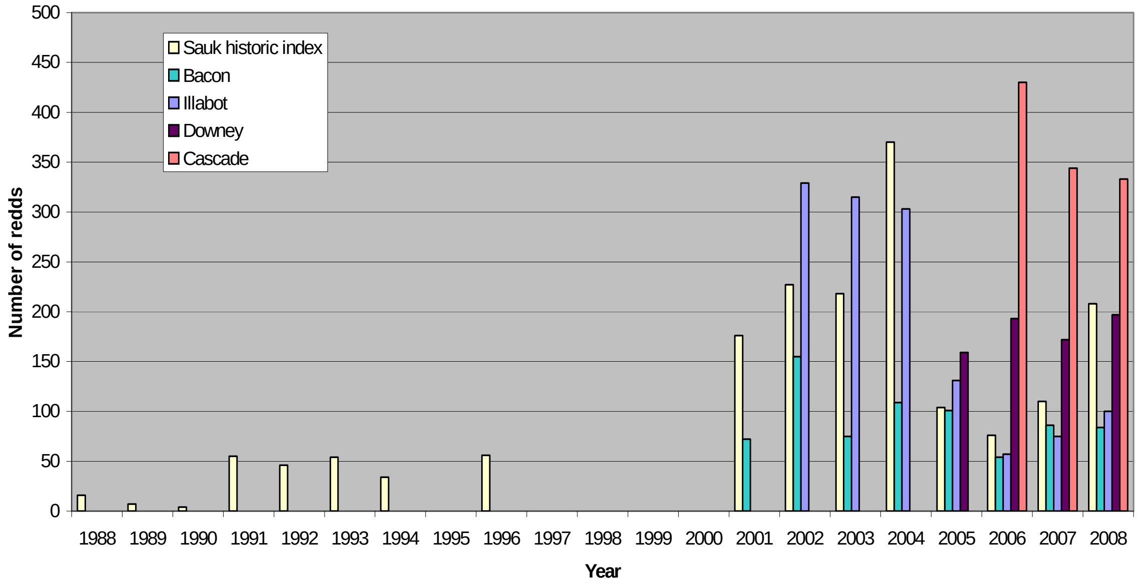

Figure 3. Long term trends in redd counts (Downen 2009, p. 4).

The majority of local populations in the core area include 100 adults or more; therefore, they are at a diminished risk of extirpation. However, some local populations probably have fewer than 100 adults and may be at risk from inbreeding depression. There is some risk of extirpation of the following local populations due to their lower numbers of adults; however, other factors, such as stable or increasing population trends may reduce this risk.

Fewer than 100 adults probably occur in Tenas Creek, but this local population is presumed to be increasing. The Straight Creek local population includes fewer than 100 migratory adults and an unknown number of resident fish (Kraemer 2001), but the migratory component appears stable. The Lime Creek local population probably has fewer than 100 migratory adults, but resident and migratory components are considered abundant.

The South Fork Cascade River local population probably has fewer than 100 migratory adults (Kraemer 2001); however, resident and migratory components are considered stable. Surveys completed on the Cascade River since 2006 have revealed large numbers of holding bull trout between Sibley Creek and the North Fork confluence. These results re-enforce 2006 and 2007 redd survey data that indicated the Cascade River harbors one of the largest and most diverse populations of bull trout in the Skagit basin (Downen 2009, p. 1).

Based on recent observations, the Sulphur Creek local population in the Lake Shannon system also has fewer than 100 adults (R2 Resource Consultants and Puget Sound Energy 2006). Prior to 2004, Goodell Creek supported more than 100 adult spawners. In October 2003, a large landslide in Goodell Creek blocked access to the majority of spawning habitat for migratory bull trout in the Goodell Creek local population. Adult counts of migratory bull trout in 2004 and 2005 have been fewer than 100 individuals (Downen 2006) in this local population. In the Baker Lake local population, annual peak counts of 85 adults have been recorded between 2001 and 2005 (R2 Resource Consultants and Puget Sound Energy 2006). Since the most upstream accessible habitat was not surveyed in these efforts, and bull trout typically spawn as far upstream as they can within a stream system, this would suggest that on average there may be at least 100 adults in this local population. Total adult abundances in Newhalem and Stettatle Creek local populations are unknown.

Productivity

Long-term redd counts in the index areas of the Lower Skagit core area generally indicate stable to increasing population trends (USFWS 2004). Therefore, this core area is not considered at risk of extirpation at this time. However, recent declines in redd counts may indicate a potential change to this long-term trend (Downen 2006).

Redd count data is available for the spawning index on the South Fork Sauk River. Redds have been counted at this location since 1988. The annual total has ranged from 4 redds in 1990 to 370 redds in 2004 (WDFW 1998 Downen, WDFW, pers. comm. 2003 and 2005 in USFWS 2008, p. 1637). The annual total averaged around 50 redds during the 1990s, but increased significantly during the early 2000s. Another reach of the South Fork Sauk River was included as an additional index area beginning in 2002.

Redd counts have been conducted in additional survey areas since 2001 (Downen, WDFW, pers. comm. 2007 in USFWS 2008, p. 1637). Counts were initiated in the Bacon Creek index area in 2001, with counts ranging between 72 and 155 redds, averaging 103 redds, between 2001 and 2004. Counts were initiated in the Illabot Creek index area in 2002, with counts ranging between 303 and 329 redds, averaging 315 redds, between 2002 and 2004. Redd counts have been conducted within index sites in Downey Creek (Suiattle River subbasin) since 2005, with an average of 170 redds counted in 2005 and 2006. Redd counts were initiated within an index site in the Cascade River in 2006, with 440 redds counted that year.

A series of flood and drought events have recently resulted in temporary declines in population abundance. A record flood event in October 2003 is thought to have impacted 2001 and 2002 brood years (WDFW, in litt. 2007 in USFWS 2008, p. 1646). A 60 percent decline in redd counts was observed in 2005 and is attributed to an extreme low summer flow event of that year (WDFW, in litt. 2007 in USFWS 2008, p. 1646). Low summer flows in 2006, followed by a record flood event in November 2006 is believed to have likely further impacted spawning success.

While redd counts in the primary indexes, including Bacon and Illabot Creeks, and the South Fork Sauk River increased modestly during 2008, counts in the Cascade River decreased somewhat. This reinforces conclusions drawn from data collected in 2006, suggesting population variations within sub-basins are not always correlated and expanded monitoring is essential to tracking basin wide trends (Downen 2009, p. 2).

The total cumulative bull trout redd count was 62.5 percent greater in 2010 than observed in 2009. However despite improved redd counts in some indexes, other indexes declined from 2009 counts (Table 1). The total cumulative redd count was below the mean from the years

Table 1. Yearly cumulative redd counts from 2005 through 2010 (based on Fowler 2011, p. 1).

IndexStream	Basin	Indexes	2010	2009	2008	2007	2006	2005
WF Bacon Creek	Skagit	1	67	21	84	86	59	101
Cascade/SF Cascade Rivers	Skagit	2	207	91	333	344	434	no data
Downey Creek	Skagit	2	95	103	197	172	193	158
SF Sauk River	Skagit	2	152	77	208	110	143	104
		Total redds:	521	292	822	712	829	363

2005 through 2009 for all index reaches in 2010 except for the South Fork Sauk River (Fowler 2011, p. 1).

The status and trend of bull trout in this core area was considered "strong" based on information available at the time of listing (USFWS 1998). Recent data would suggest that the population within the overall core area still remains strong. However, trends across the core area are not completely clear, given that year-to-year counts in the recently established index areas are variable (USFWS 2008, p. 1640). Furthermore, obtaining consistently accurate redd counts is complicated by at least two factors; recent work suggests significant year-to-year variation in habitat usage within some index areas, and timing and accessibility (including weather constraints) make these some of the most difficult surveys completed anywhere in the north Puget Sound (Fowler 2011, pp. 3, 4, 10).

Connectivity

The presence of migratory bull trout in most of the local populations indicates the bull trout in the Lower Skagit core area has a diminished risk of extirpation from habitat isolation and fragmentation. However, the lack of connectivity of the Baker Lake and Sulphur Creek local populations in the Baker River system and Stetattle Creek local population in the Gorge Lake system with other local populations in the core area is a concern with respect to long-term persistence, life history expression, and refounding. In addition, there is currently only partial connectivity within the Baker Lake system, with no upstream passage for adults within Lake Shannon at upper Baker Dam.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Lower Skagit core area have caused harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs that include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects; federally funded transportation projects involving repair and protection of roads and bridges; and section 10(a)(1)(B) permits for Habitat Conservation Plans addressing forest management practices. Capture and handling, and indirect mortality, during implementation of section 6 and section 10(a)(1)(A) permits have negatively directly affected bull trout in the Lower Skagit core area.

The number of non-Federal actions occurring in the Lower Skagit core area since the bull trout listing is unknown. Activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably have negatively affected bull trout and parts of their forage base.

A number of major restoration and conservation land protection projects have been completed in the Skagit River watershed that improve and protect bull trout habitat. Many of these projects were implemented as the result of project prioritization processes and state and federal funding coordinated by the Skagit Watershed Council (E. Connor, Seattle City Light, pers. comm. 2008 in USFWS 2008, p. 1647). Major restoration projects that have been implemented or completed since 2004 include the Milltown Island and Wiley Slough Estuary Restoration Project sponsored by the Skagit River System Cooperative (SRSC) and WDFW, and the sediment reduction projects in the middle Skagit and Suiattle River watersheds sponsored by the U.S. Forest Service. Over 1,100 acres of habitat in the Cascade River was put into permanent conservation protection through the partnership of Seattle City Light, Washington Department of Natural Resources, and USFWS (USFWS 2008, p. 1647). Several miles of FMO habitat along the middle Skagit River have been protected since 2004 by the Skagit Land Trust and The Nature Conservancy, and major areas along the middle Skagit are being restored by the Skagit Fisheries Enhancement Group and SRSC. The SRSC has been reducing the impacts of bank armoring on FMO habitats in the Sauk River by acquiring lands and subsequently removing riprap (USFWS 2008, p. 1647).

<u>Threats</u>

Threats to bull trout in the Lower Skagit core area include:

- Gorge and Baker Dams restrict connectivity of the Stetattle Creek, Baker Lake, and Sulphur Creek (Lake Shannon) local populations with the majority of other local populations in the core area due to impaired fish passage.

- Operations of the Lower Baker Dam occasionally have significantly affected water quantity in the lower Baker and Skagit Rivers.

- Agricultural practices, residential development, and the transportation network, with related stream channel and bank modifications, have caused the loss and degradation of foraging, migration, and overwintering habitats in mainstem reaches of the major forks and in a number of the tributaries.

- Estuarine nearshore foraging habitats have been, and continue to be, negatively affected by agricultural practices and development activities.

- The abundance of Chinook, chum, and pink salmon has substantially declined in the Skagit River since 2004, and steelhead have been declining in the watershed for over a decade (WDFW Salmon and Steelhead Stock Inventory-SASSI database 2008 in USFWS 2008, p. 1644). The eggs and juveniles produced by salmon, steelhead, and whitefish provide a major portion of the forage base for subadult and adult bull trout in the Skagit River (E. Lowery, UW, unpublished data 2008 in USFWS 2008, p. 1644). The abundance of the forage base has been undergoing a long-term decline in the Skagit River watershed. The declining forage base may result in long-term declines in the core area's bull trout populations (USFWS 2008, p. 1650).

- Recent model results predict that impacts from climate change will be most pronounced in high-elevation streams (Battin et al. 2007 in USFWS 2008, p. 1654). These impacts may include higher water temperatures, lower spawning flows, and, most importantly, increased magnitude of winter peak flows (Battin et al. 2007 in USFWS 2008, p. 1654). Increased peak flows and sediment loads, and related channel bed instability, will likely reduce spawning and incubation success and increase redd scour for bull trout and their prey. However, because of the size of the Skagit River basin, the large number of local populations, and number of protected areas (North Cascades National Park, Henry M. Jackson Wilderness, Glacier Peak Wilderness), there is likely greater resiliency here than in other core areas (USFWS 2008, p. 1654).

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Appendix G: Status of Critical Habitat - Bull Trout

Appendix G
STATUS OF CRITICAL HABITAT - BULL TROUT (Rangewide)

Legal Status

Current Designation

The U.S. Fish & Wildlife Service (Service) published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (70 FR 63898); the rule becomes effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range, which includes the Jarbidge River, Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as interim recovery units)[8]. Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles as bull trout critical habitat (Table 1). Designated bull trout critical habitat is of two primary use types: 1) spawning and rearing, and 2) foraging, migration, and overwintering (FMO).

Table 1. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

State	Stream/Shoreline Miles	Stream/Shoreline Kilometers	Reservoir /Lake Acres	Reservoir/ Lake Hectares
Idaho	8,771.6	14,116.5	170,217.5	68,884.9
Montana	3,056.5	4,918.9	221,470.7	89,626.4
Nevada	71.8	115.6	-	-
Oregon	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho	107.7	173.3	-	-
Washington	3,793.3	6,104.8	66,308.1	26,834.0
Washington (marine)	753.8	1,213.2	-	-
Washington/Idaho	37.2	59.9	-	-
Washington/Oregon	301.3	484.8	-	-
Total	19,729.0	31,750.8	488,251.7	197,589.2

The 2010 revision increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs compared to the 2005 designation.

This rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to

[8] The Service's 1999 coterminous listing rule identified five interim recovery units (50 CFR Part 17, pg. 58910) and our five year review recommended re-evaluation of these units based on new information (USFWS 2008, p. 9). Our critical habitat designation described six draft recovery units (75FR63927). Until the bull trout draft recovery plan is finalized, the current five interim recovery units will be used for purposes of section 7 jeopardy analyses and recovery planning. The adverse modification analysis in this biological opinion does not rely on recovery units, relying instead on the newly listed critical habitat units and subunits.

address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower main stem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: 1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (Act), in which bull trout is a covered species on or before the publication of this final rule; 2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or 3) waters where impacts to national security have been identified (75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant Critical Habitat Unit (CHU) text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. See Tables 2 and 3 for the list of excluded areas. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

Table 2.—Stream/shoreline distance excluded from bull trout critical habitat based on tribal ownership or other plan.

Ownership and/or Plan	Kilometers	Miles
Lewis River Hydro Conservation Easements	7.0	4.3
DOD – Dabob Bay Naval	23.9	14.8
HCP – Cedar River (City of Seattle)	25.8	16.0
HCP – Washington Forest Practices Lands	1,608.30	999.4
HCP – Green Diamond (Simpson)	104.2	64.7
HCP – Plum Creek Central Cascades (WA)	15.8	9.8
HCP – Plum Creek Native Fish (MT)	181.6	112.8
HCP–Stimson	7.7	4.8
HCP – WDNR Lands	230.9	149.5
Tribal – Blackfeet	82.1	51.0
Tribal – Hoh	4.0	2.5
Tribal – Jamestown S'Klallam	2.0	1.2
Tribal – Lower Elwha	4.6	2.8
Tribal – Lummi	56.7	35.3
Tribal – Muckleshoot	9.3	5.8
Tribal – Nooksack	8.3	5.1

Ownership and/or Plan	Kilometers	Miles
Tribal – Puyallup	33.0	20.5
Tribal – Quileute	4.0	2.5
Tribal – Quinault	153.7	95.5
Tribal – Skokomish	26.2	16.3
Tribal – Stillaguamish	1.8	1.1
Tribal – Swinomish	45.2	28.1
Tribal – Tulalip	27.8	17.3
Tribal – Umatilla	62.6	38.9
Tribal – Warm Springs	260.5	161.9
Tribal – Yakama	107.9	67.1
Total	3,094.9	1,923.1

Table 3. Lake/Reservoir area excluded from bull trout critical habitat based on tribal ownership or other plan.

Ownership and/or Plan	Hectares	Acres
HCP – Cedar River (City of Seattle)	796.5	1,968.2
HCP – Washington Forest Practices Lands	5,689.1	14,058.1
HCP – Plum Creek Native Fish	32.2	79.7
Tribal – Blackfeet	886.1	2,189.5
Tribal – Warm Springs	445.3	1,100.4
Total	7,849.3	19,395.8

Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63898:63943 [October 18, 2010]). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

Thirty-two CHUs within the geographical area occupied by the species at the time of listing are designated under the revised rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical biological features associated with Primary Constituent Elements (PCEs) 5 and 6, which relate to breeding habitat.

The primary function of individual CHUs is to maintain and support core areas, which 1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); 2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); 3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Hard 1995, pp. 314-315; Healey and Prince 1995, p. 182; MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and 4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (Hard 1995, pp. 321-322; MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PCEs that are critical to adult and subadult foraging, overwintering, and migration.

Primary Constituent Elements for Bull Trout

Within the designated critical habitat areas, the PCEs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, we have determined that the following PCEs are essential for the conservation of bull trout.

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 °C to 15 °C (36 °F to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these

conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

9. Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The revised PCE's are similar to those previously in effect under the 2005 designation. The most significant modification is the addition of a ninth PCE to address the presence of nonnative predatory or competitive fish species. Although this PCE applies to both the freshwater and marine environments, currently no non-native fish species are of concern in the marine environment, though this could change in the future.

Note that only PCEs 2, 3, 4, 5, and 8 apply to marine nearshore waters identified as critical habitat. Also, lakes and reservoirs within the CHUs also contain most of the physical or biological features necessary to support bull trout, with the exception of those associated with PCEs 1 and 6. Additionally, all except PCE 6 apply to FMO habitat designated as critical habitat.

Critical habitat includes the stream channels within the designated stream reaches and has a lateral extent as defined by the bankfull elevation on one bank to the bankfull elevation on the opposite bank. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. If bankfull elevation is not evident on either bank, the ordinary high-water line must be used to determine the lateral extent of critical habitat. The lateral extent of designated lakes is defined by the perimeter of the waterbody as mapped on standard 1:24,000 scale topographic maps. The Service assumes in many cases this is the full-pool level of the waterbody. In areas where only one side of the waterbody is designated (where only one side is excluded), the mid-line of the waterbody represents the lateral extent of critical habitat.

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high-water (MHHW) line, including the uppermost reach of the saltwater wedge within tidally influenced freshwater heads of estuaries. The MHHW line refers to the average of all the higher high-water heights of the two daily tidal levels. Marine critical habitat extends offshore to the depth of 10 meters (m) (33 ft) relative to the mean low low-water (MLLW) line (zero tidal level or average of all the lower low-water heights of the two daily tidal levels). This area between the MHHW line and minus 10 m MLLW line (the average extent of the photic zone) is considered the habitat most consistently used by bull trout in marine waters based on known use, forage fish availability, and ongoing migration studies and captures geological and ecological processes important to maintaining these habitats. This area contains essential foraging habitat and migration corridors such as estuaries, bays, inlets, shallow subtidal areas, and intertidal flats.

Adjacent shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes, and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on physical and biological features of the aquatic environment.

Activities that cause adverse effects to critical habitat are evaluated to determine if they are likely to “destroy or adversely modify” critical habitat by no longer serving the intended conservation role for the species or retaining those PCEs that relate to the ability of the area to at least periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PCEs to such an extent that the conservation value of critical habitat is appreciably reduced (75 FR 63898:63943; USFWS 2004, Vol. 1. pp. 140-193, Vol. 2. pp. 69-114). The Service’s evaluation must be conducted at the scale of the entire critical habitat area designated, unless otherwise stated in the final critical habitat rule (USFWS and NMFS 1998, pp. 4-39). Thus, adverse modification of bull trout critical habitat is evaluated at the scale of the final designation, which includes the critical habitat designated for the Klamath River, Jarbidge River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments. However, we consider all 32 CHUs to contain features or areas essential to the conservation of the bull trout (75 FR 63898:63901, 63944). Therefore, if a proposed action would alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation function of one or more critical habitat units for bull trout, a finding of adverse modification of the entire designated critical habitat area may be warranted (75 FR 63898:63943).

Current Critical Habitat Condition Rangewide

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 FR 31647, June 10 1998; 64 FR 17112, April 8, 1999).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: 1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7); 2) degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45); 3) the introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76); 4) in the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development; and 5) degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

Effects of Climate Change on Bull Trout Critical Habitat

One objective of the final rule was to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PCEs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with non-native fishes).

Consulted on Effects for Critical Habitat

The Service has formally consulted on the effects to bull trout critical habitat throughout its range. Section 7 consultations include actions that continue to degrade the environmental baseline in many cases. However, long-term restoration efforts have also been implemented that provide some improvement in the existing functions within some of the critical habitat units.

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