United States Department of Agriculture

Colville National Forest Land Management Plan

Final Programmatic Environmental Impact Statement

Volume II. Chapter 3 (Wildlife through Tribal Resources), Chapter 4, Literature Cited, Glossary, and Index

Forest Service | Colville National Forest | September 2019

Cover Photo: Curlew Valley (from Vulcan Mountain)

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer and lender.

Colville National Forest
Land Management Plan
Stevens, Ferry, and Pend Oreille Counties of Washington State

Final Programmatic Environmental Impact Statement

Lead Agency: USDA Forest Service

Responsible Official: Glen Casamassa, Regional Forester
USDA Forest Service, Pacific Northwest Region
1220 SW 3rd Avenue
Portland, Oregon 97208

For Information Contact: Rodney Smoldon, Forest Supervisor
Colville National Forest
765 South Main
Colville, Washington 99114
(509) 684-7000

Website: https://www.fs.usda.gov/detail/colville/landmanagement/planning/?cid=stelprd3824594

Abstract: This final environmental impact statement (FEIS) documents the analysis of six alternatives (no action, proposed action, and alternatives P, R, B, and O) developed by the Forest Service for the programmatic management of approximately 1.1 million acres administered by the Colville National Forest. For ease of reference, the accompanying revised land management plan (revised forest plan) reflects the preferred alternative (alternative P). The alternatives are described in chapter 2. The no action alternative would keep in place the management direction from the 1988 land and resource management plan (1988 forest plan), as amended. Alternative P is the preferred alternative.

The proposed action and alternatives P, R, B, and O address the following needs for action: (1) maintain or restore ecological conditions that contribute to the recovery and viability of terrestrial plant and wildlife species; (2) manage forest vegetation conditions to be more resilient to disturbances; (3) address climate change implications and vulnerabilities; (4) address changed social and economic conditions and preferences in light of ecosystem capacity; (5) accelerate improvement in watershed condition across the forest; and (6) integrate watershed and aquatic strategies across the forest.

Alternatives P, R, B, and O address new information and concerns that emerged during the implementation of the 1988 forest plan and comply with Federal laws, regulations, and policies. These alternatives also address significant issues (unresolved conflicts with the proposed action) that were identified from comments received during the scoping and public involvement period.

The Forest Service will use the predecisional administrative review process, also referred to as the objection process described in 36 CFR 219 Subpart B of the 2012 planning rule. This process gives an individual or entity an opportunity for an independent Forest Service review and resolution of issues before the approval of a plan revision; this subpart identifies who may file objections to a plan revision, the responsibilities of the participants in an objection, and the procedures that apply to the review of the objection. Generally, individuals and entities who have submitted substantive formal comments related to this plan revision during the opportunities for public comment for this decision may file an objection.

This page intentionally left blank

Colville National Forest Land Management Plan

Final Programmatic Environmental Impact Statement

Volume II: Chapter 3 (Wildlife through Tribal Resources), Chapter 4, Literature Cited, Glossary, and Index

Table of Contents

Wildlife....447
Affected Environment....447
Surrogate Wildlife Species....451
Other Species of Management Interest....455
Climate Change and Wildlife....458
Environmental Consequences of Alternatives–Wildlife....460
Summary of Effects—Wildlife....463
No Action Alternative....464
Proposed Action....485
Alternative R....506
Alternative P....527
Alternative B....549
Alternative O....569
Social and Economic Conditions....590
Introduction....590
Economic Resources....591
Affected Environment....591
Methods....599
Economic Consequences....600
Cumulative Economic Effects....604
Social Resources....606
Affected Environment....606
Environmental Consequences....621
No Action Alternative....622
Proposed Action....625
Alternative R....627
Alternative P....630
Alternative B....632
Alternative O....635
Heritage Resources....637
Affected Environment....638
Cultural Setting....638
Inventory (Identification), Evaluation, and the National Register....641
Areas Requiring More Intensive Survey....641
National Register Status of Cultural Resources....641
Public Outreach, Interpretation and Education....642
Current Condition of Archaeological Sites....643
Environmental Consequences....644
Effects of Alternatives....647
Relationship of Short-term Uses and Long-term Productivity....649
Livestock Grazing....650

Affected Environment 650
Need for Change 654
Environmental Consequences 656
Summary of Effects 657
No Action Alternative 665
Proposed Action 667
Alternative R 668
Alternative P 671
Alternative B 674
Alternative O 675
Cumulative Effects (Common to all Alternatives) 677
Minerals and Geologic Resources 678
Affected Environment 678
Environmental Consequences—Minerals 681
No Action Alternative 682
Effects Common to All Action Alternatives 684
Environmental Consequences – Geologic Resources 688
Cumulative Effects 688
Recreation 689
Introduction 690
Affected Environment 690
Need for Change 695
Environmental Consequences 708
Summary of Effects 709
No Action Alternative 711
Proposed Action 717
Alternative R 725
Alternative P 730
Alternative B 738
Alternative O 744
Cumulative Effects (Common to All Alternatives) 751
Scenery 752
Affected Environment 752
Need for Change 760
Environmental Consequences 763
No Action Alternative 764
Summary of Effects 765
Cumulative Effects (Common to all Alternatives) 776
Lands and Special Uses 776
Affected Environment 776
Need for Change 783
Environmental Consequences 783
Summary of Effects 784
Cumulative Effects 785
Tribal Resources 785
Affected Environment 785
Tribal Rights 787
Environmental Consequences 787
Effects Common to All Alternatives 791
Cumulative Environmental Consequences 793
Chapter 4. Consultation and Coordination 795

Preparers and Contributors....795
Interdisciplinary Team Members....795
Support to Interdisciplinary Team....797
Consultation and Coordination....798
Literature Cited....801
Glossary....867
Index....899

List of Tables

Table 176. Current percentage of core areas within grizzly bear management units in the Selkirk Recovery Area....450
Table 177. Current and historical viability outcomes for surrogate wildlife species assessed on the Colville National Forest....454
Table 178. Region 6 Surrogate Species and Region 6 Sensitive Species used in the Colville National Forest Wildlife Evaluation Report....456
Table 179. Influence of roads and trails on elk winter range habitat effectiveness....457
Table 180. Influence of roads and trails on deer winter range habitat effectiveness....457
Table 181. Climate change vulnerability ratings for wildlife species assessed in the Colville National Forest plan revision....458
Table 182. Evaluation criteria and key indicators for wildlife....462
Table 183. Summary of the relative contribution of each alternative to the recovery of federally listed wildlife species, viability of surrogate wildlife species, or sustainability of species of management interest....464
Table 184. Dispersal habitat suitability for surrogate wildlife species under the no action alternative, by proportion of planning area....477
Table 185. Dispersal habitat suitability for surrogate wildlife species under the proposed action, by proportion of planning area (based on desired conditions)....499
Table 186. Dispersal habitat suitability for surrogate wildlife species under alternative R, by proportion of planning area (based on desired conditions)....519
Table 187. Dispersal habitat suitability for surrogate wildlife species under alternative P, by proportion of planning area (based on desired conditions)....541
Table 188. Dispersal habitat suitability for surrogate wildlife species under alternative B, by proportion of planning area (based on desired conditions)....561
Table 189. Dispersal habitat suitability for surrogate wildlife species under alternative O, by proportion of planning area (based on desired conditions)....582
Table 190. Market segments of Colville National Forest visitors (2009)....593
Table 191. Colville National Forest recreation, wildlife, and fish visits, total economic impacts....593
Table 192. Average authorized livestock grazing data on the Colville National Forest for 2012 through 2014....594
Table 193. Colville livestock grazing total economic impacts for the socioeconomic impact zone....594
Table 194. Timber harvest volume three-year average....595
Table 195. Area where Colville National Forest timber harvest is processed....595
Table 196. Colville National Forest timber harvest economic impacts....596
Table 197. Average annual Colville National Forest expenditures for 2009 through 2011....596
Table 198. The economic impacts of the Colville National Forest budget, 2009-2011 average....596
Table 199. Total Forest Service SRS and PILT payments to Colville National Forest counties....597
Table 200. Reconstructed Forest Service 25-percent payments to Colville National Forest counties....597
Table 201. Economic impacts of Forest Service payments to counties for the Colville National Forest....598
Table 202. Current contribution of the Colville National Forest to its socioeconomic impact zone....598
Table 203. Estimated annual timber harvest (PWSQ) by alternative and by product type in CCF....601

Table 204. Estimated jobs and income supported by timber harvest by alternative (annual average) 601
Table 205. Estimated jobs and income supported by recreation expenditures, annual average 602
Table 206. Estimated cattle and sheep permitted animal unit months (AUM) by alternative, annual average 603
Table 207. Estimated jobs and income supported by grazing, annual average 603
Table 208. Estimated jobs and income supported by budget expenditures (annual average) 604
Table 209. Estimated 25-percent payments 604
Table 210. Total jobs and income supported by Colville National Forest activities and programs by alternative for the Colville socioeconomic impact zone, annual average 605
Table 211. Current population and growth trends in the socioeconomic impact zone 606
Table 212. Population density for the socioeconomic impact zone, 2010 607
Table 213. Median age of socioeconomic impact zone counties, 2010 608
Table 214. Educational attainment, percentage of persons age 25 and over of socioeconomic impact zone counties, 2010 608
Table 215. Per capita income and mean earnings of socioeconomic impact zone counties, 2012 609
Table 216. Contribution of labor and non-labor income to total personal income of socioeconomic impact zone counties, 2012 609
Table 217. Poverty rates of socioeconomic impact zone counties, 2012 612
Table 218. Poverty by race and ethnicity of socioeconomic impact zone counties, 2000 613
Table 219. Economic diversity index of socioeconomic impact zone counties, 2010 615
Table 220. Location diversity rating of socioeconomic impact zone counties, 2004 616
Table 221. Composite community resilience measures of socioeconomic impact zone counties 616
Table 222. Forested lands of socioeconomic impact zone counties 617
Table 223. Forestry and commercial logging employment and income of socioeconomic impact zone counties, 2010, percentage of total 618
Table 224. Activity participation on the Colville National Forest 619
Table 225. Cut and sold firewood, volume and value, on the Colville National Forest, FY2012 619
Table 226. Percentage of households with wood as primary heating fuel of socioeconomic impact zone counties, 2010 620
Table 227. Homes in wildland-urban interface (WUI) and wildfire risk of socioeconomic impact zone counties 621
Table 228. Colville National Forest capable rangelands 658
Table 229. Suitability of livestock grazing on the Colville National Forest 660
Table 230. Colville National Forest suitable rangelands by alternative 660
Table 231. Colville National Forest restricted access management areas, percentage by alternative 663
Table 232. Upper limit of desired road density by alternative 663
Table 233. Evaluation criteria and key indicators for mineral resources 678
Table 234. Backcountry Non-motorized Management Area – percentage of total forest acres 686
Table 235. Upper limit of desired road density or road miles 686
Table 236. Recommended wilderness – percentage of total forest acres 686
Table 237. Evaluation criteria and key indicators for recreation resources 689
Table 238. Percentage participation in activities and primary activities of Colville National Forest recreation visitors 693
Table 239. Management areas suitable for summer and winter motorized and non-motorized recreation opportunities by action alternative 695
Table 240. Eligible wild and scenic rivers on the Colville National Forest 707
Table 241. Total acres closed to over-snow vehicles by alternative 712
Table 242. Comparison of summer motorized and non-motorized trail miles by alternative 713
Table 243. Acres managed for summer backcountry motorized and backcountry non-motorized trail opportunities and total forest acres, by alternative 715

Table 244. Backcountry acres open to mountain bike trails and miles of existing trail that would be open to mountain bikes by alternative....717
Table 245. Acres and percentage of the Forest in each (recreation opportunity spectrum) ROS class by alternative....719
Table 246. Acres of recommended wilderness by alternative....721
Table 247. Scenic integrity objectives....757
Table 248. Evaluation criteria and key indicators for scenic resources....764
Table 249. Effects on scenic resources from vegetation management....767
Table 250. Effects on scenic resources from motorized recreation....770
Table 251. Effects on scenic resources from access....771
Table 252. Effects on scenic resources from recommended wilderness....772
Table 253. Effects on scenic resources from wildlife....773
Table 254. Effects on scenic resources from riparian and aquatic resource management....774
Table 255. Designated communication sites....779
Table 256. Forest Service repeater locations....780

List of Figures

Figure 13. Unemployment rate of socioeconomic impact zone counties, 2010....611
Figure 14. Cattle range capability....658
Figure 15. Sheep range capability....659
Figure 16. Cattle range suitability....661
Figure 17. Sheep range suitability....662

Wildlife

This section considers federally listed threatened, endangered, and sensitive wildlife species, and surrogate wildlife species from the wildlife specialist report (Gaines 2017), with special emphasis on the issues of old forest management and timber production, motorized recreation trails, access, and wildlife.

Affected Environment

The Colville National Forest provides a wide array of habitats for a diversity of wildlife species. The species addressed in forest planning include federally listed species, surrogate species (including Management Indicator Species and R6 Sensitive Species), endemic species, and other species of management interest. The regional forester's sensitive species list is included in appendix C of the revised forest plan.

Federally Listed and Proposed Wildlife Species

Since the completion of the 1988 forest plan, new wildlife species have been listed (Canada lynx, yellow-billed cuckoo) and proposed for listing (wolverine), and others delisted (peregrine falcon, bald eagle, gray wolf). And, new science is available concerning those species that were included in the 1988 forest plan.

Woodland Caribou

The woodland caribou was federally listed as an endangered species in 1984. The population was estimated between 27 and 46 animals during annual counts occurring from 2002 to 2012 (WDFW 2012a), then declined rapidly to just 12 caribou by 2016 (Wiles 2017). Nearly all of the winter survey detections have been in British Columbia since about 1999, with no detections on the U.S. side in five of six survey years since 2011 (Wiles 2017). The caribou recovery area is 1,477 square miles in size and comprised of lands managed by the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States, and 53 percent in British Columbia. The caribou recovery area is divided into 17 caribou management units, 4 of which occur on the Colville National Forest. The Selkirk Mountain population has been proposed for downlisting to a threatened species.

In the mid-1990s, an interagency effort was started to augment caribou populations in the Selkirk Mountains of Washington in order to advance recovery efforts (Almack 1998). A caribou management area identified in the 1988 forest plan has been used to guide management. However, new science has identified winter recreational activities as an important issue to address in relation to caribou recovery (Mitchell and Hamilton 2007); this was not addressed in the 1988 land management plan. In 2001, the USFWS issued a new Biological Opinion on the 1988 forest plan with terms and conditions that required a winter recreation strategy be completed that balanced the needs of secure winter habitat for caribou with access for winter recreation activities (USFWS 2001). Thus, a recreation strategy was developed in 2003 (USDA Forest Service 2003).

Early winter caribou habitat consists of low to mid elevation, cedar/hemlock forest stands and stands on the ecotone with subalpine fir/spruce habitats (Rominger and Oldemeyer 1989). Mature and old stand conditions and good canopy closure (approximately 70 percent) are important habitat components (Rominger 1995). There is less risk of caribou being disturbed by winter recreation activities on early-winter range. On the Sullivan Lake Ranger District, most off-road travel in these

areas is precluded by the heavily wooded nature of the preferred forest stand types. The potential for disturbance to caribou exists mainly where roads bisect these stands.

Subalpine and alpine ridges provide late winter habitat for woodland caribou (Rominger et al. 1996). Snowmobile riders are attracted to these areas for the challenging slopes and the views that they often provide. Simpson and Terry (2000) characterized snowmobile riding as posing moderate to high risks to caribou in the South Selkirk Mountains Ecosystem. A primary concern related to this activity is animals being displaced from preferred late-winter habitat (Mitchell and Hamilton 2007).

In 2012, the USFWS published in the Federal Register a revised designation of Critical Habitat for the southern Selkirk Mountains population of woodland caribou (Federal Register 77(229): 71042-71082). This resulted in the designation of 30,010 acres of Federal land in Boundary County, Idaho, and Pend Oreille County, Washington as critical habitat. The rule also identifies physical and biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protections. The physical and biological features identified for the southern Selkirk Mountains population of woodland caribou in the critical habitat rule include:

- Space for individual and population growth and for normal behavior.
- Food, water, air, light, minerals, or other nutritional or physiological requirements.
- Sites for breeding, reproduction, or rearing (or development) of offspring.
- Habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

Based on the current understanding of the physical and biological features and habitat characteristics required to sustain the southern Selkirk Mountains population of woodland caribou's life-history processes, the primary constituent elements specific to the southern Selkirk Mountains population of woodland caribou are:

- Mature to old-growth western hemlock (*Tsuga heterophylla*)/western red cedar (*Thuja plicata*) climate forest and subalpine fir (*Abies lasiocarpa*)/Engelmann spruce (*Picea engelmanni*) climax forest at least 5,000 feet in elevation; these habitats typically have 26 to 50 percent or greater canopy closure. Currently, the hemlock/cedar forest type is 21 percent early successional condition, 60 percent mid-successional condition, and 19 percent late-successional condition. Estimates of the range of variability show that 55 to 83 percent of these forest types were in a late-successional condition, indicating there is substantial potential to improve habitat conditions for woodland caribou.
- Ridge tops and high-elevation basins that are generally 6,000 feet in elevation or higher, associated with mature to old stands of subalpine fir/Engelmann spruce climate forest with relatively open (approximately 50 percent) canopy.
- Presence of arboreal hair lichens.
- High-elevation benches and shallow slopes, secondary stream bottoms, riparian areas, and seeps, and subalpine meadows with succulent forbs and grasses, flowering plants, horsetails, willow, huckleberry, dwarf birch, sedges and lichens. These are used by woodland caribou, including pregnant females, for feeding during the summer seasons.
- Corridors/transition zones that connect the habitats described above. If human activities occur, they are such that they do not impair the ability of caribou to use these areas.

Grizzly Bear

The Selkirk Grizzly Bear Recovery Area is located in northeastern Washington and includes parts of Washington, Idaho, and British Columbia. The Selkirk Recovery Area was included in the original overall grizzly bear recovery plan for the United States (USFWS 1993). The population demography recovery criteria for the Selkirk Ecosystem, established in the 1993 recovery plan are: 1) 6 females with cubs over a running 6-year average both inside the recovery area and within a 10-mile area immediately surrounding the recovery area, including Canada; 2) 7 of 10 GBMUs on the U.S. portion occupied by females with young from a running 6-year sum of verified sightings and evidence; and 3) known human-caused mortality not to exceed 4 percent of the population estimate based on the most recent 3-year sum of females with cubs. Furthermore, no more than 30 percent of this 4 percent mortality limit shall be females. These mortality limits cannot be exceeded during any two consecutive years for recovery to be achieved. Presently, grizzly bear numbers are so small in this recovery area that the mortality goal is zero human-caused mortalities. The progress in meeting these demographic recovery criteria was evaluated in 2011 by the U.S. Fish and Wildlife Service (USFWS 2011a). They found that none of the 1993 demographic recovery criteria have been met. The population goal of six females with cubs has not been met, as the 6-year running average was 0.5 female with cubs. The distribution criterion has not been met as only 4 of 10 grizzly bear management units (GBMUs) occupied by females. The criterion of zero human-caused mortality has not been met with the running 6-year average was 2.5 animals per year, including 1.2 females per year (USFWS 2011a).

Proctor et al. (2012) estimated a population size of 88 grizzly bears in the Selkirk Mountains (30 in the U.S., 58 in Canada) using DNA-based population surveys (Proctor et al. 2007) and other data sources (Wakkinen 2010). Estimates of population trends have generally show an increasing population (Wakkinen and Kasworm 2004, Kasworm 2013; however see Kasworm et al. 2012), with subadult female survival having the largest influence on overall population trend. Wakkinen and Kasworm (2004) reported that 80 percent of the known grizzly bear mortalities in the Selkirks were human-caused. In the Selkirks, the running 6-year average total human-caused mortality was 1.8 animals per year, including 0.7 females per year (Wakkinen et al. 2009, Wakkinen 2010). For the first time in more than 30 years, a grizzly bear was captured on June 29, 2016, in Washington for radio-collaring and release (Kasworm 2016). The bear was captured southeast of Sullivan Lake, was estimated to be 5-year-old, male, and weighed 365 pounds. This is only the second capture of a grizzly bear in Washington with the first occurring in 1985 near Huff Lake in the Selkirk Mountains (Kasworm 2016).

One of the key aspects of grizzly bear recovery is human access management. Access management remains one of the most influential tools used to contribute toward the recovery of grizzly bear populations (IGBC 1998). Measures of the degree of human influence on grizzly bear habitat are based on methods developed by the Interagency Grizzly Bear Committee Access Management Task Force (IGBC 1998). Based on this approach, areas with relatively limited human access are referred to as core areas and are tracked in GBMUs that have been identified throughout the recovery area. Table 176 shows the current amount of core area in the GBMUs within the analysis area. The Selkirk Recovery Area has been stratified into management situation 1, 2, and 3 areas that are used to determine where management direction is applied, but most areas will be management situation 1. Grizzly bears (*Ursus arctos horribilis*) may occur outside of the Selkirk Recovery Area, and there may be instances where the Forest consults with the U.S. Fish and Wildlife Service for effects on grizzly bears for actions outside of the Selkirk Recovery Area. Areas outside of the recovery area but still on the Colville National Forest are managed as management situation 5.

Table 176. Current percentage of core areas within grizzly bear management units in the Selkirk Recovery Area

Grizzly Bear Management Unit (GBMU)	Current Core Percentage
Le Clerc	More than 27%
Salmo-Priest	More than 64%
Sullivan-Hughes	More than 61%

Canada Lynx

Lynx are considered a species of greatest conservation need in the state of Washington (WDFW 2015). Lynx occurrence, currently and historically, has been documented in the northeastern corner of the state (McKelvey et al. 2000). Stinson (2001) stated that the highest lynx harvest in Washington was from Ferry County (Kettle-Wedge Core Area) at 35 percent. Lynx were present and reproducing in the Kettle Mountains through the 1970s (Stinson 2001), but subsequently were likely over-trapped. Currently, only occasional tracks are observed with no evidence of reproduction in northeastern Washington (Koehler et al. 2008, WDFW and USDA Forest Service 2011, report on file with Colville National Forest). While lynx have been occasionally detected within their historical range in Ferry, Stevens, and Pend Oreille counties, these detections are too few to represent a resident population (Lewis 2016).

The Canada lynx is associated with moderate and high-elevation forests composed mostly of subalpine-fir forest associations (Ruediger et al. 2000, Stinson 2001, ILBT 2013). The loss and fragmentation of habitat as a result of wildfires and the direct and indirect effects of climate change are considered substantial threats (Lewis 2016).

In 2000, the Canada lynx was listed as a threatened species, and in 2005 core, secondary, and periphery areas were identified to emphasize their importance for the recovery of lynx (USFWS 2005). To date, no recovery plan for Canada lynx has been completed. Current management direction is provided through the Canada Lynx Interagency Agreement that relies on the science summarized in the Canada Lynx Conservation Assessment and Strategy (ILBT 2013). This agreement was intended to remain until it is replaced by management direction given in revised forest plans. There is a need to revise the forest plan to incorporate the emphasis areas identified by the U.S. Fish and Wildlife Service (USFWS 2005) and to replace the interim policy given in the interagency agreement. On the Colville National Forest, the Kettle-Wedge area is identified as a Core Area for lynx, the Selkirk Mountains as Secondary Area, and the Okanogan Highlands (west of the Kettle Mountains) as Peripheral Area (USFWS 2005, ILBT 2013). No critical habitat was designated for Canada lynx on the Colville National Forest (USFWS 2009).

Yellow-billed Cuckoo

The yellow-billed cuckoo is a Threatened species under the Federal Endangered Species Act throughout much of the western United States. The western yellow-billed cuckoo was designated as a distinct population segment by the U.S. Fish and Wildlife Service in 2013, and was federally listed as a threatened species in 2014. The western population is migratory and overwinters in South America, and formerly nested across much of the western United States and southern British Columbia (Wiles and Kalasz 2017). In the 1800s and early 1900s, yellow-billed cuckoos were locally common in Washington, occurring on both sides of the Cascade Mountains and throughout the Puget Sound lowlands (WDFW 2012b). The last confirmed breeding records in Washington are from the 1930s. Yellow-billed cuckoos are now extremely rare in Washington, with only 12 observed between 1950 and 2000 (WDFW 2012b). Eight of these occurred in eastern Washington, mostly near the Cascades (WDFW 2012b). A single bird was observed on the Little Pend Oreille National

Wildlife Refuge in 2012. Yellow-billed cuckoos nest almost exclusively in riparian woodlands 50 acres or larger in size, over 300 feet wide, and dominated by cottonwoods and willows (WDFW 2012b, Wiles and Kalasz 2017). The yellow-billed cuckoo has experienced a major decline in it breeding range since the 1800s and is now extirpated throughout most of its historical range in the western United States. This decline has been attributed to habitat loss and pesticide use (Gaines and Laymon 1984, Laymon and Halterman 1987, Iten et al. 2001).

Wolverine

Wolverine have been Proposed for listing under the Federal Endangered Species Act. The wolverine is one of the rarest and least-known mammals in North America. Wolverine has been documented to occur in northeastern Washington, both historically and more recently (Aubry et al. 2007). In addition, potential habitat has been identified in northeastern Washington and in adjacent Canadian provinces (Aubry et al. 2007, LoFroth and Krebs 2007). Wolverine habitat has been described as being primarily at high elevation and isolated from human activity (Carroll et al. 2001, Rowland et al. 2003, Aubry et al. 2007). Montane coniferous forests, suitable for winter foraging and summer kit rearing, may only be useful if connected with subalpine cirque habitats required for natal denning, security areas, and summer foraging (Copeland 1996, Copeland et al. 2010). The current distribution of wolverines is likely determined by the intensity of human settlement, the persistence of spring snow cover, and the distribution of alpine/subalpine habitats (Aubry et al. 2007, Inman et al. 2012). Several researchers have documented the effects of roads, and other human activities, on wolverines and their habitat and have included roads in models of source habitat (Carroll et al. 2001, Copeland et al. 2007, Krebs et al. 2007, Raphael et al. 2001, Rowland et al. 2003, Wisdom et al. 2000). Carroll et al. (2001) found areas with road densities less than 1 mile per square mile to be strongly correlated with the presence of wolverines. Rowland et al. (2003), in a test of the Raphael et al. (2001) source habitat model, found that road density was a better predictor of wolverine abundance than the amount of habitat when applied to a watershed scale.

Surrogate Wildlife Species

Considerable new science has developed since the 1988 forest plan concerning the viability of a wide array of wildlife species that are present within the planning area (Lehmkuhl et al. 1997, Wisdom et al. 2000, Raphael et al. 2001). In addition, methods for assessing species' viability have evolved (Soule 1987, Marcot et al. 2001, Beissinger and McCullough 2002, Suring et al. 2011), and choosing which species to assess that best represent other species has changed considerably. We used the surrogate species approach to evaluate species and ecosystem viability following direction and guidance provided by Region 6 Planning (USDA Forest Service 2006b). Surrogate species are intended to represent ecological conditions that generate sustainable ecosystems, and it is not expected that the population dynamics of a surrogate species would necessarily represent the population dynamics of another species (Lambeck 1997). The concept of surrogate species differs from management indicator species (MIS) described in the regulations written to implement the National Forest Management Act (NFMA) (36 CFR 219.19). The use of MIS was considered a means of evaluating the effects of management actions on a suite of species whose population trends were assumed to reflect changes in habitat amount and quality due to the effects of the management actions (Suring et al. 2011). This assumption and the MIS concept have been called into question in the past two decades since its inception (Landres et al. 1988, Andelman et al. 2001). As a result, the MIS concept evolved to the more robust concept of surrogate species, including focal species, in the late 1990s (Lambeck 1997). Surrogate species are now considered a more appropriate approach in addressing species and ecosystem viability (Wiens et al. 2008, Suring et al. 2011).

The approach used to evaluate the ecological conditions capable of sustaining viable populations of wildlife species within the Forest planning area is described in detail in Suring et al. (2011) and Gaines et al. (2017). In summary, an eight-step process was used to assess the ecological conditions capable of sustaining viable populations of terrestrial wildlife species. The process included: (1) identification of species of concern, (2) description of source habitats, and other important ecological factors, (3) organizing species into groups, (4) selection of surrogate species for each group, (5) development of surrogate species assessment models, (6) application of the surrogate species assessment models to evaluate current and historical conditions, (7) development of conservation strategies, and (8) designing monitoring and adaptive management. Following the application of species screening criteria, 209 species were identified as species of concern within the planning area. The 209 species of concern were aggregated into 10 families (these are not phylogenetic families) and 28 groups based primarily on their habitat associations. Next, 26 surrogate species (77 percent birds, 15 percent mammals, 8 percent amphibians) were selected for use on the Colville National Forest, based on risk factors and ecological characteristics (Gaines et al. 2017, Suring et al. 2011).

Evaluation of the current conditions within the assessment area documented reductions in the viability outcomes for all surrogate species compared to historical conditions (Gaines et al. 2017). The species for which current viability outcomes are most similar to historical viability outcomes include the golden eagle, Harlequin duck, northern goshawk, peregrine falcon, and Wilson's snipe (table 177). Species for which current viability outcomes have departed the most from historical viability outcomes and are of greatest conservation concern included the eared grebe, fox sparrow, western bluebird, and white-headed woodpecker. Some of these species occur on only a small portion of the Forest or within watersheds with only a minor amount of national forest land. Because our process was based on an all-lands approach, the viability of these species was assessed.

Environmental outcomes defined in Raphael et al. (2001) were used as a basis to describe five viability outcomes. These outcomes were calculated for current and historical conditions for each surrogate species to assess changes in habitat conditions. The term "suitable environment" refers to a combination of source habitat and risk factors that influence the probability of occupancy and demographic performance of a surrogate species. The viability outcomes are based on departure from historical conditions. The five viability outcomes we used were:

Outcome A—Suitable environments are broadly distributed across the historical range of the species throughout the assessment area. Habitat abundance is high relative to historical conditions. The combination of distribution and abundance of environmental conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the surrogate species.

Outcome B—Suitable environments are broadly distributed across the historical range of the species. Suitable environments are of moderate to high abundance relative to historical conditions, but there may be gaps where suitable environments are absent or present in low abundance. However, any disjunctive areas of suitable environments are typically large enough and close enough to permit dispersal among subpopulations and to allow the species to potentially interact as a metapopulation. Species with this outcome are likely well distributed throughout most of the assessment area.

Outcome C—Suitable environments moderately distributed across the historical range of the species. Suitable environments exist at moderate abundance relative to historical conditions. Gaps where suitable environments are either absent or present in low abundance are large enough such that some subpopulations may be isolated, limiting opportunity for intraspecific interactions especially for species with limited dispersal ability. For species for which this is

not the historical condition, reduction in the species' range in the assessment area may have resulted. Surrogate species with this outcome are likely well distributed in only a portion of the assessment area.

Outcome D—Suitable environments are low to moderately distributed across the historical range of the species. Suitable environments exist at low abundance relative to their historical conditions. While some of the subpopulations associated with these environments may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches for species with limited dispersal ability. For species for which this is not the historical condition, reduction in species' range in the assessment area may have resulted. These species may not be well distributed across the assessment area.

Outcome E—Suitable environments are highly isolated and exist at very low abundance relative to historical conditions. Suitable environments are not well distributed across the historical range of the species. For species with limited dispersal ability there may be little or no possibility of population interactions among suitable environmental patches, resulting in potential for extirpations within many of the patches, and little likelihood of recolonization of such patches. There has likely been a reduction in the species' range from historical conditions, except for some rare, local endemics that may have persisted in this condition since the historical period. Surrogate species with this outcome are not well distributed throughout much of the assessment area.

There is a need to address the viability concerns for surrogate species identified in the assessment of the current conditions (Gaines et al. 2017). By addressing the habitat needs and risk factors identified for surrogate species through the assessment, ecological conditions capable of supporting viable populations of all native and non-native desirable wildlife species, including R6 Sensitive Species, would be enhanced. Some key findings of the assessment that should be addressed in the revised land and resource management plan include:

- Riparian habitats are important for a wide variety of the surrogate species assessed. A strategy that protects and restores riparian habitat, including addressing the negative effects of roads and domestic grazing, is needed.
- Late-successional and old forest habitats are generally below their historical range of variability. In some forest types, such as the dry and mesic forests, active restoration of old-forest habitat is needed to restore important habitat structures (e.g., large trees) and to reduce risk of habitat loss due to uncharacteristically severe wildfires.
- One of the primary reasons for species viability outcomes being reduced is the widespread influence of roads, including the use of roads for winter recreation. Restoring habitat effectiveness, by reducing the negative effects of roads, is important for several surrogate wildlife species.
- Restoring the connectivity of wildlife habitats is an important strategy for addressing the effects of climate change on wildlife populations. Restoring habitat connectivity, especially within riparian habitats, is important and needs to address the negative effects of roads.
- The availability of large and old trees and large snag habitat is generally lacking in many forest types because of past management practices and altered disturbance regimes. Restoration of these key habitat components is important for several surrogate wildlife species.

Table 177. Current and historical viability outcomes for surrogate wildlife species assessed on the Colville National Forest

Surrogate Wildlife Species	Current Viability Outcome	Historical Viability Outcome
American marten	B/C	A/B
Bald eagle	C	A
Bighorn sheep	B/C	A/B
Black-backed woodpecker	C	A
Canada lynx	B	A
Cassin's finch	D	A
Columbia spotted frog	C	A
Eared grebe[1]	E	C/D
Fox sparrow	E	A
Golden eagle	A/B	A
Harlequin duck	A/B	A
Lark sparrow[1]	C/D	A
Lewis's woodpecker	C/D	A
MacGillivray's warbler	C	A
Marsh wren	C	A/B
Northern goshawk	A/B	A
Northern harrier[1]	C	A
Peregrine falcon[1]	A/B	A
Pileated woodpecker	C	A
Sage thrasher[1]	D/E	A
Tiger salamander[1]	C	A
Western bluebird	D	A
White-headed woodpecker	D/E	A
Wilson's snipe[1]	B	A/B
Wolverine	B	A
Wood duck[1]	C	A

1. Surrogate species whose source habitats either do not occur or less than 25 percent occur on the Colville National Forest.

The Relationship between Sensitive Wildlife Species and Surrogate Species

There are a number of vertebrate and invertebrate species that are on the Region 6 Sensitive Wildlife Species list (July 2015 list, appendix D in Wildlife Specialist Report). Many of these species were included, along with several others, in the 209 species of concern identified by Gaines et al. (2017). Surrogate species were then selected that best represented the habitats and risk factors associated to a group of wildlife species, including R6 Sensitive Species (see Table 178). Thus, by addressing habitats and risk factors for surrogate species, these factors are also addressed for R6 Sensitive Species, and a wide range of other wildlife species. The effects analysis for surrogate species was based on the viability assessment process (USDA Forest Service 2006b, Suring et al. 2011, Gaines et al. 2017) so that each alternative was evaluated for its ability to contribute to the viability of surrogate species. For R6 Sensitive Species, the effects analysis was also based on the viability assessment process but the effects determination only evaluated whether or not the alternative would lead to a "trend toward Federal listing" or "no trend toward Federal listing." Additional and more detailed effects analyses for R6 Sensitive Species are required for project-level planning.

Other Species of Management Interest

Deer and Elk Population Status and Herds

The Selkirk Elk Herd occurs on the Colville National Forest and adjacent areas. This herd contributes significantly to local economies through wildlife viewing and recreational hunting opportunities. The Selkirk herd is currently about 1,200 animals (WDFW 2014). The Selkirk herd plan identified the desired condition for the herd as follows: increase the Pend Oreille subherd from 800 to 1,000 animals; stabilize and maintain the Hangman subherd; and reduce vehicle collisions.

Both white-tailed deer and mule deer occur on the Colville National Forest. The white-tailed deer management plan (WDFW 2010) identified two management units that include portions of the Forest: Okanogan Highlands and Selkirk. The Okanogan Highlands is 31 percent public land, 19 percent private, and 50 percent Colville Tribal lands. The management objective for white-tailed deer in this area is to maintain the current population level. The Selkirk management unit is 37 percent public land, 6 percent Colville Tribal lands, and 57 percent private lands. The objective in the unit is to reduce the effects of the antlerless harvest and increase the population. Currently, the mule deer population in northeastern Washington is below historical levels (WDFW 2016). A mule deer management plan for this area has not been completed.

Since the 1988 forest plan was completed, considerable research has been conducted on habitat relationships and the effects of human activities on deer and elk. For example, research has indicated that the availability of quality forage during non-winter periods is very important to the winter survival and productivity of elk herds (Cook 2002, Cook et al. 2004, Cook et al. 2013), more important than thermal cover (Cook et al. 1998, Lenz 1997). Existing forest plans emphasized the availability of thermal cover on winter ranges, and in some cases, at levels difficult to ecologically sustain in dry forest environments. Additional science has underscored the importance of the effects of roads and other linear recreation routes on the effectiveness of habitat for deer and elk (Rowland et al. 2005, Wisdom et al. 2005). The 1988 forest plan relies on the use of road density as an index of habitat effectiveness for deer and elk; however, recent research suggests that using the zone of influence is a better indicator (as summarized in Gaines et al. 2003, Rowland et al. 2005). Forest plan management direction for deer and elk needs to be revised to reflect the best available science.

Table 178. Region 6 Surrogate Species and Region 6 Sensitive Species used in the Colville National Forest Wildlife Evaluation Report

Habitat Group	Risk Factors	R6 Surrogate Species[A]	R6 Sensitive Species[B]
Cool-Moist Forest/Medium-Large Trees	Road density, Created openings, Loss of large trees and snags	American Marten, Pileated Woodpecker	Rosner's Hairstreak
All Forest Communities/Medium-Large Trees	Grazing, Loss of large trees, Loss of LSOF, Human disturbance, Alteration of hydrologic regime, Fire exclusion	Cassin's Finch, Northern Goshawk	Red-tailed Chipmunk, Northern Goshawk, Great Gray Owl, Fir Pinwheel
Dry Forest/Medium-Large Trees	Loss of large trees and snags, Fire exclusion	White-headed Woodpecker	White-headed Woodpecker, Eastern Tailed Blue, Meadow Fritillary
All Forest Communities/Open Forest	Loss of large trees and snags, Fire exclusion	Western Bluebird	
Open Forest/Post-fire	Road density, post-fire timber harvest	Black-backed Woodpecker, Lewis's Woodpecker	
Open Forest/Early Successional	Grazing	Fox Sparrow	
Boreal Forest	Winter recreation, Roads, Snow compaction, Changes to hydrologic regime	Canada Lynx, Northern Bog Lemming	Magnum Slug, Western bumblebee, pygmy shrew
Woodland/Grass/Shrub	Domestic sheep grazing, Fire exclusion, Grazing, Human disturbance	Bighorn Sheep, Golden Eagle, Lark Sparrow[1]	Eastern Tailed Blue
Grass/Shrub	Grazing, Invasive Species, Human disturbance	Northern Harrier[1], Sage Thrasher[1], Tiger Salamander[1]	Western Bumblebee
Riparian/Large Tree	Loss of LSOF, Human disturbance	Bald Eagle, Harlequin Duck	Bald Eagle, Harlequin Duck
Riparian/Pond/Small Lake/Backwater/Wetland /Open Water/Wet Meadow	Invasive Species, Grazing, Road density, human disturbance, Fire exclusion	Marsh Wren, Wilson's Snipe[1], Columbia Spotted Frog, Eared Grebe[1]	Common Loon, Sandhill Crane, Meadow Fritillary, Peck's Skipper, Tawny-edged Skipper
Riparian/Shrubby Deciduous	Grazing	MacGillivray's Warbler	
Open Water/Snag Habitat	Loss of snags, Human disturbance	Wood Duck[1]	Common Loon
Open Forest/Woodland/ Grass/Shrub/Cave	Loss of snags, Loss of large trees, Loss of riparian, Loss of roost sites, Human disturbance, Insecticides	Fringed Myotis, Pallid Bat, Townsend's Big-eared Bat	Little Brown Myotis, Townsend's Big-eared Bat
Habitat Generalist/Cliff	Human disturbance	Peregrine Falcon[1]	Peregrine Falcon
Habitat Generalist	Road density, Winter recreation	Wolverine	Gray Wolf, Wolverine

A/R6 Surrogate Species (formerly Focal Species) for Species Viability Assessments (USDA Forest Service 2010a).
B/R6 Sensitive Species List as of July 15, 2015 (USDA Forest Service 2015c).

1/Surrogate Species in which less than 25 percent of their source habitat occurs on the Colville National Forest.

Currently, the level of human influence on elk winter ranges is moderate (table 179). On deer winter ranges, 38 percent have a high level of human influence, 38 percent have a moderate level of human influence, and 24 percent have a low level of human influence (table 180).

Table 179. Influence of roads and trails on elk winter range habitat effectiveness

Elk Herd	Acres of Winter Range outside of zone of influence	Total Acres of Winter Range	Habitat Effectiveness Index	Current Level of Human Influence
Kettle	46,227	70,852	0.65	Moderate
Selkirk	31,300	55,459	0.56	Moderate

Table 180. Influence of roads and trails on deer winter range habitat effectiveness

Ranger District/watershed (HUC10)	Acres of winter range outside of zone of influence	Total acres of winter range	Habitat effectiveness index	Current level of human influence
Newport				
Le Clerc Creek-Pend Oreille River	2,300	3,434	0.67	Mod
Tacoma Creek-Pend Oreille River	5,227	10,990	0.48	High
Upper Little Spokane River	273	273	1.00	Low
Republic				
Rock Creek-Kettle River	966	966	1.00	Low
Curlew Creek	2,262	4,400	0.51	Mod
Toroda Creek	704	704	1.00	Low
Upper Sanpoil River	11,683	16,616	0.70	Low
Vulcan Mountain-Kettle River	9,294	15,466	0.60	Mod
West Fork Sanpoil River	3,313	3,791	0.87	Low
Sullivan Lake				
Le Clerc Creek-Pend Oreille River	6,168	10,020	0.62	Mod
Sullivan Creek-Pend Oreille River	4,889	9,969	0.49	High
Three Rivers				
Boulder Creek-Kettle River	8,975	16,011	0.56	Mod
Chewelah Creek-Colville River	6,482	10,780	0.60	Mod
Deep Creek	1,925	4,073	0.47	High
Mill Creek	1,072	2,229	0.48	High
Onion Creek-Roosevelt Lake	2,522	3,264	0.77	Low

Pollinators

Native bees, butterflies, moths, bats, and beetles are collectively referred to as native pollinators. The western bumblebee is a native pollinator that is also listed on the Region 6 Sensitive Species list and has been documented to occur on the Colville National Forest. Native pollinators pollinate more than 80 percent of wild flowering plants in temperate latitudes, thereby enhancing biodiversity and supporting more resilient ecosystems (USDA 2015). The health of native pollinator populations has

been impacted over recent decades by a variety of factors including the loss of habitat, diminished quantity and quality of food sources, exposure to pesticides, and increased adverse effects of pathogens and parasites (USDA 2015). As a result, on June 20, 2014, President Obama issued a memorandum directing the heads of executive departments of agencies to create a Federal strategy to provide for the health of pollinators. This resulted in a set of best management practices (BMPs) for management on Federal lands (USDA 2015). Some key aspects of the BMPs relevant to management on the Colville National Forest include restoration of native plants (food sources for pollinators), reducing the potential for competition from non-native pollinators through the placement of apiaries, and reducing the potential for apiaries to create nuisance bear problems.

Forest restoration treatments, such as forest thinning and prescribed fire have been used to restore native plant communities. For example, research conducted in moist Douglas-fir forests has shown that thinning to restore forest structure also increased the availability of flowering plants and other insect-pollinated species (Neill and Puettmann 2013). Dodson et al. (2008) showed that forest thinning followed by prescribed fire in dry Douglas-fir forests enhanced native plant species richness, especially flowering plants.

Climate Change and Wildlife

The anticipated climatic changes to eastern Washington environments are likely to result in a variety of effects to wildlife populations and their habitats (Gaines et al. 2012, Lawler et al. 2014). A striking conclusion reached from several climate change studies is the degree of change to wildlife habitats and populations that has already occurred (Lawler and Mathias 2007, Root et al. 2003). There are a variety of responses of wildlife to changing climatic conditions that have occurred or are anticipated to occur including: changes in species distributions, changes in the timing of breeding and other activities, changes in pathogens and invasive species distributions, changes in survival and extinction risks, and changes in the interactions among species. To aid in the assessment of the effects of climate change and forest management activities on surrogate wildlife species the Climate Change Sensitivity Database (CCSD 2013) was used to determine the vulnerability of each species and the particular effects that climate change might have, given their life history. Of the species that were assessed in the database, nine (36 percent) have a high rating, six (24 percent) have a medium rating, five (20 percent) have a low vulnerability rating, and five (20 percent) were not rated (see table 181).

Table 181. Climate change vulnerability ratings for wildlife species assessed in the Colville National Forest plan revision

Wildlife Species	Vulnerability Rating	Specific Climate Impacts
Threatened and Endangered		
Woodland Caribou	High	Climate change would alter the distribution and abundance of caribou habitat, and may change predator/prey dynamics. Population is small and highly vulnerable.
Grizzly bear	Low	Changes in snowpack would change hibernation exposing bears to humans for longer time.
Canada lynx	High	Changes in snowpack would change the distribution of key habitats and prey species. Predator/prey dynamics are likely to be influenced.

Wildlife Species	Vulnerability Rating	Specific Climate Impacts
Surrogate Wildlife		
Northern Goshawk	High	Changes to food supply and suitable habitat
Pileated Woodpecker	Medium	Loss of habitat due to altered disturbance regimes
American Marten	High	Changes to habitat distribution and amount
White-headed Woodpecker	Medium	Changes to habitat from altered disturbance regimes
Black-backed Woodpecker	Medium	Changes to habitat from altered disturbance regimes
Lewis's Woodpecker	Medium	Changes to habitat from altered disturbance regimes
Wolverine	High	Changes in persistence of spring snow used for denning
MacGillivray's Warbler	Not Available	
Golden Eagle	Medium	Changes to prey and habitat from altered disturbance regimes
Bald Eagle	Low	Changes to fish populations
Columbia Spotted Frog	High	Changes to wetland and riparian habitats
Marsh Wren	Not Available	
Wilson's Snipe	Not Available	
Western Bluebird	High	Changes to habitat from altered disturbance regimes. Changes from competition with other cavity nesters
Peregrine Falcon	Low	Generalist with high mobility
Cassin's Finch	High	Changes to extreme temperatures and dry air
Fox Sparrow	Not Available	
Water Vole	Not Available	
Species of Management Interest		
Deer	Low	Habitat generalist with high mobility
Elk	Low	Habitat generalist with high mobility

Environmental Consequences of Alternatives–Wildlife

Assumptions

In addition to the common assumptions listed in the Environmental Analysis and Overall Assumptions, the wildlife analyses included the following.

- The use of the surrogate species approach (Lambeck 1997) is a credible and scientifically rigorous method to assess ecosystem conditions that contribute to the viability of surrogate wildlife species. The baseline conditions for surrogate wildlife species in the Colville National Forest planning area are presented in Gaines et al. (2017) and give reasonable approximations of conditions at the scale of a watershed (10th Code HUC) that are influencing surrogate species habitats and populations.
- A key assumption of the landscape restoration approach that is represented in two of the alternatives (proposed action and alternative P) is that by strategically locating restoration treatments, landscape fire movement can be altered, and the risk to adjacent late-successional and old forest habitat is reduced. A considerable and growing body of science is available to support this assumption (Finney 2001, Finney et al. 2006, Kennedy et al. 2008, Lehmkuhl et al. 2007).
- Modeling future habitat trends for a select group of surrogate wildlife species required several assumptions, most importantly, that habitat associations for each species were adequately represented by the identified model states, and that the effects of forest management treatments were adequately reflected in effects on habitat conditions (Lambeck 1997, Wiens et al. 2008).

Methods of Analysis

Federally Listed and Proposed Wildlife Species

For wildlife species that are federally protected or proposed to be protected by the Endangered Species Act, recovery plans, critical habitat designation (woodland caribou only), and status reviews were used to identify factors that threaten species recovery. These factors were used to assess how well the no action alternative and each of the action alternatives addressed the threats and contributed to the recovery of the species.

Surrogate Wildlife Species

The Region 6 surrogate species assessment process (USDA Forest Service 2006b) was used to evaluate the no action and action alternatives. This approach is described in detail in Suring et al. (2011) and Gaines et al. (2017). The surrogate species assessment process was completed for the planning area to determine the baseline conditions for each of the surrogate species (see Affected Environment) and to identify risk factors that influence the viability of surrogate wildlife species. These risk factors were addressed to varying degrees in each of the alternatives and used to evaluate how well each alternative contributes to the viability of surrogate wildlife species.

Spatial and Temporal Context for Effects Analysis

The spatial context for the analyses of the effects of management alternatives varied according to the species or group of species being assessed. For the woodland caribou and grizzly bear, the portion of the respective recovery areas located on the Forest was used to address direct and indirect effects, while the entire recovery area was used to evaluate cumulative effects. For Canada lynx, the direct and indirect effects were evaluated for the core and secondary areas identified in the recovery outline (USFWS 2005). Cumulative effects for Canada lynx were evaluated by considering the adjacent

areas where lynx would most likely disperse from which included the Okanogan-Wenatchee National Forest and Washington Department of Natural Resources lands to the west and the Idaho-Panhandle National Forest to the east. The respective management plans were reviewed to consider the cumulative effects.

For wildlife species selected as surrogate species, broad-scale viability assessments were done across the species' range that occurred in northeastern Washington assessment area (Suring et al. 2011, Gaines et al. 2017). This process included two spatial scales of assessment. Direct, indirect, and cumulative effects were assessed for each individual species using the watershed (10th Code HUC) as an evaluation unit, considering all land ownerships within the watershed. Individual watershed results were then used to determine the current and historical (prior to European settlement) viability outcomes that were evaluated at the individual planning unit (in this case the Colville National Forest) level.

Future habitat trends were modeled for the following surrogate species: American marten, white-headed woodpecker, northern goshawk, pileated woodpecker, black-backed woodpecker, and Lewis's woodpecker. These trends were modeled to assess habitat conditions at 20, 50, and 100 years to estimate how different management alternatives would contribute to the viability of surrogate species. Other risk factors that influence the viability of surrogate species were assessed in the short term (less than 20 years) using the objectives and the long term (less than 50 years) using the desired conditions to estimate how alternatives might contribute to the viability of surrogate wildlife species.

For species of management interest, which included deer and elk, direct and indirect effects were considered within the portions of the herd ranges that occurred on the Forest, while cumulative effects were considered across the entire herd range. Herd ranges were identified by the Washington Department of Fish and Wildlife in herd management plans (WDFW 2010, 2014).

Key Indicators

The indicators shown in table 182 were used to evaluate the contribution of each alternative to the recovery of federally listed wildlife species, the viability of surrogate wildlife species, and the sustainability of species of management interest.

Table 182. Evaluation criteria and key indicators for wildlife

Issue	Evaluation Criteria	Key Indicator
The recovery and viability of wildlife species associated with late and old forest structures.	Wildlife species associated with late and old forest structures Moist Forests Listed species – woodland caribou Surrogate species – northern goshawk, pileated woodpecker, American marten Dry and Mesic Forests Surrogate species – pileated woodpecker, northern goshawk, white-headed woodpecker	*The amount, location and spatial configuration of old-forest habitats* *The influence of roads and trails on old-forest habitat effectiveness*
The influence of motorized access on the recovery and viability of wildlife species sensitive to human disturbances	Wildlife species that are sensitive to human disturbances that result from motorized access Non-Winter Listed species – grizzly bear Proposed/Surrogate species – wolverine Winter Listed species – Canada lynx, woodland caribou Proposed/Surrogate species – wolverine Other species – deer, elk	*The influence of linear recreation routes and roads on wildlife species will be evaluated using road density as an indicator of habitat effectiveness for wolverine, Canada lynx; and the zone of influence as an indicator of habitat effectiveness for grizzly bear, deer, and elk (Gaines et al. 2003)*
The influence of livestock grazing of the viability or sustainability of wildlife species	Surrogate wildlife species and species of management interest affected by grazing Surrogate species – MacGillivray's warbler, golden eagle, western bluebird, Cassin's finch, fox sparrow Other species – deer and elk	*Effects of grazing on the viability and habitat of surrogate and other wildlife species* The location and intensity of cattle grazing on allotments Degree of overlap between grazing allotments and source habitats for surrogate wildlife species and winter and summer ranges for deer and elk
The influence of forest management activities on habitat connectivity for surrogate wildlife species The influence of forest management activities on the viability of surrogate wildlife species dependent on snag habitats	Wildlife species used to evaluate habitat connectivity Proposed species – wolverine Surrogate species – American marten, Canada lynx, wolverine Surrogate wildlife species dependent on snag habitats Surrogate species – pileated woodpecker, white-headed woodpecker, black-backed woodpecker, Lewis's woodpecker, Western bluebird	*Wildlife habitat connectivity* The dispersal habitat suitability (Singleton et al. 2002) for surrogate species based on anticipated changes to habitat, road density, and linear recreation routes *Availability of snag habitat* The proposed vegetation management activities within source habitats for each surrogate species The road density within source habitats for each surrogate species
The influence of forest management on the viability of surrogate wildlife species associated with riparian habitats	Wildlife species associated with riparian habitats Listed species – yellow-billed cuckoo Surrogate species – water vole, bald eagle, MacGillivray's warbler, Columbia spotted frog, Wilson's snipe, eared grebe, marsh wren	*Widths of riparian management areas* *Vegetation management within riparian management areas* *Road density and zone of influence on riparian habitat effectiveness*

Summary of Effects—Wildlife

Several factors were considered in how the alternatives influenced the evaluation criteria and indicators, and how well each alternative contributes to the recovery of federally listed and proposed wildlife species, the viability of surrogate wildlife species, or the sustainability of species of management interest. These factors included: (1) How well the alternative addresses new science, especially the interactions between disturbance processes, habitat sustainability, and wildlife populations; (2) How well the alternative addresses new recovery plans, critical habitat, conservation strategies, status reviews, or management plans (e.g., ILBT 2013, USFWS 2009); (3) How the alternative addresses the impacts of roads on wildlife habitats (e.g., Gaines et al. 2003, Wisdom et al. 2000); (4) How the alternative addresses the effects of domestic grazing on wildlife habitats; and (5) How the alternative addresses anticipated effects of climate change, and specifically, does the alternative restore landscape resistance and resiliency (Gaines et al. 2012, Lawler et al. 2014).

In general, the alternatives that emphasize restoration of disturbance regimes and habitats, including reducing road and domestic grazing effects, contributed the most to the recovery, viability, and sustainability of wildlife habitats and populations (table 183). These alternatives would address habitat and risk factors identified for R6 sensitive Species and would thus not lead to a trend toward Federal listing (Wildlife Specialist Report appendix D). These alternatives include the proposed action and alternative P. Alternative R, which includes a substantial reserve system, would generate moderate to high contributions to wildlife habitats and populations, especially for wildlife species associated with late-successional and old forest habitat structures. The alternatives that emphasize single resource management (e.g., timber production) and/or do not address road and grazing effects tended to give the lowest contributions to wildlife habitats and populations. These alternatives would more likely lead to a trend toward Federal listing of R6 sensitive wildlife species because they do not address the habitats and risk factors that put these species at risk. These alternatives include no action and alternatives B and O (table 183, Wildlife Specialist Report appendix D).

Table 183. Summary of the relative contribution of each alternative to the recovery of federally listed wildlife species, viability of surrogate wildlife species, or sustainability of species of management interest

Issue/ Species	No Action	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Old Forest						
Contribution to recovery (Caribou)	Low1/	High2/	High	High	Moderate3/	Moderate
Contribution to viability	Low	Moderate	High	High	Low	Low
Motorized Recreation and Road Access						
Contribution to viability	Low	Moderate	High	High	Low	Low
Livestock Grazing						
Contribution to viability	Low	Moderate	High	High	Low	Moderate
Habitat Connectivity						
Contribution to viability	Low	Moderate	Moderate	High	Low	Low
Snag Habitat						
Contribution to viability	Low	Moderate	High	High	Low	Low
Riparian and Aquatic						
Contribution to viability	Low	Moderate	High	High	Low	Low
Other Listed Species (Lynx)						
Contribution to recovery	Low	High	Moderate	High	Low	Low
Species of Management Interest						
Contribution to sustainability	Low	Moderate	Moderate	High	Low	Low

1/ Low = a low contribution by the alternative to the recovery/viability/sustainability of the species or group of species.
2/ High = a high contribution by the alternative to the recovery/viability/sustainability of the species or group of species.
3/ Moderate = a moderate contribution by the alternative to the recovery/viability/sustainability of the species or group of species.

No Action Alternative

Federally Listed Wildlife Species

Grizzly Bear

Direct and Indirect Effects

Forest activities that influence the recovery of the grizzly bear include: human access that can displace bears from important seasonal habitats or increase the risk of bear-human interactions, disposal of livestock carcasses within range allotments to avoid attracting bears to a potential food source, and the storage of food and garbage at recreation sites to reduce the potential for bears to associate humans with food resources.

Management of grizzly bears does not vary between alternatives. Existing management direction provides standards for human access, disposal of livestock carcasses, and food and garbage storage within the Selkirk Grizzly Bear Recovery Area (IGBC 1998, USDA Forest Service 1988, USFWS 1993, USDI 2001). Existing standards have largely been met and would continue to be followed.

Climate Change

Grizzly bears have been identified as having a low sensitivity to climate change because they are opportunistic, eat a diverse array of food resources, and are highly adaptable (Servheen and Cross 2010, CCSD 2013). Anticipated impacts may include changes in the timing of denning due to longer snow-free periods and reduced snowpack (Lawler et al. 2014) and changes in the availability of food sources (Servheen and Cross 2010). These changes may put bears at risk of negative human interactions for a longer period of time each year (Servheen and Cross 2010). This would make education, proper food and garbage storage, carcass disposal measures, and human access management that much more important.

Cumulative Effects

The primary reasons for the low population of grizzly bears in the recovery zone are past persecution and human-caused mortality of bears. Legal protections are now in place to protect grizzly bears. Information/education programs, sanitation measures, and access management have and would continue to be used to aid in the recovery of grizzly bears in the Selkirk Recovery Area.

Past, present, and reasonably foreseeable future actions that could affect grizzly bears include timber harvest and associated road construction, recreational activities that can cause disturbance to bears and create potential for human-bear conflicts, and human development that fragment grizzly bear habitat. Cumulative effects are evaluated across the Recovery Area by tracking activities within GBMUs. Other land managers have adopted and are following similar management direction (USDA Forest Service 2015b) and overall recovery actions are coordinated by the Selkirk Grizzly Bear Management Subcommittee. GBMUs that occur on the Colville National Forest include the Le Clerc, Salmo-Priest, and Sullivan-Hughes. The contribution made on Federal lands to grizzly bear recovery would help to mitigate potential cumulative effects from off-forest activities.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance (e.g., core areas) to become more important to wildlife such as grizzly bears.

Black bear hunting on both sides of the international border within the Selkirk Recovery Area has the potential to add cumulatively to the mortality of grizzly bears. Hunters that encounter grizzly bears may mistakenly identify the bear, kill the bear in self-defense, or opportunistically poach the bear. Human access management within the recovery area is key to reducing the risk of mortality to grizzly bears from black bear hunting.

On private lands, the presence of garbage, pet food, fruit trees, or other attractants may lure bears into conflict situations. Bears that become habituated or a nuisance may lead to the bear being killed.

Summary

This alternative would make a high contribution to the recovery of grizzly bears in the Selkirk Recovery Area. This is based on the existing management direction, followed in all alternatives, that addresses:

- Human access management;
- Disposal of carcasses in range allotments that occur in the recovery area; and
- Proper storage of food, garbage, and other attractants that may lead to human-bear interactions.

Canada Lynx

Direct and Indirect Effects

Forest management activities that influence the recovery and conservation of Canada lynx include: vegetation management that affect lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The Interagency Lynx Biology Team (ILBT 2013) developed conservation measures for core and secondary areas (USFWS 2005) to address each of these forest management activities, and for planners to consult when revising forest plans. These were used to evaluate the potential contribution of forest management alternatives to the recovery of Canada lynx.

When the USFWS reviewed existing regulatory mechanisms to determine if listing Canada lynx as a federally protected species was warranted, they determined that existing forest plans gave inadequate protections (USFWS 2003b). Several national forests within the range of the Canada lynx subsequently amended their forest plans using the original Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) as a basis for current science. However, forest plans in Region 6 were not amended, thus, existing management plans do not address recent science and conservation recommendations (ILBT 2013), recovery objectives (USFWS 2005), or critical habitat (USFWS 2009). No critical habitat for the Canada lynx was designated on the Colville National Forest (USFWS 2009); however, both core and secondary area were identified (USFWS 2005, ILBT 2013).

Vegetation management activities affect the distribution of lynx habitat components, can fragment habitats, and create sources of disturbance (ILBT 2013). As a result, risk factors were identified and conservation measures developed to address the risk factors (ILBT 2013). The conservation measures for vegetation management apply to lynx core areas and include use of the natural range of variability to mimic pattern and scale of natural disturbances and connectivity across the landscape, while considering the future climate change (ILBT 2013). A conservation measure focused on the restoration of disturbance regimes in dry forests that occur in close proximity to lynx habitat to reduce the risk of uncharacteristically severe and frequent fires reaching lynx habitat. No management direction occurs in the 1988 forest plan that addresses these conservation measures.

Winter recreation can influence how lynx use habitats (ILBT 2013). To minimize the potential of negative effects from winter recreation, the ILBT (2013) developed conservation measures to reduce effects. Conservation measures for winter recreation in lynx core areas included reducing effects on habitat connectivity and discouraging expansion of over-the-snow routes that may influence lynx habitat use (ILBT 2013). Existing management plans do not address effects of over-the-snow recreation on lynx habitat.

The conservation measures for forest roads in lynx core areas include avoiding road reconstruction or upgrades that occur in lynx habitat and would result in increased traffic speeds or volumes (ILBT 2013). These measures were developed to reduce the potential for mortality to lynx from vehicles. There is no management direction in existing plans to address this conservation measure.

The conservation measures for grazing in lynx core areas include management of riparian areas to assure adequate habitat for snowshoe hares, the primary prey species for Canada lynx (ILBT 2013). The 1988 forest plan includes management direction for grazing in riparian areas to mitigate effects to habitat for listed fish species, but does not include anything specific to Canada lynx or snowshoe hares.

The no action alternative would provide limited management direction to address the direct and indirect effects of forest management activities on the recovery of Canada lynx. Forest management activities that can have direct and indirect effects on Canada lynx include: vegetation management that affect lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The no action alternative would give less protection for Canada lynx than alternatives R and P, and protection that is similar to alternatives B and O.

Climate Change

The potential effects of climate change on Canada lynx identified by the Interagency Lynx Biology Team (2013) included: (1) an upward shift in elevation or latitudinal distribution of lynx and prey, (2) a decrease in the amount of habitat and population size from reduced snow persistence and increased disturbance events (e.g., fires), (3) changes in demographic rates, such as survival and reproduction, and (4) changes in predator-prey relationships.

Climate change adaptations to address these effects include restoration of landscape-scale disturbance regimes to better mimic natural patterns and processes (Spies et al. 2010, Gaines et al. 2012, Lawler et al. 2014), and maintaining or restoring habitat connectivity to allow Canada lynx to adjust their ranges to changing conditions (Heller and Zavaleta 2009, ILBT 2013, Squires et al. 2013). There is limited management direction in the existing management plans to address these climate change adaptations.

Cumulative Effects

Past, present, and reasonably foreseeable actions that affect lynx habitat include timber harvest and fuels reduction, recreation, human development, and grazing on private and public lands. In addition, legal trapping of lynx, timber harvest, oil and gas development, mining, and human access in British Columbia have and would continue to affect Canada lynx and their habitat.

Past vegetation management and large-scale fires on the Forest within lynx habitat has resulted in a distribution and amount of successional stages (early, mid, late) that are outside the HRV. This alternative does not emphasize landscape restoration that would restore lynx habitats toward the HRV, providing conditions more similar to those under which lynx have commonly persisted. Thus, activities on the Forest would not mitigate for off-forest vegetation management as would occur with the action alternatives.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Grazing has occurred and would continue to take place on lands off of the Forest, potentially impacting deciduous or riparian habitats for lynx prey species.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands from the public. This would increase the effects of human disturbance on lynx habitat and make areas that have relatively low human disturbance on NFS lands even more important for lynx and other wildlife.

All Federal lands adjacent to the Forest within Canada lynx core and secondary areas would use the Lynx Conservation Assessment and Strategy (LCAS) (ILBT 2013) as current science to guide project-level consultation and land management planning. The North Cascades National Park Complex recently revised their management plan to include the LCAS (NPS 2012). The Idaho Panhandle National Forests land management plan was recently revised to address the conservation measures identified in the LCAS (USDA Forest Service 2015b). The conservation of lynx on WDNR lands is guided by the Department of Natural Resources Lynx Habitat Management Plan (WDNR 1996, updated in 2002). The management plan for the Pend Oreille National Wildlife Refuge provides conservation measures to contribute to the recovery and viability of Canada lynx (USFWS 2000). Collectively, these management plans have addressed many of the conservation measures identified for Canada lynx (ILBT 2013) and would help mitigate potential cumulative effects that may occur from off-forest activities. In addition, no critical habitat was identified on the Colville National Forest or on adjacent lands (USFWS 2009).

In Canada, timber harvesting, oil and gas development, coal mining, and the proliferation of human access associated with these industries, have and would continue to affect lynx habitat. Legal trapping occurs north of the Forest in Canada and could reduce the potential for lynx to disperse into the lynx habitat on the Forest. Trapping is not legal in Idaho, Montana, or Washington.

Summary

The no action alternative would make a low contribution to the recovery of the Canada lynx in the short (less than 20 years) and long (less than 50 years) term. This is because:

- Existing management plans do not address the best available science and conservation measures identified in the recent version of the Lynx Conservation Assessment and Strategy (ILBT 2013), and the USFWS Recovery Outline (USFWS 2005);
- Existing management plans do not address recommended climate change adaptations; and
- Existing management plans were found to give inadequate regulatory mechanisms to prevent listing lynx as a federally threatened species (USFWS 2003b).

Late-successional and Old Forest Habitats (Federally Listed Wildlife Species)

Woodland Caribou and Critical Habitat

Direct and Indirect Effects

The forest management activities that can influence the recovery and viability of woodland caribou include: (1) Vegetation management and natural disturbances affect the amount and connectivity of old forests of Engelmann spruce/subalpine fir and western redcedar/western hemlock. (2) Human access that can increase the potential for poaching and cause disturbance to caribou during the critical winter period. These effects were used to evaluate the potential contribution of each alternative to the recovery of woodland caribou.

This alternative would not implement new science, recommendations from the Biological Opinion issued in 2001 (USFWS 2001) on the 1988 forest plan (USDA Forest Service 1988), or address the critical habitat designation (USFWS 2012a). Vegetation management is currently guided by the management direction given in the land management allocation for caribou. The 1988 forest plan attempted to strike a balance between retaining old growth and providing for timber production. Timber harvest has been cited as one of the primary factors that has reduced and fragmented old growth habitats for woodland caribou (USFWS 1994, 2012a).

A term and condition of the 2001 Biological Opinion was that the Forest develop a winter recreation strategy that protects important winter habitats for caribou while providing some level of winter recreation access. This strategy was developed (USDA Forest Service 2003), but would not be formally adopted until the forest plan is revised. This alternative does not emphasize reducing the negative effects of forest roads on wildlife habitat (such as the proposed action and alternatives R and P).

Climate Change

Climate change would likely alter the distribution and abundance of suitable caribou habitat, and would change snow depths and persistence, which affect seasonal movements of mountain caribou (WDFW 2012a). The potential effects of climate change depend on the interaction of seasonal temperatures and snowfall patterns, and occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Management adaptations to address the effects of climate change include a focus on forest restoration and reducing non-climatic factors that affect wildlife populations (e.g., restoring habitat effectiveness). This alternative would not implement these adaptations.

Cumulative Effects

The caribou recovery area is 1,477 square miles in size and includes the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States, and 53 percent in British Columbia. The Idaho Panhandle National Forests recently revised their forest plan to address habitat and risk factors identified in the caribou recovery plan and critical habitat (USDA Forest Service 2015b). The caribou recovery team works cooperatively to address cumulative effects on woodland caribou.

Past activities on the Forest have impacted caribou habitat. Over-the-snow motorized use may have caused disturbance to caribou.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) within caribou habitat that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would not manage habitats toward HRV, and would not be as effective at mitigating for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife such as caribou.

Big game hunting continues on both sides of the U.S./Canada border. Encounters with hunters may result in caribou mortality as a result of mistaken identification. Legal harvest of caribou by Treaty Indians does occur, but with few statistics on the number of animals taken, it is difficult to evaluate the influence on the caribou population. Fatal collisions with vehicles occur on open roads in caribou habitat and are likely to continue. Predation by mountain lions, wolves, and other predators would continue, with the effect on the caribou population dependent on big game populations, predator populations, and a variety of other factors.

One important factor is how the Canadian officials decide to manage this herd. In the British Columbia portion of the recovery area, human activities that would continue to impact caribou habitat include gas, powerline, and international border corridors, recreation activities, timber harvest, and highways.

Summary

Implementation of the no action alternative would make a low contribution to the recovery of woodland caribou. The reasons for this are:

- This alternative would not address new science and risk factors identified in the recovery plan and critical habitat;
- This alternative would not formally adopt the winter recreation strategy for caribou habitat that was a Term and Condition of the 2001 Biological Opinion; and
- This alternative does not focus on the protection and restoration of habitat, that would better address expected climate change effects, cumulative effects, and enhance landscape resiliency.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the viability of late-successional and old forest (LSOF) dependent surrogate species include: the loss of LSOF habitat from fire (Healy et al. 2008, Davis et al. 2011, 2015), vegetation treatments (e.g., timber harvest, thinning, prescribed fire) that affect forest structure (e.g., canopy closure, snags, downed wood) (Healy et al. 2008, Wisdom and Bate 2008, Davis et al. 2011), management of roads that influence habitat effectiveness (Gaines et al. 2003), and protection of riparian areas which are an important element of LSOF habitats for some species (e.g., bald eagles).

The existing management direction for LSOF species is based on a system of small management areas that retains LSOF habitat for specific management indicator species (e.g., American marten, barred owl, pileated woodpecker). These areas range in size from 75 to 300 acres, are relatively equally distributed, but have no way to provide for habitat connectivity between or among the small islands of habitat. These small islands of habitat are also highly susceptible to disturbances such as fire, insects, and tree diseases, with no redundancy or replacement habitat in the event they are lost. This system was based on minimizing the effects of protection of LSOF habitat on the timber harvest level. This system was deemed inadequate to provide for the viability of LSOF species and thus forest plans were amended with the Eastside Screens (USDA Forest Service 1995b).

The area in-between the small islands of LSOF habitat is managed primarily through even-aged timber production, with some protections for elements of LSOF habitat, such as snags and downed wood. However, the combination of roads and timber harvest generally results in these areas having snag habitat below levels that would maintain viable populations of snag-dependent wildlife species. Again, the management direction in the original forest plan was deemed inadequate, thus additional direction was adopted through the Eastside Screens (USDA Forest Service 1995b). The Eastside Screens restrict the cutting of trees greater than 21 inches in diameter.

This alternative would not provide management direction that would reduce the negative effects of roads on wildlife habitats. Currently, there are about 4,000 miles of road, resulting in an overall road density on the roaded portion of the Forest of about 3 miles per square mile, which is considered a low level of habitat effectiveness for many surrogate species (Wisdom et al. 2000, Gaines et al. 2003).

Overall, the no action alternative would provide management direction for LSOF habitat that is similar to alternatives B and O, but would provide less habitat than alternatives R and P. This alternative would not improve the viability outcomes in the short (less than 20 years) or long (less than 50 years) time periods (appendix B of the Wildlife Specialist Report) for surrogate wildlife species that are dependent on LSOF habitats.

Climate Change

The sensitivity of LSOF associated surrogate wildlife species to the effects of climate change were identified as medium for pileated woodpecker, and high for northern goshawk and American marten (CCSD 2013). The primary effect of climate change is the loss of LSOF habitats due to altered disturbance regimes (CCSD 2013).

Since the mid-1980s, the size and intensity of large wildfires in the western United States have increased markedly (Westerling et al. 2006), due, in part, to a reduction in fuel moisture driven by increased temperature and lower snowpack. Increases in fire risk and severity have been also been driven, in part, by increased fuel loads because of fire suppression practices used over the last century (McKenzie et al. 2004). Predicted increases in spring and summer temperature identified in many climate change models would exacerbate the frequency and intensity of disturbances such as fire (McKenzie et al. 2004, Wotton and Flannigan 1993) and defoliation caused by forest insects (Littell et al. 2009). In the interior Columbia Basin, Littell et al. (2009) predicted that the area burned is likely to double or even triple by 2050. Climate-driven changes in fire regimes would likely be the dominant driver of changes to forests and LSOF habitats in the western United States over the next century (McKenzie et al. 2004).

A landscape restoration approach is not emphasized in this alternative. Landscape-scale restoration has been identified as an adaptive strategy to create landscapes more resilient to climate change (Spies et al. 2010, Gaines et al. 2012) and to maintain late-successional and old forest habitat structure (Lawler et al. 2014). The emphasis on restoration of resiliency would result in landscapes, including disturbance regimes, which are more resilient to climate change through the application of strategically located restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior may be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires may be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007).

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats, and protect and restore LSOF habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional, especially late-open, habitats compared to HRV. This alternative would manage habitats toward HRV, resulting in a distribution and amount of successional stages that better mimic conditions under which surrogate wildlife species evolved, and better mitigate for the cumulative effects of off-forest timber harvest.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of this alternative would make a relatively low contribution to the viability of LSOF-dependent surrogate wildlife species. This determination is based on the following:

- The LSOF habitat provided by this alternative may not maintain viable populations of LSOF surrogate wildlife species;
- This alternative does not emphasize restoration of landscape resiliency to reduce the loss of LSOF habitats to uncharacteristically severe wildfires;
- The protection and conservation of key elements of LSOF habitat such as old trees, snags, and riparian areas is less than other alternatives and dated; and
- The alternative would not result in the restoration of habitat effectiveness by reducing the negative effects of roads on LSOF habitats.

Motorized Recreation and Road Access

Proposed Species – Wolverine

Direct and Indirect Effects

Motorized recreation and the use of forest roads may influence the habitat use and populations of wolverines. These potential effects include displacement from key habitats, disturbance during critical periods, and the risk of mortality caused (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wolverine). The effects of motorized

recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of this alternative would have limited opportunity to reduce the negative effects of roads on wolverine habitat. The current management direction for roads is limited, scattered through numerous document and amendments, and was largely intended to address big-game species (e.g., road density is limited to between 0.4 and 1.5 miles of open road per square mile on winter ranges).

This alternative would not change the current level of winter or summer motorized trail use, thus, would not change the impacts to habitat effectiveness for wolverines. Overall, this alternative would provide a level of habitat effectiveness for wolverines that is similar to alternative O, and less than the proposed action and alternatives B, R, and P.

Climate Change

The sensitivity of wolverines to the effects of climate change is rated as high (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of roads and motorized recreation on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads and motorized recreation, habitats can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wolverines to adjust their ranges as conditions change. The management direction for roads provided in the no action alternative would make very limited improvement to habitat effectiveness for wolverines.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Colville National Forest) means that management of roads and motorized trails on Federal lands is even more important for proposed species such as the wolverine.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

The implementation of the no action alternative would make a relatively low contribution to the recovery of wolverine populations and habitat restoration. This would occur because:

- The alternative includes limited management direction to reduce the effects of roads on habitat effectiveness for surrogate wildlife species;

- This alternative does not alter the current effects that summer and winter motorized trails have on habitat effectiveness for surrogate wildlife species; and
- This alternative does little to address the cumulative effects of human access and development on wildlife habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Motorized recreation and the use of forest roads influence the viability of surrogate wildlife species. These potential effects include displacement from key habitats, disturbance during critical periods, and the risk of mortality caused by collisions with vehicles (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wildlife). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of this alternative would have limited opportunity to reduce the negative effects of roads on surrogate species habitats. The current management direction for roads is limited, scattered through numerous document and amendments, and was largely intended to address big-game species (e.g., road density is limited to between 0.4 to 1.5 miles of open road per square mile on winter ranges).

This alternative would not change the current level of winter or summer motorized trail use, thus would not change the impacts to surrogate species habitat effectiveness. Overall, this alternative would provide a level of habitat effectiveness for surrogate wildlife that is similar to alternative O, and less than the proposed action and alternatives B, R, and P. The viability outcomes for surrogate wildlife species would not be improved and would remain below the historical capability.

Climate Change

The sensitivity of surrogate wildlife species to climate change, and that were used to assess the effects of roads and motorized recreation is rated as moderate for bighorn sheep and high for Harlequin duck, Canada lynx, and wolverine (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of roads and motorized recreation on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads and motorized recreation, habitats (especially riparian and wetland habitats) can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wildlife to adjust their ranges as conditions change. The management direction for roads provided in the no action alternative would make very limited improvement to habitat effectiveness for surrogate wildlife species.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Forest) means that management of roads and motorized trails on Federal lands is even more important to the viability of surrogate wildlife species.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

The implementation of this alternative would make a relatively low contribution to the viability of surrogate wildlife species whose habitats are influenced by motorized access. This would occur because:

- The alternative includes limited management direction to reduce the effects of roads on habitat effectiveness for surrogate wildlife species,
- This alternative does not alter the current effects that summer and winter motorized trails have on habitat effectiveness for surrogate wildlife species, and
- This alternative does little to address the cumulative effects of human access and development on wildlife habitats.

Livestock Grazing

Surrogate Wildlife Species

Direct and Indirect Effects

Grazing can influence habitats of surrogate wildlife species by removing key habitat elements (e.g., dense shrubs for MacGillivray's warbler and fox sparrow), especially in riparian habitats, altering disturbance regimes that maintain habitat structure (e.g., frequent fires in dry forests and grasslands keep open canopy for western bluebird), and influence the availability of important prey items (e.g., squirrels for golden eagles). To address the potential effects on surrogate wildlife species, the management direction regarding grazing in riparian habitat and upland habitats for each alternative was assessed.

This alternative would continue with the existing interim direction (INFISH) for riparian habitats. Presently, some riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would have little effect on altering the distribution of livestock that would allow riparian habitats to recover.

This alternative does not include ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) or standards to protect unique habitats. This alternative would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, approximately 68 percent of the Forest is in a livestock allotment and animal unit months (AUMs) average about 25,000 per year. The viability outcomes for surrogate wildlife species would not be improved and would remain below the historical capability.

Climate Change

Habitats that are particularly sensitive to the effects of climate change include riparian areas (including wetlands) and alpine areas (Lawler et al. 2014). A management adaptation to make these habitats more resilient to climate change is to reduce the effects of non-climatic stressors (e.g., roads, intense grazing, etc.) (Lawler et al. 2014). This alternative has limited management direction that would restore the resiliency of habitats that are sensitive to climate change.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Panhandle National Forests, it is managed to accommodate other public land uses, such as contributing to the viability of surrogate wildlife species. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific wildlife habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for wildlife habitats on Federal lands that contribute to the viability of surrogate wildlife species.

This alternative does not include management direction for some key habitats that would better account for the cumulative effects of grazing on wildlife habitats.

Summary

Implementation of this alternative would make a relatively low contribution to viability for surrogate wildlife species that are influenced by domestic grazing. This determination is based on:

- This alternative has limited management direction for riparian habitat to reduce the negative effects of grazing and improve riparian habitat condition, and
- This alternative would not change the number, grazing intensity or distribution of livestock.

Habitat Connectivity

Surrogate Wildlife Species

Direct and Indirect Effects

A number of forest management activities influence habitat connectivity for surrogate wildlife species. These include the amount, patch sizes, and arrangement of suitable habitats; location; and density of motorized travel routes, especially in relation to riparian and LSOF habitats.

Current management direction focuses on providing habitat connectivity for LSOF species through the identification of connectivity corridors during project planning (as per Eastside Screens, USDA Forest Service 1995b). Additional provisions for low to moderate mobility LSOF species are provided in Riparian Management Zones. No management direction addresses habitat connectivity for wildlife species that are not associated with LSOF habitats (e.g., wide-ranging carnivores, Singleton et al. 2002).

The implementation of this alternative would have limited opportunity to reduce the negative effects of roads on habitat connectivity for surrogate wildlife species (table 184) because current management direction for roads is limited, scattered through numerous documents and amendments, and was largely intended to address big-game species only. This alternative would not change the current level of winter or summer motorized trail use, thus would not change the effects to surrogate

species habitat effectiveness. The viability outcomes for surrogate wildlife species would not be improved and would remain below the historical capability.

Table 184. Dispersal habitat suitability for surrogate wildlife species under the no action alternative, by proportion of planning area

Surrogate Species used to Assess Habitat Connectivity	Low Dispersal Habitat Suitability	Moderate Dispersal Habitat Suitability	High Dispersal Habitat Suitability
American Marten	41%	39%	20%
Canada Lynx	7%	60%	33%
Wolverine	8%	48%	44%

1/See Singleton et al. (2002) and Gaines et al. (2017) for a definition of and methods used to determine dispersal habitat suitability.

Climate Change

Maintaining and restoring ecological connectivity is the most oft-cited climate adaptation strategy for biodiversity conservation (Heller and Zavaleta 2009, Opdam and Wascher 2004, Parmesan 2006, Spies et al. 2010) and has been identified as an important adaptation strategy for wildlife in northeastern Washington (Gaines et al. 2012). This is because species' range shifts have been the primary biological response to past episodes of climatic change, yet widespread anthropogenic barriers to movement would now challenge species' ability to respond (Price 2002, Thomas and Lennon 1999, Wormworth and Mallon 2006).

Current management plans provide direction to address habitat connectivity for some highly mobile LSOF wildlife species. However, there is no management direction that addresses habitat connectivity for wildlife species not associated with LSOF habitats (e.g., wide-ranging carnivores), nor do existing management plans address the effects of forest roads on habitat connectivity. Much has been learned about the effects of climate change on wildlife since the 1988 forest plan was developed and amended, and the 1988 forest plan does not adequately address recommended climate adaptations to maintain or restore habitat connectivity for a wide array of wildlife species.

Cumulative Effects

Past, present, and reasonably foreseeable human developments and transportation infrastructure, along with land ownership patterns, create cumulative impacts that limit options to conserve or restore regional habitat connectivity. Regional habitat connectivity has been evaluated for a variety of wildlife species, including the surrogate wildlife species used to evaluate connectivity in this planning area (Singleton et al. 2002, WWHCWG 2010, Proctor et al. 2015). These assessments have shown the importance of the Colville National Forest in providing stepping-stone habitats between the Cascade Range and Selkirk Mountains (Singleton et al. 2002, WWHCWG 2010). Connectivity from the Cascade Range to the Kettle Range and the Selkirk Mountains is interrupted by transportation corridors and human developments that are associated with the Okanogan, Upper Columbia, and Pend Oreille river valleys (Singleton et al. 2002, WWHCWG 2010). Additionally, connectivity planning in southern British Columbia identified linkage areas that could greatly enhance wildlife movements between the Selkirk Mountains and Purcell Mountains (Apps et al. 2007, Proctor et al. 2015).

Reducing the direct and indirect effects of roads on wildlife habitats would contribute to the maintenance and restoration of habitat connectivity, including cumulative effects, but is not well addressed in the 1988 forest plan. Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent

or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

The existing management plans have limited direction that addresses habitat connectivity, and most is relevant to wildlife species associated with LSOF habitats. Thus, the implementation of the no action alternative would provide a relatively low contribution to the viability of surrogate wildlife species used to assess habitat connectivity. The primary reasons for this conclusion include:

- No management direction to address wildlife species that are not associated with LSOF habitats (e.g., wide-ranging carnivores); and
- Limited management direction that addresses the effects of roads and road network on habitat connectivity, despite this being a primary factor that influences wildlife movements.

Snag Habitat

Surrogate Wildlife Species

Direct and Indirect Effects

Some forest activities directly influence the availability of habitat for snag-dependent surrogate species. These include firewood cutting (Bate et al. 2007, Hollenbeck et al. 2013), hazard tree reduction that causes the loss of snag habitat along roads and at recreation sites (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom and Bate 2008), and removal of snags during timber harvest for safety reasons (Wisdom and Bate 2008).

The 1988 forest plan management direction for snag habitat to address the potential loss of habitat in timber sale operations was based on snag densities that more recent science has shown would not provide for viable populations of snag-dependent species. This alternative does not include a diameter limit on the size of snags cut for firewood as in other alternatives.

Existing management plans provide limited opportunity to reduce the negative effects of roads on surrogate species habitats, such as the loss of snag habitat, because current management direction for roads is limited, scattered through numerous documents and amendments (e.g., Roadless Rule, USDA Forest Service 2000, Forest Service Manual (FSM) 7700), and was largely intended to address big-game species only.

Overall, this alternative would provide habitat protections for snag-dependent wildlife that are similar to alternatives B and O, but less than the proposed action and alternatives R and P. The viability outcomes for snag-dependent surrogate wildlife species would not be improved and remain below the historical capability.

Climate Change

Surrogate wildlife species associated with snag habitats include the pileated woodpecker, white-headed woodpecker, black-backed woodpecker, and Lewis's woodpecker. These species have a medium sensitivity rating to climate change, and the western bluebird as high sensitivity (CCSD 2013). The primary effect anticipated from climate change is the loss of habitat due to altered disturbance regimes. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for snag-dependent

surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change, loss of snag habitat from relatively intense timber harvest, and loss associated with roads as snags are cut for firewood and to reduce hazard trees. The increase in fire associated with climate change could create a short-term gain in snag habitat followed by a long-term reduction (80 to 100 years, Harrod et al. 1998) as snags attrition occurs.

Cumulative Effects

Past and current management on public and private lands have generally resulted in a reduction in large (greater than 20 inches d.b.h.) snag habitat below HRV (Hessburg et al. 1999). The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and more rigorous snag requirements to contribute to the viability of snag-dependent wildlife (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitats and current required snag densities make limited contribution to the viability of surrogate wildlife species. The limited management direction for snag habitat on non-Federal lands adjacent to the planning area places additional emphasis on providing for viability populations of snag-dependent wildlife species on Federal lands. Fuels reduction projects are possible on all land ownerships, in particular where they are near residences. These can be done is such a way that they restore wildlife habitat that has been affected by fire exclusion, but treatments can lead to the loss of snag habitat for safety reasons.

Summary

Implementation of this alternative would make a relatively low contribution to the viability of snag-dependent surrogate wildlife species. This determination is based on:

- The negative effects of roads on the loss of snag habitat would not be addressed;
- The snag densities that are required to be left following timber harvest do not address recent science showing these number to be too low to maintain viable populations of snag-dependent species; and
- There is no diameter limit on the size of snags that are cut for firewood.

Riparian Habitats

Federally Listed Wildlife Species

Yellow-billed Cuckoo - Threatened

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent species such as the yellow-billed cuckoo include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In the no action alternative, management direction for watersheds and riparian habitats is not consolidated into one consistent set of plan components (e.g., direction is in both the 1988 forest plan and in the INFISH amendment). Standards and guidelines would limit management activities allowed to occur within riparian habitats. This alternative includes smaller (compared to other

alternatives except alternative B) riparian management area widths along intermittent streams, lakes, and ponds in the areas covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

The implementation of this alternative would not reduce the effects of roads on riparian habitats. Overall, this alternative would provide habitat protection for the yellow-billed cuckoo that is similar to alternative B, but less than the proposed action and alternatives O, R, and P.

Climate Change

Climate change is expected to have an overall negative effect throughout the range of the yellow-billed cuckoo (Post et al. 2009, USFWS 2013). Riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effect anticipated from climate change is the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic regimes and disturbances (fire) regimes (Lawler et al. 2014).

The emphasis of this alternative is on timber management. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for riparian species such as the yellow-billed cuckoo is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and some loss of riparian habitat from timber harvest. In addition, an important adaptation for climate change for riparian habitats is to restore their resiliency by reducing the negative effects of roads (Lawler et al. 2014). However, this alternative has limited management direction to reduce road effects on riparian habitats and does not emphasize watershed restoration.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. Management plans for the Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge reduce the negative effects of roads on wildlife habitats, and protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative that occur on private lands.

Summary

The implementation of this alternative make a relatively low contribution to the recovery of yellow-billed cuckoo. This determination is based on the following:

- This alternative lacks effective and clear management direction to reduce the negative effects of roads on riparian habitat; and
- More rigorous riparian management direction, including standards, included in other alternatives (e.g., R, P), which better protects riparian habitats and would better address potential effects of climate change and cumulative effects.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent surrogate species include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In the no action alternative, management direction for watersheds and riparian habitats is not consolidated into one consistent set of plan components (e.g., direction is in both the 1988 forest plan and in the INFISH amendment). Standards and guidelines would limit management activities allowed to occur within riparian habitats. This alternative includes smaller (compared to other alternatives except B) riparian management area widths along intermittent streams, lakes, and ponds in the areas covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of this alternative would not reduce the effects of roads on riparian habitats. Overall, this alternative would provide habitat protection for riparian associated wildlife that is similar to the alternative B, but less than the proposed action and alternatives O, R, and P.

Conditions that contribute to the viability of surrogate species would be maintained at levels below the historical capability and viability outcomes would not be considerably improved.

Climate Change

Some of the riparian-associated surrogate species are rated as high sensitivity to climate change (CCSD 2013), and riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effect anticipated from climate change is the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic regimes and disturbances (fire) regimes (Lawler et al. 2014).

The emphasis of this alternative is on timber management. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for riparian-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and some loss of riparian habitat from timber harvest. In addition, an important adaptation for climate change for riparian habitats is to restore their resiliency by reducing the negative effects of roads (Lawler et al. 2014). However, this alternative has limited management direction to reduce road effects on riparian habitats and does not emphasize watershed restoration.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. Management plans for the Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge reduce the negative effects of roads on wildlife habitats, and protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995; ACS-USDA Forest Service 1994).

On private lands, Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife

species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of this alternative would make a relatively low contribution to the viability of riparian-dependent surrogate wildlife species. This determination is based on the following:

- This alternative lacks effective and clear management direction to reduce the negative effects of roads on riparian habitat for surrogate wildlife species;
- More rigorous riparian management direction including standards, included in other alternatives (e.g., R), which better protects riparian habitats and would better address potential effects of climate change and cumulative effects; and
- The viability outcomes for surrogate wildlife species dependent on riparian habitats would not be improved.

Species of Management Interest

Deer and Elk

Direct and Indirect Effects

Forest management activities can influence deer and elk populations and habitat use. Vegetation management activities may affect the distribution and abundance of cover and forage. Adequate forage is particularly important during the summer and fall before the following birthing season when this can have a positive effect on the condition of pregnant females (Lenz 1997, Cook 1998, Cook 2002, Cook et al. 2004, Cook et al. 2005, Cook et al. 2013). The management of forest roads and trails can influence how deer and elk use habitats, and influence the interactions between deer and elk (Rowland et al. 2005, Wisdom et al. 2005a, b). Additionally, deer and elk can compete with domestic livestock for both food resources (Findholt et al. 2005) and space (Coe et al. 2001, Coe et al. 2005). Thus, the potential effects that vegetation management, road and trail management, and grazing management can have on deer and elk habitats and population are evaluated for each of the alternatives.

Under the no action alternative, cover and forage for deer and elk on winter ranges emphasizes the retention of winter thermal cover. Considerable research has shown that the management of deer and elk winter habitat should be less focused on the retention of thermal cover and more focused on the availability of forage on summer and fall habitats (see Cook et al. 2005 and 2013 for a review). This alternative, like alternatives B and O, would not incorporate the current science about the role of winter thermal cover and summer forage in contributing to the sustainability of deer and elk populations.

This alternative would not alter the current habitat effectiveness for deer and winter ranges through road management. The Selkirk Elk Herd has a moderate level of habitat effectiveness (moderate level of human influence) on their winter ranges (see Gaines et al. 2003 for calculation of habitat effectiveness). Currently, in 38 percent of the watersheds, winter habitat for deer has a high habitat effectiveness index (low level of human influence), 38 percent of the winter habitat has a moderate level of habitat effectiveness (moderate level of human influence), and 24 percent has a low level of habitat effectiveness (high level of human influence). Current management direction for winter ranges is based on road density standards. Rowland et al. (2005) found road density to be a poor

indicator of habitat use by deer and elk and recommended the use of the zone of influence instead. This is incorporated into the proposed action and alternatives R and P.

Under this alternative, no changes would occur to current grazing practices on national forest allotments. Degraded range conditions would be maintained or slowly be improved, likely having negative effects to deer and elk habitat use and populations (Coe et al. 2001, 2005, Findholt et al. 2005). More robust range management direction (e.g., ecologically based desired conditions in the other alternatives) would not be adopted.

Climate Change

Deer and elk have a low level of sensitivity to the effects of climate change due to their ability to tolerate a relatively wide range of climatic conditions, their high mobility, and as habitat generalists (CCSD 2013). However, alternatives that restore landscape pattern and functions while reducing the effects of roads on deer and elk summer and winter habitats would provide more resilience in deer and elk populations. This alternative does not emphasize landscape-scale restoration, nor does it provide consistent and effective management direction for roads that would restore habitat effectiveness for deer and elk.

Cumulative Effects

The historical cattle and sheep grazing that occurred on portions of the Forest degraded range conditions (Wissmar et al. 1994, Bunting et al. 2002). These conditions, combined with current domestic (cattle) and wild ungulate grazing (primarily elk and deer), have resulted in the maintenance or slow recovery of poor range conditions in some areas (Wissmar et al. 1994, Bunting et al. 2002). In turn, these poor range conditions have had negative effects on some important unique habitats such as riparian areas and meadows. This alternative would not result in more rigorous grazing management direction that would help to address this situation.

Winter ranges for deer and elk occur on Federal lands, adjacent wildlife management areas managed by the State, and private lands. Elk herd management plans (WDFW 2014) provide guidance for elk management on State lands and make recommendations for elk management on NFS lands. Management plans for deer include the White-tailed Deer Management Plan that provides direction to manage hunting to maintain deer populations (WDFW 2010). A statewide general management plan for mule deer has been developed, but does not provide herd-specific management objectives (WDFW 2016). Mule deer are widely distributed across the Forest. A considerable amount of historical winter range for deer and elk is now in private land ownership or under the waters of Lake Roosevelt (created by the Grand Coulee Dam). The cumulative effects of the existing management plans (State and Federal lands) would provide for the conditions that contribute to sustainable populations of deer and elk, while considering the effects of private land development.

Summary

Implementation of the no action alternative would make a relatively low contribution to the conditions that support sustainable populations of deer and elk. This is based on the following:

- This alternative would not address new science that recommends de-emphasizing the importance of winter thermal cover and increasing the emphasis on summer and fall forage quality and quantity;
- This alternative does not provide consistent and effective direction on the management of roads to restore habitat effectiveness on deer and elk summer and winter ranges; and

- This alternative would not include more rigorous management direction to improve the conditions of key habitats, such as riparian areas and meadows that are in poor condition due to the cumulative effects of past grazing practices, and current domestic and wild ungulate grazing.

Native Pollinators

Direct and Indirect Effects

Forest management activities can influence native pollinator populations and include vegetation management, grazing, and placement of apiaries (USDA 2015).

The no action alternative does not include desired conditions to restore forest structure and composition at the landscape scale. This alternative is more focused on timber management. This alternative does not emphasize the restoration of disturbance regimes or the application of restorative treatments that enhances native plant communities and native pollinator habitats (Dodson et al. 2008, Neill and Puettmann 2013).

While the no action alternative does promote the restoration of native plant communities, it does not include ecologically based desired conditions for vegetation or standards to protect unique habitat from grazing that are based on more recent science and monitoring. This alternative would not alter the number of livestock, intensity of grazing, or the amount of area grazed. Presently, 68 percent of the forest is in a livestock allotment and AUMs average about 25,000 per year.

This alternative does not include plan direction for the placement of apiaries that would reduce the potential for non-native pollinators to compete with native pollinators.

Climate Change

Native pollinators are considered to be sensitive to the effects of climate change, although our understanding of climate effects is very limited. Alternatives that address non-climate-related factors such as native vegetation restoration and reducing the impacts of grazing would be more beneficial than the no action alternative in maintaining and restoring habitat for native pollinators.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Pan Handle National Forest, it is managed to accommodate other public land uses. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for native pollinator habitats on Federal lands. This alternative does not include management direction for some key habitats that would better account for the cumulative effects of grazing on pollinator habitats.

Summary

Implementation of the no action alternative would make a relatively low contribution to maintenance and restoration of habitat for native pollinators. This determination is based on:

- While this alternative does promote the restoration of native plant communities, other action alternatives place a greater emphasis on this;
- This alternative would not change the number, grazing intensity or distribution of livestock; and

- This alternative does not include plan direction for the placement of apiaries that would reduce the potential for competition between non-native and native pollinators.

Proposed Action

Federally Listed Wildlife Species

Grizzly Bear

Direct and Indirect Effects

Forest activities that influence the recovery of the grizzly bear include: human access that can displace bears from important seasonal habitats or increase the risk of bear-human interactions, disposal of livestock carcasses within range allotments to avoid attracting bears to a potential food source, and the storage of food and garbage at recreation sites to reduce the potential for bears to associate humans with food sources.

Management of grizzly bears does not vary between alternatives. Existing management direction provides standards for human access, disposal of livestock carcasses, and food and garbage storage within the Selkirk Grizzly Bear Recovery Area (IGBC 1998, USDA Forest Service 1988, USFWS 1993, USDI 2001). Existing standards have largely been met and would continue to be followed.

Climate Change

Grizzly bears have been identified as having a low sensitivity to climate change because they are opportunistic, eat a diverse array of food resources, and are highly adaptable (Servheen and Cross 2010, CCSD 2013). Anticipated impacts may include changes in the timing of denning due to longer snow-free periods and reduced snowpack (Lawler et al. 2014) and changes in the availability of food sources (Servheen and Cross 2010). These changes may put bears at risk of negative human interactions for a longer period each year (Servheen and Cross 2010). This would make education, proper food and garbage storage, carcass disposal measures, and human access management that much more important.

Cumulative Effects

The primary reasons for the low population of grizzly bears in the recovery zone are past persecution and human-caused mortality of bears. Legal protections are now in place to protect grizzly bears. Information and education programs, sanitation measures, and access management have and would continue to be used to aid in the recovery of grizzly bears in the Selkirk Recovery Area.

Past, present, and reasonably foreseeable future actions that could affect grizzly bears include timber harvest and associated road construction, recreational activities that can cause disturbance to bears and create potential for human-bear conflicts, and human development that fragment grizzly bear habitat. Cumulative effects are evaluated across the recovery area by tracking activities within GBMUs. Other land managers have adopted and are following similar management direction (USDA Forest Service 2015b) and overall recovery is coordinated by the Selkirk Grizzly Bear Management Subcommittee. GBMUs that occur on the Colville National Forest include the Le Clerc, Salmo-Priest, and Sullivan-Hughes. The contribution made on Federal lands to grizzly bear recovery would help to mitigate potential cumulative effects from off-forest activities.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance (e.g., core areas) becoming more important to wildlife such as grizzly bears.

Black bear hunting on both sides of the international border within the Selkirk Recovery Area has the potential to add cumulatively to the mortality of grizzly bears. Hunters that encounter grizzly bears may mistakenly identify the bear, kill the bear in self-defense, or opportunistically poach the bear. Human access management within the recovery area is key to reducing the risk of mortality to grizzly bears from black bear hunting.

On private lands, the presence of garbage, pet food, fruit trees, or other attractants may lure bears into conflict situations. Bears that become habituated or a nuisance may lead to the bear being killed.

Summary

The proposed action would make a relatively high contribution to the recovery of grizzly bears in the Selkirk Recovery Area. This is based on the existing management direction, followed in all alternatives, that addresses:

- Human access management,
- Disposal of carcasses in range allotments that occur in the recovery area, and
- Proper storage of food, garbage, and other attractants that may lead to human-bear interactions.

Canada Lynx

Direct and Indirect Effects

The forest management activities that influence the recovery and conservation of Canada lynx include: vegetation management that affects lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The Interagency Lynx Biology Team (ILBT 2013) developed conservation measures for core and secondary areas (USFWS 2005) to address each of these forest management activities, and for planners to consult when revising forest plans. These were used to evaluate the potential contribution of forest management alternatives to the recovery of Canada lynx.

Vegetation management activities affect the distribution of lynx habitat components, can fragment habitats, and create sources of disturbance (ILBT 2013). As a result, risk factors were identified and conservation measures developed to address the risk factors (ILBT 2013). The conservation measures for vegetation management apply to lynx core areas and include the use of the natural range of variation to mimic the pattern and scale of natural disturbances and connectivity across the landscape, while considering future climate change (ILBT 2013). A conservation measure focused on the restoration of disturbance regimes in dry forests that occur in close proximity to lynx habitat to reduce the risk of uncharacteristically severe and frequent fires reaching lynx habitat. Finally, conservation measures also limit the amount of vegetation management and the rate of habitat change (e.g., acres treated per decade) within lynx analysis units. The implementation of this alternative includes management direction to manage habitat for Canada lynx toward desired

conditions that are based on the natural range of variability. This means that habitats would be managed so that the amount of habitat, patch sizes, and spatial arrangement would mimic conditions under which lynx have commonly persisted (Hessburg et al. 1999, Agee 2000). These conservation measures would provide foraging, denning, and travel habitat components for lynx, while reducing the potential of habitat loss and fragmentation from uncharacteristically severe wildfires.

Winter recreation can influence how lynx use habitats (ILBT 2013). To minimize the potential of negative effects from winter recreation, the ILBT (2013) developed conservation measures to reduce effects. Conservation measures for winter recreation in lynx core areas included reducing effects on habitat connectivity and discouraging expansion of over-the-snow routes that may influence lynx habitat use (ILBT 2013). Management direction in this alternative is for no expansion of over-the-snow winter recreational activities in lynx habitat.

The conservation measures for forest roads in lynx core areas include avoiding road reconstruction or upgrades that occur in lynx habitat that would result in increased traffic speeds or volumes (ILBT 2013). These measures would reduce the potential for vehicular traffic to result in a source of mortality to lynx. This alternative includes management direction to limit road reconstruction and upgrades in lynx habitat that would increase traffic volume or speed. This would reduce the potential for lynx mortality associated with vehicle-collisions.

The conservation measures for grazing in lynx core areas include management of riparian areas to assure adequate habitat for snowshoe hares, the primary prey species for Canada lynx (ILBT 2013).

The proposed action would provide management direction to address the direct and indirect effects of forest management activities on the recovery of Canada lynx. The direct and indirect effects that the management direction addresses include desired conditions for vegetation management to provide lynx habitat components (foraging, denning, travel), direction to reduce the effects of winter recreation on Canada lynx habitat connectivity and lynx habitat use, limiting speeds on forest roads to reduce the risk of mortality to lynx from vehicle collisions, and standards and guidelines to improve condition in riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The proposed action would provide more protection for Canada lynx than no action, and alternatives B, and O, and similar to alternatives R and P.

Climate Change

The potential effects of climate change on Canada lynx identified by the Interagency Lynx Biology Team (2013) included: (1) An upward shift in elevation or latitudinal distribution of lynx and prey, (2) A decrease in the amount of habitat and population size from reduced snow persistence and increased disturbance events (e.g., fires), (3) Changes in demographic rates, such as survival and reproduction, and (4) Changes in predator-prey relationships.

Climate change adaptations to address these effects include restoration of landscape-scale disturbance regimes to better mimic natural patterns and processes (Spies et al. 2010, Gaines et al. 2012, Lawler et al. 2014), and maintaining or restoring habitat connectivity to allow Canada lynx to adjust their ranges to changing conditions (Heller and Zavaleta 2009, ILBT 2013, Squires et al. 2013). There is management direction in this alternative to implement climate change adaptations through the focus on whole-landscape restoration, and the restoration of conditions that would enhance connectivity of habitats (see Habitat Connectivity sections).

Cumulative Effects

Past, present, and reasonably foreseeable actions that affect lynx habitat include timber harvest and fuels reduction, recreation, human development, and grazing on private and public lands. In addition, legal trapping of lynx, timber harvest, oil and gas development, mining and human access in British Columbia have and would continue to affect Canada lynx and their habitat.

Past vegetation management and large-scale fires on the Forest within lynx habitat has resulted in a distribution and amount of successional stages (early, mid, late) that are outside the HRV. The proposed action would result in vegetation management activities that would restore lynx habitats toward the HRV, providing conditions more similar to those under which lynx evolved.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Grazing has occurred and would continue to take place on off-forest lands, potentially impacting deciduous or riparian habitats for lynx prey species.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in areas with relatively low human disturbance on NFS lands becoming even more important to lynx and other wildlife.

All Federal lands within Canada lynx core and secondary areas would use the Lynx Conservation Assessment and Strategy (LCAS) (ILBT 2013) as current science to guide project-level consultation and land management planning. The North Cascades National Park Complex recently revised their management plan to include the LCAS (NPS 2012). The Idaho Panhandle National Forests plan was recently revised to address the conservation measures identified in the LCAS (USDA Forest Service 2015b). The conservation of lynx on WDNR lands is guided by the Department of Natural Resources Lynx Habitat Management Plan (WDNR 1996, updated in 2002). The management plan for the Pend Oreille National Wildlife Refuge provides conservation measures to contribute to the recovery and viability of Canada lynx (USFWS 2000). Collectively, these management plans have addressed many of the conservation measures identified for Canada lynx (ILBT 2013) and would help mitigate potential cumulative effects that may occur from off-forest activities. In addition, no critical habitat was identified on the Colville National Forest or on adjacent lands (USFWS 2009).

In Canada, timber harvesting, oil and gas development, coal mining, and the proliferation of human access associated with these industries, have and would continue to affect lynx habitat. Legal trapping occurs north of the Forest in Canada and could reduce the potential for lynx to disperse into the lynx habitat on the Forest. Trapping is not legal in Idaho, Montana, or Washington.

Summary

The proposed action would make a relatively high contribution to the recovery of the Canada lynx in both the short (less than 20 years) and long (less than 50 years) term. Most future actions consistent with this alternative may result in effects to Canada lynx that are either insignificant or discountable, in part due to the conservation measures implemented and also due to the low numbers of lynx on the Colville National Forest. Lynx distribution and population numbers can vary over time. Potential effects to lynx will be addressed in more detail during future consultations on the selected alternative with USFWS. This is because of the following:

- This alternative incorporates the best available science and conservation measures identified in the recent version of the Lynx Conservation Assessment and Strategy (ILBT 2013), and USFWS Recovery Outline (USFWS 2005).
- This alternative would implement recommended climate change adaptations by focusing on the restoration of forest disturbance regimes and resiliency, and reducing the impacts of roads on habitat connectivity.
- This alternative addresses previous findings that existing management plans provided inadequate regulatory mechanisms to prevent the listing of lynx as a federally threatened species (USFWS 2003b).

Late-successional and Old Forest Habitats (Federally Listed Wildlife Species)

Woodland Caribou and Critical Habitat

Direct and Indirect Effects

The forest management activities that can influence the recovery and viability of woodland caribou include: (1) Vegetation management and natural disturbances affect the amount and connectivity of old forests of Engelmann spruce/subalpine fir and western redcedar/western hemlock. (2) Human access that can increase the potential for poaching and cause disturbance to caribou during the critical winter period. These effects were used to evaluate the potential contribution of each alternative to the recovery of woodland caribou.

This alternative would implement new science, recommendations from the Biological Opinion issued in 2001 (USFWS 2001) on the 1988 forest plan (USDA Forest Service 1988), and address the critical habitat designation (USFWS 2012a). Vegetation management would be focused on the restoration of late-successional and old forest habitats based the natural and future range of variability. The desired conditions would be for the amount, spatial arrangement, and connectivity of caribou habitat to mimic natural patterns and processes.

A term and condition of the 2001 Biological Opinion was that the Forest develop a winter recreation strategy that protects important winter habitats for caribou while providing some level of winter recreation access. This strategy was developed (USDA Forest Service 2003) and would be fully integrated into the proposed action. The strategy includes information and education about the effects of winter recreation on wildlife, monitoring and enforcement of areas closed to over-the-snow activities, and limitations on permitted over-the-snow activities. Collectively, these actions have reduced the impacts of winter recreation to caribou habitat while providing recreation opportunities in areas and at the time of the winter season when effects to caribou are minimal. In addition to winter recreation, this alternative emphasizes reducing the negative effects of forest roads on wildlife habitat (though not to the degree of alternatives R and P).

Climate Change

Climate change would likely alter the distribution and abundance of suitable caribou habitat, and would change snow depths and persistence, which affect seasonal movements of mountain caribou (WDFW 2012a). The potential effects of climate change depend on the interaction of seasonal temperatures and snowfall patterns and occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Management adaptations to address the effects of climate change include a focus on forest restoration and reducing non-climatic factors that affect wildlife populations (e.g., reducing the negative impacts of roads and winter recreation). The proposed action would implement these adaptations.

Cumulative Effects

The caribou recovery area is 1,477 square miles in size and includes the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States and 53 percent in British Columbia. The Idaho Panhandle National Forests recently revised its forest plan to address habitat and risk factors identified in the caribou recovery plan and critical habitat (USDA Forest Service 2015b). The caribou recovery team works cooperatively to address cumulative effects on woodland caribou.

Past activities on the Forest have impacted caribou habitat. Over-the-snow motorized use, prior to the implementation of the Winter Recreation Strategy (USDA Forest Service 2003), may have caused disturbance to caribou. The proposed action would continue with implementation of the Winter Recreation Strategy, limiting the cumulative effects on caribou.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would manage habitats toward HRV, resulting in a distribution and amount of successional stages that better mimic conditions under which caribou evolved, and better mitigate for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife, such as caribou.

Big game hunting continues on both sides of the U.S./Canada border. Encounters with hunters may result in caribou mortality as a result of mistaken identification. Legal harvest of caribou by Treaty Indians does occur, but with few statistics on the number of animals taken, it is difficult to evaluate the influence of this on the caribou population. Fatal collisions with vehicles occur on open roads in caribou habitat and are likely to continue. Predation by mountain lions, wolves, and other predators would continue, with the effect on the caribou population dependent on big game populations, predator populations, and a variety of other factors.

One important factor is how the Canadian officials decide to manage this herd. In the British Columbia portion of the recovery area, human activities that would continue to impact caribou habitat include gas, powerline, and international border corridors, recreation activities, timber harvest, and highways.

Summary

Implementation of the proposed action would make a relatively high contribution to the recovery of woodland caribou. The reasons for this determination are:

- This alternative would address new science and risk factors identified in the recovery plan and critical habitat.

- This alternative would formally adopt the winter recreation strategy for caribou habitat that was a Term and Condition of the 2001 Biological Opinion.
- This alternative emphasizes the protection and restoration of caribou habitat, better addressing expected climate change effects and enhancing habitat resiliency.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the viability of late-successional and old forest (LSOF) dependent surrogate species include: the loss of LSOF habitat from fire (Healy et al. 2008, Davis et al. 2011, 2015), vegetation treatments (e.g., timber harvest, thinning, prescribed fire) that affect forest structure (e.g., canopy closure, snags, downed wood) (Healy et al. 2008, Wisdom et al. 2008, Davis et al. 2011), management of roads that influence habitat effectiveness (Gaines et al. 2003), and protection of riparian areas, which are an important element of LSOF habitats for some species (e.g., bald eagles).

The dynamic landscape restoration approach that is emphasized in the proposed action would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior can be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires can be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007). In addition, implementation of this alternative would include greater use of managed fire to achieve desired conditions for restoration and resiliency (Noss et al. 2006, Franklin and Johnson 2012).

For some LSOF surrogate species, such as the white-headed woodpecker, conservation assessments have recommended the use of stand-level treatments to restore habitat because current habitat levels are well below historic levels (Mellen-McLean et al. 2013, Gaines et al. 2017). The effects of restoration treatments on birds has been studied and shown that treatments that retain large trees and promote within-stand spatial variability can have positive effects on surrogate bird species, including the white-headed woodpecker (Gaines et al. 2007, Gaines et al. 2010). The implementation of this alternative would result in approximately 5,000 acres per year of restorative treatments within dry and mesic forests, creating potentially favorable conditions for white-headed woodpeckers.

Implementation of this alternative includes plan components for several key elements of LSOF habitat. For instance, desired conditions for snag habitat address the potential loss of snags in vegetation management treatments. This alternative would also require that firewood cutting occur in designated areas only, and not allow removal of downed wood and snags greater than 20 inches d.b.h. In addition, the proposed action provides for the retention of large trees, which are currently below historical levels in most forested landscapes (Hessburg et al. 1999).

Implementation of this alternative would reduce the negative effects of roads on LSOF habitats within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 2 miles or less per square mile on 23 percent of the Forest, and 3 miles or less per square mile on 48 percent of the Forest.

Overall, this alternative would provide greater protection for LSOF habitats than no action and alternatives B and O; similar to alternative P; and less than alternative R. The viability outcome for

surrogate wildlife species associated with LSOF habitats would be improved in both the short (less than 20 years) and long (less than 50 years) time periods as desired conditions are achieved.

Climate Change

The sensitivity of LSOF-associated surrogate wildlife species to the effects of climate change were identified as medium for pileated woodpecker, and high for northern goshawk and American marten (CCSD 2013). The primary effect of climate change is the loss of LSOF habitats due to altered disturbance regimes (CCSD 2013).

Since the mid-1980s, the size and intensity of large wildfires in the western United States have increased markedly (Westerling et al. 2006), due, in part, to a reduction in fuel moisture driven by increased temperature and lower snowpack. Increases in fire risk and severity have been also been driven, in part, by increased fuel loads because of fire suppression practices used over the last century (McKenzie et al. 2004). Predicted increases in spring and summer temperature identified in many climate change models would exacerbate the frequency and intensity of disturbances such as fire (McKenzie et al. 2004, Wotton and Flannigan 1993) and defoliation caused by forest insects (Littell et al. 2009). In the interior Columbia Basin, Littell et al. (2009) predicted that the area burned is likely to double or even triple by 2050. Climate-driven changes in fire regimes would likely be the dominant driver of changes to forests and LSOF habitats in the western United States over the next century (McKenzie et al. 2004).

The dynamic landscape restoration approach that is emphasized in the proposed action represents the implementation of an adaptive strategy to create landscapes more resilient to climate change (Spies et al. 2010, Gaines et al. 2012). Landscape-scale restoration has been identified as an adaptive strategy to maintain late-successional and old forest habitat structure (Lawler et al. 2014). The emphasis on restoration of resiliency would result in landscapes, including disturbance regimes, which are more resilient to climate change through the application of restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior can be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires can be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007). In addition, implementation of the proposed action would include greater use of managed fire to achieve desired conditions for restoration and resiliency (Noss et al. 2006, Franklin and Johnson 2012).

Cumulative Effects

Adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore LSOF habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and LSOF habitat protections in the original forest plan were found to be inadequate and were amended by the Eastside Screens (USDA Forest Service 1995b).

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional, especially late-open, habitats compared to HRV. This alternative would manage habitats toward HRV resulting in a distribution

and amount of successional stages that better mimic conditions under which surrogate wildlife species evolved, and better mitigate for the cumulative effects of off-forest timber harvest.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of the proposed action would make a moderate contribution to the viability of LSOF-dependent surrogate wildlife species. The contribution would be due to the following components of this alternative:

- Emphasis on the dynamic landscape restoration to restore landscape resiliency and reduce the loss of LSOF habitats to uncharacteristically severe wildfires;
- The protection and conservation of key elements of LSOF habitat such as large trees, large snags, and riparian habitats; and
- Emphasis on restoring habitat effectiveness by reducing the negative effects of roads on LSOF habitats (though not to the same degree as alternatives R and P).

Motorized Recreation and Road Access

Proposed Species – Wolverine

Direct and Indirect Effects

Motorized recreation and the use of forest roads may influence the habitat use and populations of wolverines. These potential effects include displacement from key habitats, disturbance during critical periods, and an increased risk of mortality (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wolverine). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of the proposed action would reduce the effects of roads on wolverine habitat within 10 watersheds in the short term (less than 20 years based on objectives). In the longer-term (less than 50 years based on desired conditions) this alternative would result in road densities of 2 miles or less per square mile on 23 percent of the Forest, and equal to or less than 3 miles/square mile on 48 percent of the Forest. Habitat effectiveness for surrogate wolverines would be improved from a low level of habitat effectiveness to a moderate level of habitat effectiveness in portions of 15 watersheds as desired conditions for road access are achieved.

The proposed action would not change the current level of winter or summer motorized trail use, thus, would not change the effects to wolverine habitat effectiveness. Overall, this alternative would provide greater habitat effectiveness for wolverines than no action and alternatives B and O, and less

than alternatives R and P. Implementation of the proposed action would result in some improvement to the habitat conditions that could support a wolverine population.

Climate Change

The sensitivity of wolverines to the effects of climate change are rated as high (CCSD 2013). An important climate change adaptation that has been recommended for wolverines is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats can become more resilient to the effects of climate change, and habitat connectivity can be restored, allowing wolverines to adjust their ranges as conditions change. Implementation of the proposed action includes management direction to make modest improvement to habitat effectiveness for wolverines by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Colville National Forest) means that management of roads and motorized trails on Federal lands is even more important for wolverine habitats.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wolverines.

Summary

Implementation of the proposed action would make a moderate contribution to the maintenance and restoration of wolverine habitat. A determination of May Impact on wolverine habitat has been made based on the following:

- The alternative includes management direction to moderately reduce the effects of roads on habitat effectiveness for surrogate wildlife species, and
- This alternative does not alter the current effects that summer and winter motorized trails have on habitat effectiveness for wolverines.

Surrogate Wildlife Species

Direct and Indirect Effects

Motorized recreation and the use of Forest roads influence the viability of surrogate wildlife species (Wisdom et al. 2000, Gaines et al. 2003). These potential effects include displacement from key habitats, disturbance during critical periods, and the risk of mortality caused by collisions with

vehicles (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wildlife). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of the proposed action would reduce the effects of roads on surrogate species habitat effectiveness within 10 watersheds in the short term (less than 20 years based on Objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 2 miles or less per square mile on 23 percent of the Forest, and equal to or less than 3 miles or less per square mile on 48 percent of the Forest. Habitat effectiveness for surrogate wildlife species would be improved from a low level of habitat effectiveness to a moderate level of habitat effectiveness in portions of 15 watersheds as desired conditions for road access are achieved.

The proposed action would not change the current level of winter or summer motorized trail use, and thus, would not change the effects to surrogate species habitat effectiveness. Overall, this alternative would provide greater habitat effectiveness for surrogate wildlife species than no action and alternatives B and O, and less than alternatives R and P. Implementation of the proposed action would result in some improvement in the viability outcomes for surrogate wildlife species used to assess the effects of roads and trails on wildlife habitats.

Climate Change

The sensitivity of surrogate wildlife species used to assess the effects of roads and motorized recreation is rated as moderate for bighorn sheep, and high for Canada lynx and wolverine (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats (especially riparian and wetland habitats) can become more resilient to the effects of climate change, and habitat connectivity can be restored, allowing wildlife to adjust their ranges as conditions change. Implementation of the proposed action includes management direction to make modest improvement to habitat effectiveness for surrogate wildlife by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Forest) means that management of roads and motorized trails on Federal lands is even more important to the viability of surrogate wildlife species.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would

increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of the proposed action would make a moderate contribution to the viability of surrogate wildlife species whose habitats are influenced by motorized access. This would occur because:

- The alternative includes management direction to moderately reduce the effects of roads on habitat effectiveness for surrogate wildlife species, and
- This alternative does not alter the current effects that summer and winter motorized trails have on habitat effectiveness for surrogate wildlife species.

Livestock Grazing

Surrogate Wildlife Species

Direct and Indirect Effects

Grazing can influence habitats of surrogate wildlife species by removing key habitat elements (e.g., dense shrubs for MacGillivray's warbler and fox sparrow), especially in riparian habitats; altering disturbance regimes that maintain habitat structure (e.g., frequent fires in dry forests and grasslands keep open canopy for western bluebird), and influence the availability of important prey species (e.g., squirrels for golden eagles). To address the potential effects on surrogate wildlife species, the management direction regarding grazing in riparian habitat and upland habitats for each alternative was assessed.

This alternative would include management direction for riparian habitats relying mostly on guidelines (not standards as in alternatives R and P). Presently, many riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would improve on altering the distribution of livestock that would allow riparian habitats to recover.

The proposed action includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and guidelines to protect unique habitats. This alternative would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. However, management direction could result in some adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats. The proposed action would make modest improvements in the viability outcomes for surrogate wildlife species that were used to assess grazing effects.

Climate Change

Habitats that are particularly sensitive to the effects of climate change include riparian areas (including wetlands) and alpine areas (Lawler et al. 2014). A management adaptation to make these habitats more resilient to climate change is to reduce the effects of non-climatic stressors (e.g., roads, intense grazing, etc.) (Lawler et al. 2014). This alternative includes management direction that would help to restore the resiliency of habitats that are sensitive to climate change.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Panhandle National Forests, it is managed to accommodate other public land uses, such as contributing to the viability of surrogate wildlife species. On the adjacent Pend Oreille Wildlife Refuge, grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific wildlife habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for wildlife habitats on Federal lands that contribute to the viability of surrogate wildlife species. The proposed action includes management direction for some key habitats that would better account for the cumulative effects of grazing on wildlife habitats.

Summary

Implementation of the proposed action would make a moderate contribution to viability for surrogate wildlife species that are influenced by domestic grazing. This determination is based on:

- This alternative does include management direction (generally, guidelines and not standards as in alternatives R and P) for riparian habitat that would reduce the negative effects of grazing and improve riparian habitat condition.
- This alternative would not change the number of AUMs or grazing intensity, but may alter the distribution of livestock to protect some unique habitats.
- This alternative would include management direction that could make habitats that are sensitive to the effects of climate change more resilient.

Snag Habitat

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the availability of habitat for snag-dependent surrogate species include firewood cutting (Bate et al. 2007, Hollenbeck et al. 2013), the loss of snag habitat along roads and at recreation sites from hazard tree removal (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008, FSM 7700), and removal of snags during timber harvest for safety reasons (Wisdom et al. 2008). Implementation of the proposed action includes management direction for snag habitat to address the potential loss of habitat in timber sale operations, would require that firewood cutting occur in designated areas only, and not allow removal of snags greater than 20 inches d.b.h.

Implementation of this alternative would decrease the loss of snag habitat due to hazard tree removal and firewood cutting along roads within 10 watersheds in the short term (less than 20 years based on Objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of equal to or less than 2 miles per square mile on 23 percent of the Forest, and equal to or less than 3 miles per square mile on 48 percent of the Forest.

Overall, the proposed action would provide greater protection of snag habitat than no action and alternatives B and O, and less than alternatives P and R. This alternative would enhance the viability outcomes for surrogate wildlife species that are dependent on snag habitats.

Climate Change

Surrogate species associated with snag habitats include the pileated woodpecker, white-headed woodpecker, black-backed woodpecker, and Lewis's woodpecker. These species have a medium sensitivity rating to climate change, and the western bluebird as high sensitivity (CCSD 2013). The primary effect anticipated from climate change is the loss of habitat due to altered disturbance regimes. The whole landscape restoration approach that is emphasized in the proposed action would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations, and greater use of managed fire to achieve desired conditions for landscape restoration and resiliency. Because forest disturbances such as fire, insects, and diseases directly influence the availability of snag habitat over time, restoration of disturbance regimes to mimic natural processes would aid in restoring snag habitat. In addition, this alternative would reduce non-climatic stressors by limiting the loss of large snags and reducing the impacts of roads.

Cumulative Effects

Adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and more rigorous snag requirements to contribute to the viability of snag-dependent wildlife (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitats, and current required snag densities make limited contribution to the viability of surrogate wildlife species. The limited management direction for snag habitat on non-Federal lands adjacent to the planning area, places additional emphasis on providing for viability populations of snag-dependent wildlife species on Federal lands. Fuels reduction projects are possible on all land ownerships, in particular where they are near residences. These can be done in such a way that they restore wildlife habitat that has been affected by fire exclusion, but treatments can lead to the loss of snag habitat for safety reasons.

Summary

Implementation of the proposed action would make a moderate contribution to the viability of snag-dependent surrogate wildlife species. This determination is based on the following:

- This alternative would focus on restoring disturbance regimes that influence the availability and condition of snag habitat.
- This alternative would make modest reductions in the negative effects of roads on snag habitat.
- This alternative provides management direction to protect snag habitat during vegetation management activities and from being cut for firewood.

Habitat Connectivity

Surrogate Wildlife Species

Direct and Indirect Effects

A number of forest management activities influence habitat connectivity for surrogate wildlife species. These include the amount, patch sizes, and spatial arrangement of suitable habitats; and the location and density of motorized travel routes, especially in relation to riparian and LSOF habitats.

These are addressed in the evaluation of how forest management alternatives would affect habitat connectivity for surrogate wildlife species.

Implementation of the proposed action includes management direction to manage wildlife habitats for surrogate wildlife species toward desired conditions that are based on the natural and future range of variability. This means that habitats for a wide-range of species would be managed so that the amount of habitat, patch sizes, and spatial arrangement would mimic conditions under which those species evolved (Hessburg et al. 1999).

In this alternative, management direction for riparian habitats is consolidated into one consistent set of plan components that applies to the Colville National Forest. Guidelines would limit management activities that are allowed to occur within riparian habitats and influence habitat connectivity. This alternative includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of the proposed action would reduce the negative effects of roads on habitat connectivity for surrogate wildlife species within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 2 miles or less per square mile on 23 percent of the Forest, and equal to 3 miles or less per square mile on 48 percent of the Forest. Habitat connectivity would be improved compared to the current condition (table 185).

Table 185. Dispersal habitat suitability for surrogate wildlife species under the proposed action, by proportion of planning area (based on desired conditions)

Surrogate Species used to Assess Habitat Connectivity	Low Dispersal Habitat Suitability	Moderate Dispersal Habitat Suitability	High Dispersal Habitat Suitability
American Marten	32% (-9%)	48% (+9%)	20%
Canada Lynx	5% (-2%)	62% (+2%)	33%
Wolverine	6% (-2%)	50% (+20%)	44%

Numbers in parentheses show increases (+) or decreases (-) in the proportion of the planning area in low, moderate, or high dispersal habitat suitability compared to the current condition.

1/See Singleton et al. (2002) and Gaines et al. (2017) for a definition of and methods used to determine dispersal habitat suitability.

Climate Change

Maintaining and restoring ecological connectivity is the most oft-cited climate adaptation strategy for biodiversity conservation (Heller and Zavaleta 2009, Opdam and Wascher 2004, Parmesan 2006, Spies et al. 2010) and has been identified as an important adaptation strategy for wildlife in northeastern Washington (Gaines et al. 2012). This is because species' range shifts have been the primary biological response to past episodes of climatic change, yet widespread anthropogenic barriers to movement would now challenge species' ability to respond (Price 2002, Thomas and Lennon 1999, Wormworth and Mallon 2006). Implementation of the proposed action addresses climate change adaptations that are recommended to maintain or restore habitat connectivity for surrogate wildlife species.

Cumulative Effects

Past, present, and reasonably foreseeable human developments and transportation infrastructure, along with land ownership patterns create cumulative impacts that limit options to conserve and restore regional connectivity. Regional habitat connectivity has been evaluated for a variety of wildlife species, including the surrogate wildlife species used to evaluate connectivity in this planning area (Singleton et al. 2002, WWHCWG 2010, Proctor et al. 2015). These assessments have shown the importance of the Colville National Forest in providing stepping-stone habitats between the Cascades and Selkirk Mountains (Singleton et al. 2002, WWHCWG 2010). Connectivity from the Cascade Range to the Kettle Range and Selkirk Mountains is interrupted by transportation corridors and human developments associated with the Okanogan, Upper Columbia, and Pend Oreille river valleys (Singleton et al. 2002, WWHCWG 2010). Additionally, connectivity planning in southern British Columbia identified linkage areas that could greatly enhance wildlife movement between the Selkirk Mountains and Purcell Mountains (Apps et al. 2007, Proctor et al. 2015).

Reducing the direct and indirect effects of roads on wildlife habitats would contribute to the maintenance and restoration of habitat connectivity, including cumulative effects. Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of the proposed action would make a moderate contribution to providing habitat connectivity that is important for the viability of surrogate wildlife species. This conclusion is based on the following:

- Habitat amounts, patch sizes, and connectivity would be managed toward desired conditions based on the natural range of variability, providing condition similar to those under which surrogate wildlife species evolved.
- The negative effects of roads on habitat connectivity, including riparian and LSOF habitat would be moderately reduced.

Riparian Habitats

Federally Listed Wildlife Species

Yellow-billed Cuckoo - Threatened

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent species such as the yellow-billed cuckoo include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In the proposed action, management direction for watersheds and riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest. Guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes greater riparian management area widths along intermittent streams, lakes, and

ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

The implementation of this alternative would reduce the effects of roads on riparian habitats within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions) this alternative would result in road densities of 2 miles or less per square mile on 23 percent of the Forest, and 3 miles or less per square mile on 48 percent of the Forest.

The proposed action would include management direction for riparian habitats relying mostly on guidelines (not standards as in alternatives R and P). Presently, many riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would make an improvement on altering the distribution of livestock that would allow riparian habitats to recover.

Overall, this alternative would provide greater protection for riparian habitats that provide important habitat for the yellow-billed cuckoo, than no action and alternative B, similar to alternative O, and less than alternatives P and R.

Climate Change

Climate change is expected to have an overall negative effect throughout the range of the yellow-billed cuckoo (Post et al. 2009, USFWS 2013). Riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The whole landscape restoration approach that is emphasized in the proposed action would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations. In addition, emphasis of this alternative in reducing the negative effects of roads (though not to the same degree as alternative R or P) on aquatic habitats would help to make them more resilient to disturbances.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protection in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian-associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of the proposed action would make a moderate contribution to the recovery of the yellow-billed cuckoo. This determination is based on the following:

- This alternative would make modest reductions in the negative effects that roads have on riparian habitats.
- This alternative would consolidate and make more consistent management direction for riparian habitats using guidelines and providing larger management zones than existing direction.
- The landscape restoration emphasis of this alternative would restore disturbance regimes, reducing the effects of uncharacteristically severe fires on riparian habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent surrogate species include management of roads, recreation sites, grazing, and vegetation treatments that occur within riparian habitats.

In the proposed action, management direction for watersheds and riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest. Guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

The implementation of this alternative would reduce the effects of roads on riparian habitats within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions) this alternative would result in road densities of 2 miles or less per square mile on 23 percent of the Forest, and 3 miles or less per square mile on 48 percent of the Forest.

This alternative would include management direction for riparian habitats relying mostly on guidelines (not standards as in alternatives R and P). Presently, many riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would make a modest improvement on altering the distribution of livestock that would allow riparian habitats to recover.

Overall, the proposed action would provide greater protection for riparian habitats than no action and alternative B, similar to alternative O, and less than alternatives P and R. The viability outcome for surrogate wildlife species that are dependent upon riparian habitats would be improved.

Climate Change

Some of the riparian associated surrogate species are rated as high sensitivity to climate change (CCSD 2013) and riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The whole landscape restoration approach that is emphasized in this alternative would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations. In addition, emphasis of this alternative in reducing the negative effects of roads (though not to the same degree as the R or P alternatives) on aquatic habitats would help to make them more resilient to disturbances.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian-associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of the proposed action would make a moderate contribution to the viability of riparian-dependent surrogate wildlife species. This determination is based on the following:

- This alternative would make modest reductions in the negative effects that roads have on riparian habitats.
- This alternative would consolidate and make more consistent management direction for riparian habitats using guidelines and providing larger management zones than existing direction.
- The landscape restoration emphasis of this alternative would restore disturbance regimes, reducing the effects of uncharacteristically severe fires on riparian habitats.

Species of Management Interest

Deer and Elk

Direct and Indirect Effects

Forest management activities can influence deer and elk populations and habitat use. Vegetation management activities may affect the distribution and abundance of cover and forage. Adequate forage is particularly important during the summer and fall before the following birthing season, when this can have a positive effect on the condition of pregnant females (Lenz 1997, Cook et al. 1998, Cook 2002, Cook et al. 2004, Cook et al. 2005, Cook et al. 2013). The management of forest roads and trails can influence how deer and elk use habitats, and influence the interactions between deer and elk (Rowland et al. 2005, Wisdom et al. 2005a, b). Additionally, deer and elk can compete with domestic livestock for both food resources (Findholt et al. 2005) and space (Coe et al. 2001, Coe et al. 2005). Thus, the potential effects that vegetation management, road and trail management,

and grazing management can have on deer and elk habitats and populations are evaluated for each of the alternatives.

Under the proposed action, cover and forage for deer and elk on winter and summer ranges would be managed commensurate with the natural range of variability. This would result in a sustainable level of cover and more emphasis on enhancement of forage conditions. Considerable research has shown that the management of deer and elk winter habitat should be less focused on the retention of thermal cover, and more focused on the availability of forage on summer and fall habitats (see Cook et al. 2005 and 2013 for a review).

This alternative would improve habitat effectiveness for deer and elk on summer and winter ranges by reducing the impacts of roads. The Selkirk Elk Herd has a moderate level of habitat effectiveness (low level of human influence) on their winter ranges. Overall, habitat effectiveness would be restored on approximately 24,000 acres of habitat on elk range under this alternative. The desired conditions for elk winter ranges would be to have a low level of human influence (less than 30 percent of the winter range in the zone of influence of an open road, motorized route, or designated ski trail).

For deer, this alternative would result in a high level of habitat effectiveness (low level of human influence) on 31 percent of the winter ranges, a moderate level of habitat effectiveness on 62 percent of the winter ranges, and a low level of habitat effectiveness on 6 percent. The desired conditions for deer winter ranges would be to have a high level of habitat effectiveness (low level of human influence, less than 30 percent of the winter range in the zone of influence of an open road, motorized route, or designated ski trail).

Current management direction for winter ranges is based on road density standards and would be changed to use of the zone of influence (Rowland et al. 2005). The proposed action includes more robust range management direction to aid in the recovery of range conditions that are currently in poor condition and have been slow to recover from past grazing practices.

Climate Change

Deer and elk have a low level of sensitivity to the effects of climate change due to their ability to tolerate a relatively wide range of climatic conditions, their high mobility, and as habitat generalists (CCSD 2013). However, alternatives that restore landscape pattern and functions while reducing the effects of roads on deer and elk summer and winter habitats would provide more resilient deer and elk populations. The proposed action emphasizes landscape-scale restoration and provides consistent management direction for roads that would make modest contributions to restore habitat effectiveness for deer and elk.

Cumulative Effects

Historical cattle and sheep grazing that occurred on portions of the Forest degraded range conditions (Wissmar et al. 1994, Bunting et al. 2002). These conditions, combined with current domestic (cattle) and wild ungulate grazing (primarily elk and deer), have resulted in the maintenance or slow recovery from poor range conditions in some areas (Bunting et al. 2002). In turn, these poor range conditions have had negative effects on some important unique habitats such as riparian areas and meadows. The proposed action would result in more rigorous grazing management direction that would help to address this situation.

Winter ranges for deer and elk occur on Federal lands, adjacent wildlife management areas managed by the State, and private lands. Elk herd management plans (WDFW 2014) provide guidance for elk

management on State lands and make recommendations for elk management on NFS land. Management plans for deer include the White-tailed Deer Management Plan that covers the two management units on the Colville National Forest and provides direction to manage hunting to either maintain or increase white-tailed deer populations (WDFW 2010). A statewide general management plan for mule deer has been developed, but does not provide herd-specific management objectives (WDFW 2016). Mule deer are widely distributed across the Forest. A considerable amount of historical winter range for deer and elk is now in private land ownership or under the waters of Lake Roosevelt (created by the Grand Coulee dam). The cumulative effects of the existing management plans (State and Federal lands) would provide for the conditions that contribute to sustainable populations of deer and elk, while considering the impacts of private land development.

Summary

The implementation of the proposed action would make a moderate contribution to the conditions that support sustainable populations of deer and elk. This is based on the following:

- This alternative would address new science that recommends de-emphasizing the importance of winter thermal cover and increasing the emphasis on summer and fall forage quality and quantity.
- This alternative provides consistent and effective direction on the management of roads and trails to restore habitat effectiveness on deer and elk summer and winter ranges.
- This alternative would include more rigorous management direction to improve the conditions of key habitats, such as riparian areas and meadows, which are in poor condition due to the cumulative effects of past grazing practices, and current domestic and wild ungulate grazing.

Native Pollinators

Direct and Indirect Effects

Forest management activities can influence native pollinator populations and include vegetation management, grazing, and placement of apiaries (USDA 2015).

The dynamic landscape restoration approach that is emphasized in the proposed action would result in landscape-scale restoration of forest structure and composition, and disturbance regimes. This would be accomplished through the implementation of restorative treatments such as forest thinning and prescribed fire to achieve desired conditions. Restorative treatments such as thinning and prescribed fire have been shown to enhance native plant communities, including native pollinator habitats (Dodson et al. 2008, Neill and Puettmann 2013).

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and guidelines to protect unique habitats. This alternative would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. However, management direction could result in some adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats. This alternative would make modest improvements in the habitat conditions for native pollinators.

The proposed action includes plan direction for the placement of apiaries that would reduce the potential for non-native pollinators to compete with rare native pollinators.

Climate Change

Native pollinators are considered to be sensitive to the effects of climate change, although our understanding of climate effects is very limited. Alternatives, such as the proposed action, which address non-climate related factors such as native vegetation restoration and reducing the impacts of grazing are beneficial in maintaining and restoring habitat for native pollinators.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Pan Handle National Forest, it is managed to accommodate other public land uses. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for native pollinator habitats on Federal lands. This alternative includes management direction for native plant restoration, protection of key habitats, and management direction to reduce the impacts of grazing on native plant communities. This management direction would better account for the cumulative effects of grazing on pollinator habitats.

Summary

Implementation of the proposed action would make a relatively low contribution to maintenance and restoration of habitat for native pollinators. This determination is based on:

- This alternative emphasizes the restoration of native plant communities
- This alternative would reduce impacts to native plant communities from grazing.
- This alternative includes plan direction on the placement of apiaries to reduce the potential for non-native pollinators to compete with rare native pollinators.

Alternative R

Federally Listed Wildlife Species

Grizzly Bear

Direct and Indirect Effects

Forest activities that influence the recovery of the grizzly bear include: human access that can displace bears from important seasonal habitats or increase the risk of bear-human interactions, disposal of livestock carcasses within range allotments to avoid attracting bears to a potential food source, and the storage of food and garbage at recreation sites to reduce the potential for bears to associate humans with food sources.

Management of grizzly bears does not vary between alternatives. Existing management direction provides standards for human access, disposal of livestock carcasses, and food and garbage storage within the Selkirk Grizzly Bear Recovery Area (IGBC 1998, USDA Forest Service 1988, USFWS 1993, USDI 2001). Existing standards have largely been met and would continue to be followed.

Climate Change

Grizzly bears have been identified as having a low sensitivity to climate change because they are opportunistic, eat a diverse array of food resources, and are highly adaptable (Servheen and Cross 2010, CCSD 2013). Anticipated impacts may include changes in the timing of denning due to longer

snow-free periods and reduced snowpack (Lawler et al. 2014) and changes in the availability of food sources (Servheen and Cross 2010). These changes may put bears at risk of negative human interactions for a longer period of time each year (Servheen and Cross 2010). This would make education, proper food and garbage storage, carcass disposal measures, and human access management that much more important.

Cumulative Effects

The primary reasons for the low population of grizzly bears in the recovery zone are past persecution and human-caused mortality of bears. Legal protections are now in place to protect grizzly bears. Information/education programs, sanitation measures, and access management have and would continue to be used to aid in the recovery of grizzly bears in the Selkirk Recovery Area.

Past, present, and reasonable foreseeable future actions that could affect grizzly bears include timber harvest and associated road construction, recreational activities that can cause disturbance to bear and create potential for human-bear conflicts, and human development that fragment grizzly bear habitat. Cumulative effects are evaluated across the Recovery Area by tracking activities within GBMUs. Other land managers have adopted and are following similar management direction (USDA Forest Service 2015b) and overall recovery is coordinated by the Selkirk Grizzly Bear Management Subcommittee. GBMUs that occur on the Colville National Forest include the Le Clerc, Salmo-Priest, and Sullivan-Hughes. The contribution made on Federal lands to grizzly bear recovery would help to mitigate potential cumulative effects from off-forest activities. However, because alternative R does not address reducing the negative impacts of roads on wildlife habitats like the proposed action and alternative P, it does less to mitigate cumulative effects.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands by the public. This would increase human disturbance and result in areas with relatively low human disturbance (e.g., core areas) on NFS lands becoming even more important to wildlife such as grizzly bears.

Black bear hunting on both sides of the international border within the Selkirk Recovery Area has the potential to add cumulatively to the mortality of grizzly bears. Hunters that encounter grizzly bears may mistakenly identify the bear, kill the bear in self-defense, or opportunistically poach the bear. Human access management within the recovery area is key to reducing the risk of mortality to grizzly bears from black bear hunting.

On private lands, the presence of garbage, pet food, fruit trees, or other attractants may lure bears into conflict situations. Bears that become habituated or a nuisance may lead to the bear being killed.

Summary

Alternative R would make a relatively high contribution to the recovery of grizzly bears in the Selkirk Recovery Area. This is based on the existing management direction, followed in all alternatives, that addresses:

- Human access management,

- Disposal of carcasses in range allotments that occur in the recovery area, and
- Proper storage of food, garbage and other attractants that may lead to human-bear interactions.

Canada Lynx

Direct and Indirect Effects

Forest management activities that influence the recovery and conservation of Canada lynx include: vegetation management that affects lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The Interagency Lynx Biology Team (ILBT 2013) developed conservation measures for core and secondary areas (USFWS 2005) to address each of these forest management activities, and for planners to consult when revising forest plans. These were used to evaluate the potential contribution of forest management alternatives to the recovery of Canada lynx.

Vegetation management activities affect the distribution of lynx habitat components, can fragment habitats, and create sources of disturbance (ILBT 2013). As a result, risk factors associated with vegetation management have been identified and conservation measures recommended to address the risk factors (ILBT 2013). The conservation measures for vegetation management apply to lynx core areas and include mimicking the pattern and scale of natural disturbances and connectivity across the landscape, while considering the future range of variability (ILBT 2013). The ILBT (2013) also recommended a conservation measure focused on the restoration of disturbance regimes in dry forests that occur in close proximity to lynx habitat to reduce the risk of uncharacteristically severe and frequent fires reaching lynx habitat. Finally, there are conservation measures that limit the amount of vegetation management and the rate of habitat change (e.g., acres treated per decade) within lynx analysis units. Alternative R emphasizes an LSOF Reserve network covering about 48 percent of the Forest. The remaining matrix, covering about 25 percent of the Forest, would be managed primarily for timber production. No management direction in this alternative guides land management to mimic the pattern and scale of natural disturbances as recommended for the vegetation conservation measures.

Conservation measures were identified to address the effects that highways have on habitat connectivity for lynx in core areas (ILBT 2013).

Conservation measures for winter recreation in lynx core areas included reducing effects on habitat connectivity and to discourage expansion of over-the-snow routes that may influence lynx habitat use (ILBT 2013). The implementation of this alternative would include management direction that addresses effects of over-the-snow recreation on lynx habitat.

The conservation measures for forest roads in lynx core areas include avoiding road reconstruction or upgrades that occur in lynx habitat that would result in increased traffic speeds or volumes (ILBT 2013). These measures would reduce the potential for vehicular traffic to result in a source of mortality to lynx. There is management direction in this alternative to address this conservation measure.

The conservation measures for grazing in lynx core areas include management of riparian areas to assure adequate habitat for snowshoe hares, the primary prey species for Canada lynx (ILBT 2013). Alternative R would include management direction for grazing in riparian areas to provide for habitat for listed fish species, and direction specific to Canada lynx or snowshoe hares.

Alternative R would provide management direction to address most, but not all (see discussion above) of the direct and indirect effects of forest management activities on the recovery of Canada lynx. The direct and indirect effects that are addressed under this alternative include management direction to limit the effects of winter recreation on Canada lynx habitat connectivity and habitat use; to limit traffic speed on forest roads to reduce the risk of mortality to lynx from vehicle collisions, and standards and guidelines to improve conditions of riparian areas that provide habitat for snowshoe hare, a primary food resource for Canada lynx. Alternative R would provide protection for Canada lynx that is greater than no action and alternatives B and O, but less than the proposed action and alternative P.

Climate Change

The potential effects of climate change on Canada lynx identified by the Interagency Lynx Biology Team (2013) included: (1) an upward shift in elevation or latitudinal distribution of lynx and prey, (2) a decrease in the amount of habitat and population size from reduced snow persistence and increased disturbance events (e.g., fires), (3) changes in demographic rates, such as survival and reproduction, and (4) changes in predator-prey relationships.

Climate change adaptations to address these effects include restoration of landscape-scale disturbance regimes to better mimic natural patterns and processes (Spies et al. 2010, Gaines et al. 2012, Lawler et al. 2014), and maintaining or restoring habitat connectivity to allow Canada lynx to adjust their ranges to changing conditions (Heller and Zavaleta 2009, ILBT 2013, Squires et al. 2013). There is limited management direction in alternative R to address these climate change adaptations.

Cumulative Effects

Past, present, and reasonably foreseeable actions that affect lynx habitat include timber harvest and fuels reduction, recreation, human development, and grazing on private and public lands. In addition, legal trapping of lynx, timber harvest, oil and gas development, mining and human access in British Columbia have and would continue to affect Canada lynx and their habitat.

Past vegetation management and large-scale fires on the Forest within lynx habitat has resulted in a distribution and amount of successional stages (early, mid, late) that are outside the HRV. Alternative R would not emphasize vegetation management activities to restore lynx habitats toward the HRV.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Grazing has occurred and would continue to take place on off-forest lands potentially impacting deciduous or riparian habitats for lynx prey species.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands by the public. This would increase the effects of human disturbance on lynx habitat and result in areas that have relatively low human disturbance on NFS lands becoming more important to lynx and other wildlife.

All Federal lands within Canada lynx core and secondary areas would use the Lynx Conservation Assessment and Strategy (LCAS) (ILBT 2013) as current science to guide project-level consultation and land management planning. The North Cascades National Park Complex recently revised their

management plan to include the LCAS (NPS 2012). The Idaho Panhandle National Forests land management plan was recently revised to address the conservation measures identified in the LCAS (USDA Forest Service 2015b). The conservation of lynx on WDNR lands is guided by the Department of Natural Resources Lynx Habitat Management Plan (WDNR 1996, updated in 2002). The management plan for the Pend Oreille National Wildlife Refuge provides conservation measures to contribute to the recovery and viability of Canada lynx (USFWS 2000). Collectively, these management plans have addressed many of the conservation measures identified for Canada lynx (ILBT 2013) and would help mitigate potential cumulative effects that may occur from off-forest activities. In addition, no critical habitat was identified on the Colville National Forest or on adjacent lands (USFWS 2009).

In Canada, timber harvesting, oil and gas development, coal mining, and the proliferation of human access associated with these industries, have and would continue to affect lynx habitat. Legal trapping occurs north of the Forest in Canada and could reduce the potential for lynx to disperse into the lynx habitat on the Forest. Trapping is not legal in Idaho, Montana, or Washington.

Summary

Alternative R would make a moderate contribution to the recovery of the Canada lynx in both the short (less than 20 years) and long (less than 50 years) term. This is because of the following:

- This alternative does not address the vegetation management conservation measures identified in the recent version of the Lynx Conservation Assessment and Strategy (ILBT 2013) to mimic natural vegetation pattern and processes.
- This alternative does address the conservation measures for roads, over-the-snow activities, and grazing, and
- This alternative would address some of the climate change adaptations, but would not emphasize landscape-scale restoration of landscape resiliency.

Late-successional and Old Forest Habitats (Federally Listed Species)

Woodland Caribou and Critical Habitat

Direct and Indirect Effects

The forest management activities that can influence the recovery and viability of woodland caribou include: (1) Vegetation management and natural disturbances affect the amount and connectivity of old forests of Engelmann spruce/subalpine fir and western redcedar/western hemlock. (2) Human access that can increase the potential for poaching and cause disturbance to caribou during the critical winter period. These effects were used to evaluate the potential contribution of each alternative to the recovery of woodland caribou.

Alternative R would implement new science, recommendations from the Biological Opinion issued in 2001 (USFWS 2001) on the 1988 forest plan (USDA Forest Service 1988), and address the critical habitat designation (USFWS 2012a). Vegetation management would be focused on the protection of late-successional and old forest habitats based on a network of reserves. The desired conditions address the amount, spatial arrangement, and connectivity of caribou habitat to mimic natural patterns and processes.

A term and condition of the 2001 Biological Opinion was that the Forest develop a winter recreation strategy that protects important winter habitats for caribou while providing some level of winter

recreation access. This strategy was developed (USDA Forest Service 2003) and would be fully integrated into this alternative. The strategy includes information and education about the effects of winter recreation on wildlife, monitoring and enforcement of areas closed to over-the-snow activities, and limitations on permitted over-the-snow activities. Collectively, these actions have reduced the impacts of winter recreation to caribou habitat while providing recreation opportunities in areas and at the time of the winter season when effects to caribou are minimal. In addition to winter recreation, this alternative emphasizes substantially reducing the negative effects of forest roads on wildlife habitat.

Climate Change

Climate change would likely alter the distribution and abundance of suitable caribou habitat, and would also change snow depths and persistence, which affect seasonal movements of mountain caribou (WDFW 2012). The potential effects of climate change depend on the interaction, not only of seasonal temperatures and snowfall patterns, but also occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Management adaptations to address the effects of climate change include a focus on forest restoration and reducing non-climatic factors that affect wildlife populations (e.g., restoring habitat effectiveness). Alternative R would implement these adaptations.

Cumulative Effects

The caribou recovery area is 1,477 square miles in size and includes the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States and 53 percent in British Columbia. The Idaho Panhandle National Forests recently revised the forest plan to address habitat and risk factors identified in the caribou recovery plan and critical habitat (USDA Forest Service 2015b). The caribou recovery team works cooperatively to address cumulative effects on woodland caribou.

Past activities on the Forest have impacted caribou habitat. Over-the-snow motorized use, prior to the implementation of the Winter Recreation Strategy (USDA Forest Service 2003), may have caused disturbance to caribou. The alternative would continue with implementation of the Winter Recreation Strategy, limiting the cumulative effects on caribou.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. Alternative R would emphasize the protection and restoration of LSOF habitat within the caribou recovery area, helping to mitigate for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife such as caribou. However, because this alternative does not address the negative impacts of roads on wildlife habitat, it provides less opportunity to mitigate the cumulative effects of recreation.

Big game hunting continues on both sides of the U.S./Canada border. Encounters with hunters may result in caribou mortality as a result of mistaken identification. Legal harvest of caribou by Treaty Indians does occur, but with few statistics on the number of animals taken it is difficult to evaluate the influence of this on the caribou population. Fatal collisions with vehicles occur on open roads in caribou habitat and are likely to continue. Predation by mountain lions, wolves, and other predators would continue, with the effect on the caribou population dependent on big game populations, predator populations and a variety of other factors.

One important factor is how the Canadian officials decide to manage this herd. In the British Columbia portion of the recovery area, human activities that would continue to impact caribou habitat include gas, powerline, and international border corridors; recreation activities; timber harvest; and highways.

Summary

Implementation of alternative R would make a relatively high contribution to the recovery of woodland caribou. The reasons for this determination are:

- This alternative would address new science and risk factors identified in the recovery plan and critical habitat.
- This alternative would formally adopt the winter recreation strategy for caribou habitat that was a term and condition of the 2001 Biological Opinion.
- This alternative emphasizes the protection and restoration of caribou habitat, better addressing expected climate change effects and enhancing resiliency.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the viability of LSOF-dependent surrogate species include: the loss of LSOF habitat from fire (Healy et al. 2008, Davis et al. 2011, 2015); vegetation treatments (e.g., timber harvest, thinning, prescribed fire) that affect forest structure (e.g., canopy closure, snags, downed wood)(Healy et al. 2008, Wisdom and Bate 2008, Davis et al. 2011); management of roads that influence habitat effectiveness (Gaines et al. 2003); and protection of riparian areas, which are an important element of LSOF habitats for some species (e.g., bald eagles).

Alternative R provides for the viability of LSOF species through a system of LSOF emphasis areas (reserves) that encompass about 51 percent of the Forest. This alternative attempts to better accommodate habitat loss from fires and other disturbances by creating a larger network of LSOF habitats with increasing redundancy. This emphasizes short-term habitat protection for LSOF species instead of landscape-scale restoration (as in the proposed action and alternative P).

The implementation of this alternative includes plan components for several key elements of LSOF habitat. For instance, desired conditions for snag habitat address the potential loss of habitat in vegetation management treatments. This alternative would allow no firewood cutting in LSOF emphasis areas and no removal of snags greater than 20 inches d.b.h. (except for safety reasons). This alternative includes a 21-inch diameter limit on the removal of live trees.

The implementation of this alternative would substantially decrease the negative effects of roads on LSOF habitat within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed to meet other management objectives. In the longer term (less than 50 years

based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and 2 miles or less per square mile on 22 percent of the Forest, further reducing road-associated effects to LSOF habitats and surrogate species.

Overall, alternative R would provide greater protection for LSOF habitats than no action, the proposed action, and alternatives B and O, and similar to alternative P. This alternative would improve the viability outcomes for surrogate wildlife species that are dependent on LSOF habitats in both the short (less than 20 years) and long (less than 50 years) time periods as desired conditions are achieved.

Climate Change

The sensitivity of LSOF-associated surrogate wildlife species to the effects of climate change were identified as medium for pileated woodpecker, and high for northern goshawk and American marten (CCSD 2013). The primary effect of climate change is the loss of LSOF habitats due to altered disturbance regimes (CCSD 2013, Lawler et al. 2014).

Since the mid-1980s, the size and intensity of large wildfires in the western United States have increased markedly (Westerling et al. 2006), due, in part, to a reduction in fuel moisture driven by increased temperature and lower snowpack. Increases in fire risk and severity have also been driven, in part, by increased fuel loads because of fire suppression practices used over the last century (McKenzie et al. 2004). Predicted increases in spring and summer temperature identified in many climate change models would exacerbate the frequency and intensity of disturbances such as fire (McKenzie et al. 2004, Wotton and Flannigan 1993) and defoliation caused by forest insects (Littell et al. 2009). In the interior Columbia Basin, Littell et al. (2009) predicted that the area burned is likely to double or even triple by 2050. Climate-driven changes in fire regimes would likely be the dominant driver of changes to forests and LSOF habitats in the western United States over the next century (McKenzie et al. 2004).

The effectiveness of a system of reserves may be compromised under climate change as species' habitat shifts to nonreserved areas (Araujo et al. 2004, Carroll et al. 2009). The LSOF habitat network proposed in alternative R would add additional area (compared to no action and alternatives B and O) to increase redundancy in the LSOF network. However, this alternative does not focus on landscape-scale forest restoration that has been identified as an important climate change adaptation to maintain LSOF habitats (Lawler et al. 2014).

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore LSOF habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and LSOF habitat protections in the original forest plan were found to be inadequate and were amended by the Eastside Screens (USDA Forest Service 1995b).

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would emphasize the protection and restoration of LSOF habitat within management

areas that cover about 51 percent of the Forest under this alternative, helping to mitigate for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Summary

Implementation of alternative R would make a relatively high contribution to the viability of LSOF-dependent surrogate wildlife species. The contribution would be due to the following components of this alternative:

- Emphasis on the protection of LSOF habitats.
- The protection and conservation of key elements of LSOF habitat such as large trees, large snags, and riparian areas, and
- The emphasis on restoring habitat effectiveness by substantially reducing the negative effects of roads on LSOF habitats.

Motorized Recreation and Road Access

Proposed Species – Wolverine

Direct and Indirect Effects

Motorized recreation and the use of forest roads may influence the habitat use and populations of wolverines. These potential effects include displacement from key habitats, disturbance during critical periods, and an increased risk of mortality (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wolverine). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative R would have limited opportunity to reduce the negative effects of roads on wolverine habitat because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and only address big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness (Wisdom et al. 2000) for wolverines.

Implementation of this alternative would reduce the negative effects of roads on wolverine habitat in 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and 2 miles or less per square mile on 22 percent of the Forest. Habitat effectiveness (as affected by roads) for wolverines would be improved from a current low level of habitat effectiveness in 32 watersheds to a moderate level of habitat effectiveness in 16 watersheds and a high level of habitat effectiveness in 16 watersheds as desired conditions for road access are achieved.

Implementation of alternative R would also reduce the impacts of summer-motorized trails on habitat effectiveness for wolverine. Approximately 30 miles of summer-motorized trails would be reduced

or converted to non-motorized use within two watersheds. The implementation of this alternative would result in the highest habitat effectiveness for wolverines as a result of reducing the impacts of roads and motorized trails.

Climate Change

The sensitivity of wolverines to the effects of climate change is considered to be high (CCSD 2013). An important climate change adaptation that has been recommended for wolverine is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wolverines to adjust their ranges as conditions change. The implementation of this alternative includes management direction to make substantial improvement to habitat effectiveness for wolverines by reducing road and motorized trail impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative impacts of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Colville National Forest) means that management of roads and motorized trails on Federal lands is even more important for wolverine habitats.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict, because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wolverines.

Summary

Implementation of alternative R would make a relatively high contribution to the maintenance and restoration of habitat for wolverine and result in a May Impact determination.

This would occur because:

- The alternative includes management direction to substantially reduce the impact of roads on habitat effectiveness for wolverines, and
- This alternative reduces the effects that summer motorized trails have on habitat effectiveness for wolverines.

Surrogate Wildlife Species

Direct and Indirect Effects

Motorized recreation and the use of forest roads influence the viability of surrogate wildlife species. These potential effects include displacement from key habitats, disturbance during critical periods, and the risk of mortality caused by collisions with vehicles (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail-associated factors that influence wildlife). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative R would reduce the negative effects of roads on surrogate species habitats in 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and 2 miles or less per square mile on 22 percent of the Forest. Habitat effectiveness (as affected by roads) for surrogate wildlife species would be improved from a current low level of habitat effectiveness in 32 watersheds to a moderate level of habitat effectiveness in 16 watersheds and a high level of habitat effectiveness in 16 watersheds as desired conditions for road access are achieved.

Implementation of this alternative would also reduce the impacts of summer-motorized trails on habitat effectiveness for surrogate wildlife species. Approximately 30 miles of summer-motorized trails would be reduced or converted to non-motorized use within two watersheds. The implementation of alternative R would result in the highest habitat effectiveness for surrogate wildlife species as a result of reducing the impacts of roads and motorized trails.

Climate Change

The sensitivity of surrogate wildlife species used to assess the effects of roads and motorized recreation is rated as moderate for bighorn sheep, and high for Canada lynx and wolverine (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats (especially riparian and wetland habitats) can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wildlife to adjust their ranges as conditions change. Implementation of alternative R includes management direction to make substantial improvement to habitat effectiveness for surrogate wildlife by reducing road and motorized trail impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative impacts of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Forest) means that management of roads and motorized trails on Federal lands is even more important to the viability of surrogate wildlife species.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative R would make a relatively high contribution to the viability of surrogate wildlife species. This would occur because:

- The alternative includes management direction to substantially reduce the impact of roads on habitat effectiveness for surrogate wildlife species, and
- This alternative reduces the effects that summer motorized trails have on habitat effectiveness for surrogate wildlife species.

Livestock Grazing

Surrogate Wildlife Species

Direct and Indirect Effects

Grazing can influence habitats of surrogate wildlife species by removing key habitat elements (e.g., dense shrubs for MacGillivray's warbler and fox sparrow), especially in riparian habitats; alter disturbance regimes that maintain habitat structure (e.g., frequent fires in dry forests and grasslands keep open canopy for western bluebird); and influence the availability of important prey items (e.g., squirrels for golden eagles). To address the potential effects on surrogate wildlife species, the management direction regarding grazing in riparian habitat and upland habitats for each alternative was assessed.

Alternative R would include management direction for riparian habitats that includes additional standards (compared to no action, the proposed action and alternatives B and O). Presently, many riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would make a considerable improvement on altering the distribution of livestock that would allow riparian habitats to recover.

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and standards to protect unique habitats. This alternative would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. However, management direction would result in adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats. This alternative, along with alternative P, has the greatest potential to improve viability outcomes for surrogate wildlife species that are influenced by grazing.

Climate Change

Habitats that are particularly sensitive to the effects of climate change include riparian areas (including wetlands) and alpine areas (Lawler et al. 2014). A management adaptation to make these habitats more resilient to climate change is to reduce the effects of non-climatic stressors (e.g., roads,

intense grazing, etc.) (Lawler et al. 2014). Alternative R includes management direction that would help restore the resiliency of habitats that are sensitive to climate change.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Panhandle National Forests, it is managed to accommodate other public land uses, such as contributing to the viability of surrogate wildlife species. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific wildlife habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for wildlife habitats on Federal lands that contribute to the viability of surrogate wildlife species.

Alternative R includes management direction for some key habitats that would better account for the cumulative effects of grazing on wildlife habitats.

Summary

Implementation of alternative R would make a relatively high contribution to viability for surrogate wildlife species that are influenced by domestic grazing. This determination is based on:

- This alternative includes management direction (including standards) for riparian habitat that would reduce the negative effects of grazing and improve riparian habitat condition.
- This alternative would not change the number or grazing intensity, but would alter the distribution of livestock to protect some unique habitats.
- This alternative includes management direction that could make habitats that are sensitive to the effects of climate change more resilient.

Habitat Connectivity

Surrogate Wildlife Species

Direct and Indirect Effects

A number of forest management activities influence habitat connectivity for surrogate wildlife species. These include the amount, patch sizes, and spatial arrangement of suitable habitats; location and density of motorized travel routes, especially in relation to riparian and LSOF habitats. These are addressed in the evaluation of how forest management alternatives would affect habitat connectivity for surrogate wildlife species.

Alternative R is focused on providing habitat connectivity for LSOF species through a network of LSOF emphasis areas that encompass a considerably larger area than any other alternative. The LSOF emphasis areas are positioned at distances from each other to allow highly mobile species to move among them. Additional provisions for low to moderate mobility LSOF species are provided through management direction for riparian management areas. There is limited direction for habitat connectivity for species not associated with LSOF habitats (e.g., wide-ranging carnivores, Singleton et al. 2002).

In this alternative, management direction for riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest. Standards and guidelines would limit management activities that are allowed to occur within riparian habitats and influence habitat connectivity. This alternative includes greater riparian management area widths along

intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of alternative R would decrease the negative effects of roads on habitat connectivity for surrogate wildlife species within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed to meet other management objectives. In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and equal to 2 miles or less per square mile on 22 percent of the Forest, further reducing road-associated effects to habitat connectivity. The implementation of this alternative would result in considerable improvement in habitat connectivity for surrogate wildlife species (table 186).

Implementation of this alternative would also reduce the effects of summer-motorized trails on habitat connectivity for surrogate wildlife species. Approximately 30 miles of summer-motorized trails would be reduced or converted to non-motorized use within two watersheds.

Table 186. Dispersal habitat suitability for surrogate wildlife species under alternative R, by proportion of planning area (based on desired conditions)

Surrogate Species used to Assess Habitat Connectivity	Low Dispersal Habitat Suitability	Moderate Dispersal Habitat Suitability	High Dispersal Habitat Suitability
American Marten	31% (-10%)	32% (-7%)	37% (+17%)
Canada Lynx	5% (-2%)	36% (-24%)	59% (+26%)
Wolverine	6% (-2%)	26% (-22%)	62% (+18%)

Numbers in parentheses show increases (+) or decreases (-) in the proportion of the planning area in low, moderate, or high dispersal habitat suitability compared to the current condition.
1/See Singleton et al. (2002) and Gaines et al. (2017) for a definition of and methods used to determine dispersal habitat suitability.

Climate Change

Maintaining and restoring ecological connectivity is the most oft-cited climate adaptation strategy for biodiversity conservation (Heller and Zavaleta 2009, Opdam and Wascher 2004, Parmesan 2006, Spies et al. 2010) and has been identified as an important adaptation strategy for wildlife in northeastern Washington (Gaines et al. 2012). This is because species' range shifts have been the primary biological response to past episodes of climatic change, yet widespread anthropogenic barriers to movement would now challenge species' ability to respond (Price 2002, Thomas and Lennon 1999, Wormworth and Mallon 2006). The implementation of this alternative addresses the climate change adaptations that are recommended to maintain or restore habitat connectivity, but emphasizes LSOF species. Other alternatives (e.g., the proposed action and alternative P) maintain or restore habitat connectivity for a wider array of wildlife species.

Cumulative Effects

Past, present, and reasonably foreseeable human developments and transportation infrastructure, along with land ownership patterns, create cumulative impacts that limit options to conserve and restore regional connectivity. Regional habitat connectivity has been evaluated for a variety of wildlife species, including the surrogate wildlife species used to evaluate connectivity in this planning area (Singleton et al. 2002, WWHCWG 2010, Proctor et al. 2015). These assessments have shown the importance of the Colville National Forest in providing stepping-stone habitats between the Cascades and Selkirk Mountains (Singleton et al. 2002, WWHCWG 2010). Connectivity from

the Cascades to the Kettle Range to the Selkirk Mountains is interrupted by transportation corridors and human developments associated with the Okanogan, Upper Columbia, and Pend Oreille river valleys (Singleton et al. 2002, WWHCWG 2010). Additionally, connectivity planning in southern British Columbia identified linkage areas that could greatly enhance wildlife movements between the Selkirk Mountains and Purcell Mountains (Apps et al. 2007, Proctor et al. 2015).

This alternative emphasizes reducing the direct and indirect effects of roads on wildlife habitats, contributing to the maintenance and restoration of habitat connectivity, and reducing cumulative effects. Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative R would make a moderate contribution to providing habitat connectivity that is important for the viability of surrogate wildlife species. This conclusion is based on the following:

- An extended network (compared to the existing network) of LSOF habitat areas would provide additional habitat connectivity for LSOF species, but limited management direction for wildlife species not associated with LSOF habitats.
- The negative effects of roads on habitat connectivity, including riparian and LSOF habitat would be considerably reduced.

Snag Habitat

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the availability of habitat for snag-dependent surrogate species include firewood cutting (Bate et al. 2007, Hollenbeck et al. 2013), the loss of snag habitat along roads and at recreation sites from hazard tree removal (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008, FSM 7700), and removal of snags during timber harvest for safety reasons (Wisdom et al. 2008). The implementation of alternative R includes management direction for snag habitat to address the potential loss of habitat in timber sale operations, would not allow firewood cutting in reserves (reserves in this alternative include considerably more land area than any other alternative), and would not allow removal of snags greater than 20 inches d.b.h.

Implementation of this alternative would reduce the loss of snag habitat due to hazard tree removal along roads in 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions) this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and 2 miles or less per square mile on 22 percent of the Forest.

Overall, this alternative would provide greater habitat for snag-dependent surrogate wildlife species than any other alternative, and would improve the viability outcomes for snag-dependent surrogate wildlife species.

Climate Change

Surrogate wildlife species associated with snag habitats include the pileated woodpecker, white-headed woodpecker, black-backed woodpecker, and Lewis's woodpecker, which are rated as medium sensitivity to climate change, and the western bluebird as high sensitivity (CCSD 2013). The primary effect anticipated from climate change is the loss of habitat due to altered disturbance regimes. The emphasis of alternative R is on short-term habitat protection within an extended reserve system and relatively intensive timber management within the matrix, outside of the reserves. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for snag-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and loss of snag habitat in the matrix from relatively intense timber harvest. The increase in fire associated with climate change could create a short-term gain in snag habitat followed by a long-term (80 to 100 years, Harrod et al. 1998) reduction as snags attrition occurs.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and more rigorous snag requirements to contribute to the viability of snag-dependent wildlife (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitats and current required snag densities make limited contribution to the viability of surrogate wildlife species. The limited management direction for snag habitat on non-Federal lands adjacent to the planning area, places additional emphasis on providing for viability populations of snag-dependent wildlife species on Federal lands. Fuels reduction projects are possible on all land ownerships, in particular where they are near residences. These can be done in such a way that they restore wildlife habitat that has been affected by fire exclusion, but treatments can lead to the loss of snag habitat for safety reasons.

Summary

Implementation of alternative R would make a relatively high contribution to the viability of snag-dependent surrogate wildlife species. This determination is based on:

- This alternative would focus on providing protections for snag habitat.
- This alternative would make substantial reductions in the negative effects of roads on snag habitat.
- This alternative provides management direction to protect snag habitat during vegetation management activities and snags from being cut for firewood outside designated areas.

Riparian Habitats

Federally Listed Wildlife Species

Yellow-billed Cuckoo - Threatened

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent species such as the yellow-billed cuckoo include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In this alternative, management direction for watersheds and riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest. Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of alternative R would reduce the effects of roads on riparian habitat within 10 watersheds in the short term (less than 20 years based on objectives). In the longer-term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and 2 miles or less per square mile on 22 percent of the Forest.

Overall, this alternative would provide greater habitat protection for riparian-associated wildlife species, such as the yellow-billed cuckoo, than no action, the proposed action, and alternatives O and B, and similar to alternative P.

Climate Change

Climate change is expected to have an overall negative effect throughout the range of the yellow-billed cuckoo (Post et al. 2009, USFWS 2013). Riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The emphasis of alternative R is on short-term habitat protection within a reserve system and relatively intensive timber management within the matrix, outside of the reserves. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, riparian habitats are likely to be lost at an accelerated rate due to increased disturbances associated with climate change and loss of habitat in the matrix from relatively intense timber harvest.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be

inadequate and were amended (PACFISH, INFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an "all lands" approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of alternative R would make a relatively high contribution to the recovery of the yellow-billed cuckoo. This determination is based on the following:

- This alternative would make substantial reductions in the negative effects that roads have on riparian habitats.
- This alternative would consolidate and make more consistent management direction for riparian habitats using standards and providing larger management zones than existing direction.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent surrogate species include management of roads, recreation sites, grazing, and vegetation treatments that occur within riparian habitats.

In this alternative, management direction for watersheds and riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest. Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of this alternative would reduce the effects of roads on riparian habitat within 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions) this alternative would result in road densities of 1 mile or less per square mile on 51 percent of the Forest, and 2 miles or less per square mile on 22 percent of the Forest.

Overall, alternative R would provide greater habitat protection for riparian-dependent surrogate wildlife species than no action, the proposed action and alternatives O and B, and similar to alternative P. The viability outcomes for riparian-dependent surrogate wildlife species would be improved.

Climate Change

Some of the riparian-associated surrogate species are rated as high sensitivity to climate change (CCSD 2013) and riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The emphasis of alternative R is on short-term habitat protection within a reserve system and relatively intensive timber management within the matrix, outside of the reserves. Because alternative R does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for riparian-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and loss of habitat in the matrix from relatively intense timber harvest.

Cumulative Effects

Adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (PACFISH, INFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian-associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of alternative R would make a relatively high contribution to the viability of riparian-dependent surrogate wildlife species. This determination is based on the following:

- This alternative would make substantial reductions in the negative effects that roads have on riparian habitats.
- This alternative would consolidate and make more consistent management direction for riparian habitats using standards and providing larger management zones than existing direction.

Species of Management Interest

Deer and Elk

Direct and Indirect Effects

Forest management activities can influence deer and elk populations and habitat use. Vegetation management activities may affect the distribution and abundance of cover and forage. Adequate forage is particularly important during the summer and fall before the following birthing season, when this can have a positive effect on the condition of pregnant females (Lenz 1997, Cook 1998, Cook 2002, Cook et al. 2004, Cook et al. 2005, Cook et al. 2013). The management of forest roads and trails can influence how deer and elk use habitats, and influence the interactions between deer and elk (Rowland et al. 2005, Wisdom et al. 2005a, b). Additionally, deer and elk can compete with domestic livestock for both food resources (Findholt et al. 2005) and space (Coe et al. 2001, Coe et al. 2005). Thus, the potential effects that vegetation management, road and trail management, and grazing management can have on deer and elk habitats and population are evaluated for each of the alternatives.

Under alternative R, cover and forage for deer and elk on winter ranges emphasizes the retention of winter thermal cover. Considerable research has shown that the management of deer and elk winter habitat should be less focused on the retention of thermal cover, and more focused on the availability of forage on summer and fall habitats (see Cook et al. 2005 and 2013 for a review). This alternative would not incorporate the current science about the role of winter thermal cover in providing for deer and elk populations.

Much of the summer range for deer and elk under this alternative is managed either within a wilderness reserve or within a LSOF habitat reserve network. This limits the opportunities to restore forage conditions that contribute to elk productivity.

Alternative R would improve habitat effectiveness for deer and elk on summer and winter ranges. The Selkirk Elk Herd has a moderate level of habitat effectiveness (low level of human influence) on their winter ranges. Under this alternative, habitat effectiveness would be improved to high (a low level of human influence). Overall, habitat effectiveness would be restored on approximately 48,000 acres of habitat on elk range under this alternative. The desired conditions for elk winter ranges would be to have a low level of human influence (less than 30 percent of the winter range in the zone of influence of an open road, motorized route, or designated ski trail).

For deer, this alternative would result in a high level of habitat effectiveness (low level of human influence) on 81 percent of the deer winter ranges, a moderate level of habitat effectiveness on 13 percent, and a low level of habitat effectiveness on 6 percent. The desired conditions for deer winter ranges would be to have a low level of human influence (less than 30 percent of the winter range in the zone of influence of an open road, motorized route, or designated ski trail).

Current management direction for winter ranges is based on road density standards and would be changed to use of the zone of influence (Rowland et al. 2005). This alternative includes more robust range management direction to aid in the recovery of range conditions that are poor and slow to recover from past grazing practices.

Climate Change

Deer and elk have a low level of sensitivity to the effects of climate change due to their ability to tolerate a relatively wide range of climatic conditions, their high mobility, and as habitat generalists (CCSD 2013). However, alternatives that restore landscape pattern and functions while reducing the effects of roads on deer and elk summer and winter habitats would provide more resilience deer and elk populations. Alternative R provides consistent management direction for roads that would make considerable contributions to restore habitat effectiveness for deer and elk. However, this alternative does not emphasize landscape-scale forest restoration, considered an important climate change adaptation to restore landscape resiliency to disturbances and create more sustainable habitat conditions (Lawler et al. 2014).

Cumulative Effects

The historical cattle and sheep grazing that occurred on portions of the Forest severely degraded range conditions (Wissmar et al. 1994, Bunting et al. 2002). These conditions, combined with current domestic (cattle) and wild ungulate grazing (primarily elk and deer), have resulted in maintenance or slow recovery of poor range conditions in some areas (Wissmar et al. 1994, Bunting et al. 2002). In turn, these poor range conditions have had negative effects on some important unique habitats such as riparian areas and meadows. This alternative would result in more rigorous grazing management direction that would help to address this situation.

Winter ranges for deer and elk occur on Federal lands, adjacent wildlife management areas managed by the State, and private lands. Elk herd management plans (WDFW 2014) provide guidance for elk management on State lands and make recommendations for elk management on NFS land. Management plans for deer include the White-tailed Deer Management Plan that covers the two management units on the Colville National Forest and provides direction to manage hunting to either maintain or increase white-tailed deer populations (WDFW 2010). A considerable amount of historical winter range for deer and elk is now in private land ownership or under the waters of Lake Roosevelt (created by the Grand Coulee dam). The cumulative effects of the existing management plans (State and Federal lands) would provide for the conditions that contribute to sustainable populations of deer and elk, while considering the effects of private land development.

Summary

Implementation of alternative R would make a moderate contribution to the conditions that support sustainable populations of deer and elk. This is based on the following:

- This alternative would not address new science that recommends de-emphasizing the importance of winter thermal cover and increasing the emphasis on summer and fall forage quality and quantity. It would also limit management activities that increase forage productivity.
- This alternative does provide consistent and effective direction on the management of roads and trails to restore habitat effectiveness on deer and elk summer and winter ranges.
- This alternative includes more rigorous management direction to improve the conditions of key habitats, such as riparian areas and meadows that are in poor condition due to the cumulative effects of past grazing practices, and current domestic and wild ungulate grazing.

Native Pollinators

Direct and Indirect Effects

Forest management activities can influence native pollinator populations and include vegetation management, grazing, and placement of apiaries (USDA 2015).

This alternative emphasizes the protection of LSOF habitats within reserves that would occur on about 51 percent of the Forest. The areas outside of reserves would be managed to emphasize timber production. Alternative R does not emphasize landscape restoration of vegetation and disturbance regimes that would result in a mosaic of habitats and application of restorative treatments that enhance native plant communities and habitats for native pollinators (Dodson et al. 2008, Neill and Puettmann 2013).

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and guidelines to protect unique habitats. Alternative R would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. However, management direction could result in some adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats. This alternative would make modest improvements in the habitat conditions for native pollinators.

This alternative includes plan direction for the placement of apiaries that would reduce the potential for non-native pollinators to compete with rare native pollinators.

Climate Change

Native pollinators are considered to be sensitive to the effects of climate change, although our understanding of climate effects is very limited. Alternatives, such as this one, that address non-climate related factors such as native vegetation restoration and reducing the impacts of grazing are beneficial in maintaining and restoring habitat for native pollinators.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Pan Handle National Forest, it is managed to accommodate other public land uses. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for native pollinator habitats on Federal lands. Alternative R includes management direction for native plant restoration, protections of key habitats, and management direction to reduce the impacts of grazing on native plant communities. This management direction would better account for the cumulative effects of grazing on pollinator habitats.

Summary

Implementation of alternative R would make a relatively low contribution to maintenance and restoration of habitat for native pollinators. This determination is based on:

- This alternative emphasizes the protection of LSOF habitat through a system of reserves, but does not emphasize the landscape restoration of vegetation, disturbance regimes, and native plant communities.
- This alternative would reduce impacts to native plant communities from grazing.
- This alternative would include plan direction for the placement of apiaries that would reduce the potential for non-native pollinators to compete with rare native pollinators.

Alternative P

Federally Listed Wildlife Species

Grizzly Bear

Direct and Indirect Effects

Forest activities that influence the recovery of the grizzly bear include: human access that can displace bears from important seasonal habitats or increase the risk of bear-human interactions, disposal of livestock carcasses within range allotments to avoid attracting bears to a potential food source, placement of apiaries under special use permits, and the storage of food and garbage at recreation sites to reduce the potential for bears to associate humans with food sources.

Management of grizzly bears does not vary between alternatives. Existing management direction provides standards for human access, disposal of livestock carcasses, and food and garbage storage within the Selkirk Grizzly Bear Recovery Area (IGBC 1998, USDA Forest Service 1988, USFWS 1993, USDI 2001). Existing standards have largely been met and would continue to be followed. This alternative does include guidance that would limit the placement of apiaries within the grizzly bear recovery zone.

Climate Change

Grizzly bears have been identified as having a low sensitivity to climate change because they are opportunistic, eat a diverse array of food resources, and are highly adaptable (Servheen and Cross 2010, CCSD 2013). Anticipated impacts may include changes in the timing of denning due to longer snow-free periods and reduced snowpack (Lawler et al. 2014) and changes in the availability of food sources (Servheen and Cross 2010). These changes may put bears at risk of negative human interactions for a longer period of time each year (Servheen and Cross 2010). This would make education, proper food and garbage storage, carcass disposal measures, and human access management that much more important.

Cumulative Effects

The primary reasons for the low population of grizzly bears in the recovery zone are past persecution and human-caused mortality of bears. Legal protections are now in place to protect grizzly bears. Information/education programs, sanitation measures, and access management have and would continue to be used to aid in the recovery of grizzly bears in the Selkirk Recovery Area.

Past, present, and reasonable foreseeable future actions that could affect grizzly bears include timber harvest and associated road construction, recreational activities that can cause disturbance to bear and create potential for human-bear conflicts, and human development that fragments grizzly bear habitat. Cumulative effects are evaluated across the recovery area by tracking activities within GBMUs. Other land managers have adopted and are following similar management direction (USDA Forest Service 2015b) and overall recovery is coordinated by the Selkirk Grizzly Bear Management Subcommittee. GBMUs that occur on the Colville National Forest include the Le Clerc, Salmo-Priest, and Sullivan-Hughes. The contribution made on Federal lands to grizzly bear recovery would help to mitigate potential cumulative effects from off-forest activities. Alternative P would reduce the negative impacts of roads on wildlife habitats like the proposed action and alternative R, which helps to mitigate cumulative effects.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands by the public. This would increase the effects of human disturbance on grizzly bears and result in NFS lands that have relatively low human disturbance (e.g., core areas) to become more important to wildlife such as grizzly bears.

Black bear hunting on both sides of the international border within the Selkirk Recovery Area has the potential to add cumulatively to the mortality of grizzly bears. Hunters that encounter grizzly bears may mistakenly identify the bear, kill the bear in self-defense, or opportunistically poach the bear. Human access management within the recovery area is key to reducing the risk of mortality to grizzly bears from black bear hunting.

On private lands, the presence of garbage, pet food, fruit trees, or other attractants may lure bears into conflict situations. Bears that become habituated or a nuisance may lead to the bear being killed.

Summary

Alternative P would make a relatively high contribution to the recovery of grizzly bears in the Selkirk Recovery Area. This is based on the existing management direction, followed in all alternatives, that addresses:

- Human access management,
- Disposal of carcasses in range allotments that occur in the recovery area, and
- Proper storage of food, garbage and other attractants that may lead to human-bear interactions.

Canada Lynx

Direct and Indirect Effects

The forest management activities that influence the recovery and conservation of Canada lynx include: vegetation management that affect lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The Interagency Lynx Biology Team (ILBT 2013) developed conservation measures for core and secondary areas (USFWS 2005) to address each of these forest management activities, and for planners to consult when revising forest plans. These were used to evaluate the potential contribution of forest management alternatives to the recovery of Canada lynx.

Vegetation management activities (e.g., timber harvest, prescribed fire) affect the distribution of lynx habitat components, can fragment habitats, and create sources of disturbance (ILBT 2013). As a result, the ILBT (2013) identified risk factors associated with vegetation management and developed conservation measures to address the risk factors. The conservation measures for vegetation management apply to lynx core areas and include using the HRV to mimic the pattern and scale of natural disturbances and connectivity across the landscape, while considering the future range of climate change (ILBT 2013). A conservation measure focused on the restoration of disturbance regimes in dry forests that occur in close proximity to lynx habitat to reduce the risk of uncharacteristically severe and frequent fires reaching lynx habitat. Finally, conservation measures were recommended that limit the amount of vegetation management and the rate of habitat change (e.g., acres treated/decade) within lynx analysis units. Implementation of alternative P includes management direction to manage habitat for Canada lynx toward desired conditions that are based on the HRV. This means that habitats would be managed so that the amount of habitat, patch sizes, and spatial arrangement would mimic conditions under which Canada lynx evolved (Agee 2000). These conservation measures would provide foraging, denning, and travel habitat components for lynx, while reducing the potential of habitat loss and fragmentation from uncharacteristically severe wildfires, a key threat to lynx habitat (Lewis 2016).

Winter recreation can influence how lynx use habitats (ILBT 2013). To minimize the potential of negative effects from winter recreation, the ILBT (2013) developed conservation measures to reduce effects. Conservation measures for winter recreation in lynx core areas included reducing effects on habitat connectivity and discouraging expansion of over-the-snow routes that may influence lynx habitat use (ILBT 2013). There is management direction in alternative P that limits over-the-snow winter recreational activities in lynx habitat.

The conservation measures for forest roads in lynx core areas include avoiding road reconstruction or upgrades that occur in lynx habitat that would result in increased traffic speeds or volumes (ILBT

2013). These measures would reduce the potential for vehicular traffic to result in a source of mortality to lynx. This alternative includes management direction to limit road reconstruction and upgrades in lynx habitat that would increase traffic volume or speed. This would reduce the potential for lynx mortality associated with vehicle collisions.

The conservation measures for grazing in lynx core areas include management of riparian areas to assure adequate habitat for snowshoe hares, the primary prey species for Canada lynx (ILBT 2013). Alternative P includes management direction for grazing in riparian management areas specific to providing habitat for snowshoe hares.

Alternative P would provide management direction to address the direct and indirect effects of forest management activities on the recovery of Canada lynx. The direct and indirect effects that the plan direction addresses include desired conditions for vegetation management to provide lynx habitat components (foraging, denning, travel), plan components to limit the effects of winter recreation on Canada lynx habitat connectivity and habitat use, plan direction that limits speed on forest roads to reduce the risk of mortality to lynx from vehicle collisions, and standards and guidelines to improve conditions in riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx. Alternative P would provide more protections for Canada lynx than any of the other alternatives, and would make a substantial contribution to the recovery of Canada lynx.

Climate Change

The potential effects of climate change on Canada lynx identified by the Interagency Lynx Biology Team (2013) included: (1) an upward shift in elevation or latitudinal distribution of lynx and prey, (2) a decrease in the amount of habitat and population size from reduced snow persistence and increased disturbance events (e.g., fires), (3) changes in demographic rates, such as survival and reproduction, and (4) changes in predator-prey relationships.

Climate change adaptations to address these effects include restoration of landscape-scale disturbance regimes to better mimic natural patterns and processes (Spies et al. 2010, Gaines et al. 2012), and maintaining or restoring habitat connectivity to allow Canada lynx to adjust their ranges to changing conditions (Heller and Zavaleta 2009, ILBT 2013, Squires et al. 2013). There is management direction in alternative P to implement these climate change adaptations through the emphasis on dynamic-landscape restoration, and the restoration of conditions that would enhance connectivity of habitats (see Habitat Connectivity sections).

Cumulative Effects

Past, present, and reasonably foreseeable actions that affect lynx habitat include timber harvest and fuels reduction, recreation, human development, and grazing on private and public lands. In addition, legal trapping of lynx, timber harvest, oil and gas development, mining and human access in British Columbia have and would continue to affect Canada lynx and their habitat.

Past vegetation management and large-scale fires on the Forest within lynx habitat have resulted in a distribution and amount of successional stages (early, mid, late) that are outside the HRV. This alternative would result in vegetation management activities that would restore lynx habitats toward the HRV, providing conditions more similar to those under which lynx evolved.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Grazing has occurred and would continue to take place on off-forest lands, potentially impacting deciduous or riparian habitats for lynx prey species.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in areas with relatively low human disturbance on NFS lands becoming even more important to lynx and other wildlife.

All Federal lands within Canada lynx core and secondary areas would use the Lynx Conservation Assessment and Strategy (LCAS) (ILBT 2013) as current science to guide project-level consultation and land management planning. The North Cascades National Park Complex recently revised their management plan to include the LCAS (NPS 2012). The Idaho Panhandle National Forests land management plan was recently revised to address the conservation measures identified in the LCAS (USDA Forest Service 2015b). The conservation of lynx on WDNR lands is guided by the Department of Natural Resources Lynx Habitat Management Plan (WDNR 1996, updated in 2002). The management plan for the Pend Oreille National Wildlife Refuge provides conservation measures to contribute to the recovery and viability of Canada lynx (USFWS 2000). Collectively, these management plans have addressed many of the conservation measures identified for Canada lynx (ILBT 2013) and would help mitigate potential cumulative effects that may occur from off-forest activities. In addition, no critical habitat was identified on the Colville National Forest or on adjacent lands (USFWS 2009).

In Canada, timber harvesting, oil and gas development, coal mining, and the proliferation of human access associated with these industries, have and would continue to affect lynx habitat. Legal trapping occurs north of the Forest in Canada and could reduce the potential for lynx to disperse into the lynx habitat on the Forest. Trapping is not legal in Idaho, Montana, or Washington.

Summary

Alternative P would make a relatively high contribution to the recovery of the Canada lynx in both the short (less than 20 years) and long (less than 50 years) term. This is because of the following:

- This alternative incorporates the best available science and conservation measures identified in the recent version of the Lynx Conservation Assessment and Strategy (ILBT 2013), and the USFWS Recovery Outline (USFWS 2005).
- This alternative would implement recommended climate change adaptations by focusing on the restoration of forest disturbance regimes and resiliency, and reducing the impacts of roads on habitat connectivity.
- This alternative addresses previous findings that existing management plans provided inadequate regulatory mechanisms to prevent the listing of lynx as a federally threatened species (USFWS 2003b).

Late-successional and Old Forest Habitats (Federally Listed Species)

Woodland Caribou and Critical Habitat

Direct and Indirect Effects

The forest management activities that can influence the recovery and viability of woodland caribou include: (1) Vegetation management and natural disturbances affect the amount and connectivity of old forests of Engelmann spruce/subalpine fir and western red cedar/western hemlock. (2) Human access that can increase the potential for poaching and cause disturbance to caribou during the critical winter period. These effects were used to evaluate the potential contribution of each alternative to the recovery of woodland caribou.

This alternative would implement new science, recommendations from the Biological Opinion issued in 2001 (USFWS 2001) on the 1988 forest plan (USDA Forest Service 1988), and address the critical habitat designation (USFWS 2012a). Vegetation management would be focused on restoring late-successional and old forest habitats based the historic range of variability. The desired conditions would be for the amount, spatial arrangement, and connectivity of caribou habitat to mimic natural patterns and processes.

A term and condition of the 2001 Biological Opinion was that the Forest develop a winter recreation strategy that protects important winter habitats for caribou, while providing some level of winter recreation access. This strategy was developed (USDA Forest Service 2003) and is fully integrated into this alternative. This strategy includes information and education about the effects of winter recreation on wildlife, monitoring and enforcement of areas closed to over-the-snow activities, and limitations on permitted over-the-snow activities. Collectively, these actions have reduced the impacts of winter recreation to caribou habitat while providing recreation opportunities in areas and at the time of the winter season when effects to caribou are minimal. In addition to winter recreation, this alternative emphasizes substantially reducing the negative effects of forest roads on wildlife habitat.

The management guidance for woodland caribou and vegetation management in this alternative, would contribute to the maintenance and restoration of the primary constituent elements of designated critical habitat for the woodland caribou. This would allow the critical habitat to support the life-history needs of the southern Selkirk Mountains population of woodland caribou and provide for the conservation of the species.

Climate Change

Climate change would likely alter the distribution and abundance of suitable caribou habitat, and would also change snow depths and persistence, which affect seasonal movements of mountain caribou (WDFW 2012). The potential effects of climate change depend on the interaction, not only of seasonal temperatures and snowfall patterns, but also occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Management adaptations to address the effects of climate change include a focus on forest restoration and reducing non-climatic factors that affect wildlife populations (e.g., restoring habitat effectiveness). Alternative P would implement these adaptations.

Cumulative Effects

The caribou recovery area is 1,477 square miles in size and includes the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States and 53 percent in British Columbia. The Idaho

Panhandle National Forests recently revised the forest plan to address habitat and risk factors identified in the caribou recovery plan and critical habitat (USDA Forest Service 2015b). The caribou recovery team works cooperatively to address cumulative effects on woodland caribou.

Past activities on the Forest have impacted caribou habitat. Over-the-snow motorized use, prior to the implementation of the Winter Recreation Strategy (USDA Forest Service 2003), may have caused disturbance to caribou. Alternative P would continue with implementation of the Winter Recreation Strategy, limiting the cumulative effects on caribou.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would manage habitats toward HRV, resulting in a distribution and amount of successional stages that better mimic conditions under which caribou evolved, and better mitigate for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife such as caribou.

Big game hunting continues on both sides of the U.S./Canada border. Encounters with hunters may result in caribou mortality as a result of mistaken identification. Legal harvest of caribou by Treaty Indians does occur, but with few statistics on the number of animals taken it is difficult to evaluate the influence of this on the caribou population. Fatal collisions with vehicles occur on open roads in caribou habitat and are likely to continue. Predation by mountain lions, wolves and other predators would continue, with the effect on the caribou population dependent on big game populations, predator populations, and a variety of other factors.

One important factor is how the Canadian officials decide to manage this herd. In the British Columbia portion of the recovery area, human activities that would continue to impact caribou habitat include gas, powerline, and international border corridors, recreation activities, timber harvest, and highways.

Summary

Implementation of alternative P would make a relatively high contribution to the recovery of woodland caribou. The reasons for this determination are:

- This alternative would address new science and risk factors identified in the recovery plan and critical habitat.
- This alternative would formally adopt the winter recreation strategy for caribou habitat that was a term and condition of the 2001 Biological Opinion.
- This alternative emphasizes the protection and restoration of caribou habitat, better addressing expected climate change effects and enhancing resiliency.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the viability of LSOF-dependent surrogate species include: the loss of LSOF habitat from fire (Healy et al. 2008, Davis et al. 2011, 2015), vegetation treatments (e.g., timber harvest, thinning, prescribed fire) that affect forest structure (e.g., canopy closure, snags, downed wood) (Healy et al. 2008, Wisdom et al. 2008, Davis et al. 2011), management of roads that influence habitat effectiveness (Gaines et al. 2003), and protection of riparian areas that are an important element of LSOF habitats for some species.

The dynamic landscape restoration approach emphasized in alternative P would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior may be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires may be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007). Landscape restoration through the implementation of this alternative would include a network of dense, multi-layered habitat patches tailored to specific conditions and surrogate species (Gaines et al. 2010, Franklin and Johnson 2012). The amount, patch size, and spatial arrangement of dense, multi-layered habitat would be managed within or toward the historic range of variation for each landscape (e.g., watershed) (Hessburg et al. 2013). In addition, implementation of this alternative would include greater use of managed fire to achieve desired conditions for restoration and resiliency (Noss et al. 2006, Franklin and Johnson 2012).

For some LSOF surrogate species, such as the white-headed woodpecker, conservation assessments have recommended the use of stand-level treatments to restore habitat because current habitat levels are well below historic levels (Mellen-McLean et al. 2013, Gaines et al. 2017). The effects of restoration treatments on birds has been studied and shown that treatments that retain large trees and promote spatial variability can have positive effects on surrogate bird species, including the white-headed woodpecker (Gaines et al. 2007, Gaines et al. 2010). The implementation of this alternative would result in approximately 5,000 acres per year of restorative treatments within dry and mesic forests, creating favorable conditions for white-headed woodpeckers.

Implementation of alternative P includes plan components for several key elements of LSOF habitat. For instance, desired conditions for snag habitat address the potential loss of snags in vegetation management treatments and guidelines limit cutting of large trees (greater than 20 inches d.b.h.). This alternative would also require that firewood cutting occur in designated areas only, and not allow removal of snags greater than 20 inches d.b.h. outside of designated areas. In addition, this alternative provides for the retention and restoration of late-successional forest structure, which is currently lacking in most forested landscapes (Hessburg et al. 1999).

Implementation of this alternative would reduce the negative effects of roads on LSOF habitats within 10 watersheds in the short term (less than 20 years based on Objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions) this alternative would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest, considerably reducing the negative effects of roads on LSOF habitats.

Overall, alternative P would provide greater protection for LSOF habitats than no action, the proposed action and alternatives B, O, and R. This alternative would improve the viability outcomes for surrogate species that are dependent on LSOF habitats in both the short (less than 20 years) and long (less than 50 years) time periods as desired conditions are achieved.

Climate Change

The sensitivity of LSOF-associated surrogate wildlife species to the effects of climate change were identified as medium for pileated woodpecker, and high for northern goshawk and American marten (CCSD 2013). The primary effect of climate change is the loss of LSOF habitats due to altered disturbance regimes (CCSD 2013, Lawler et al. 2014).

Since the mid-1980s, the size and intensity of large wildfires in the western United States have increased markedly (Westerling et al. 2006), due, in part, to a reduction in fuel moisture driven by increased temperature and lower snowpack. Increases in fire risk and severity have been also been driven, in part, by increased fuel loads because of fire suppression practices used over the last century (McKenzie et al. 2004). Predicted increases in spring and summer temperature identified in many climate change models would exacerbate the frequency and intensity of disturbances such as fire (McKenzie et al. 2004, Wotton and Flannigan 1993) and defoliation caused by forest insects (Littell et al. 2009). In the interior Columbia Basin, Littell et al. (2009) predicted that the area burned is likely to double or even triple by 2050. Climate-driven changes in fire regimes would likely be the dominant driver of changes to forests and LSOF habitats in the western United States over the next century (McKenzie et al. 2004).

The dynamic landscape restoration approach that is emphasized in alternative P represents the implementation of an adaptive strategy to create landscapes more resilient to climate change (Spies et al. 2010, Gaines et al. 2012) and to maintain LSOF habitats (Lawler et al. 2014). The emphasis on restoration of resiliency would result in landscapes, including disturbance regimes that are more resilient to climate change through the application of strategically located restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior can be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires can be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007). In addition, implementation of this alternative would include greater use of managed fire to achieve desired conditions for restoration and resiliency (Noss et al. 2006, Franklin and Johnson 2012).

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore LSOF habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and LSOF habitat protections in the original forest plan were found to be inadequate and were amended by the Eastside Screens (USDA Forest Service 1995b).

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would manage habitats toward HRV, resulting in a distribution and amount of

successional stages that better mimic conditions under which caribou evolved, and better mitigate for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Summary

Implementation of alternative P would make a relatively high contribution to the viability of LSOF-dependent surrogate wildlife species. The high contribution would be due to the following components of this alternative:

- Emphasis on landscape restoration to enhance landscape resiliency,
- The conservation of LSOF habitat across whole landscape (not just in reserves),
- The protection and restoration of key elements of LSOF habitat such as late-successional structure and riparian areas, and
- The emphasis on restoring habitat effectiveness by substantially reducing the negative effects of roads on LSOF habitats.

Motorized Recreation and Road Access

Proposed Species – Wolverine

Direct and Indirect Effects

Motorized recreation and the use of forest roads may influence the habitat use and populations of wolverines. These potential effects include displacement from key habitats, disturbance during critical periods, and an increased risk of mortality (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wolverine). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative P would reduce the negative effects of roads on wolverine habitat in 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest. The remainder of the Forest would remain unroaded. Habitat effectiveness (as affected by roads) for wolverines would be improved from a current low to moderate level of habitat effectiveness in 26 watersheds to a moderate level of habitat effectiveness in 17 watersheds and a high level of habitat effectiveness in 9 watersheds as desired conditions for road access are achieved.

Overall, alternative P would provide greater habitat effectiveness for wolverines than no action, the proposed action, and alternatives B and O, and somewhat less than alternative R. This alternative would improve habitat conditions for wolverines, whose habitats are influenced by roads and motorized trails.

Climate Change

The sensitivity of wolverine to the effects of climate change is considered to be high (CCSD 2013). An important climate change adaptation that has been recommended for wolverine is to reduce the negative effects of non-climate-related stressors such as the effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats can become more resilient to the effects of climate change, and habitat connectivity can be restored, allowing wolverines to adjust their ranges as conditions change. The implementation of alternative P includes management direction to make substantial improvement to habitat effectiveness for wolverines by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative impacts of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in current forest plans to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Forest) means that management of roads and motorized trails on Federal lands is even more important for the habitat of wolverines.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wolverines.

Summary

Implementation of alternative P would make a relatively high contribution to the maintenance and restoration of habitat for wolverines and result in a May Impact determination. This would occur because:

- This alternative includes management direction to substantially reduce the impact of roads on habitat effectiveness for wolverines, and
- This alternative does not alter the current impacts that summer and winter motorized trails have on habitat effectiveness for wolverines.

Surrogate Wildlife Species

Direct and Indirect Effects

Motorized recreation and the use of forest roads influence the viability of surrogate wildlife species. These potential effects include displacement from key habitats, disturbance during critical time periods, and the risk of mortality caused by collisions with vehicles (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail-associated factors that influence wildlife). The

effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative P would reduce the negative effects of roads on surrogate species habitats in 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest. The remainder of the Forest would remain unroaded. Habitat effectiveness (as affected by roads) for surrogate wildlife species would be improved from a current low to moderate level of habitat effectiveness in 26 watersheds to a moderate level of habitat effectiveness in 17 watersheds and a high level of habitat effectiveness in 9 watersheds as desired conditions for road access are achieved.

Overall, alternative P would provide greater habitat effectiveness for surrogate wildlife species than no action, the proposed action and alternatives B and O, and somewhat less than alternative R. This alternative would improve the viability outcomes for surrogate wildlife species whose habitats are influenced by roads and motorized trails.

Climate Change

The sensitivity of surrogate wildlife species used to assess the effects of roads and motorized recreation is rated as high for Canada lynx and wolverine (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of non-climate-related stressors such as the effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats (especially riparian and wetland habitats) can become more resilient to the effects of climate change, and habitat connectivity can be restored, allowing wildlife to adjust their ranges as conditions change. The implementation of alternative P includes management direction to make substantial improvement to habitat effectiveness for surrogate wildlife by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative impacts of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in current forest plans to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Forest) means that management of roads and motorized trails on Federal lands is even more important to the viability of surrogate wildlife species.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative P would make a relatively high contribution to the viability of surrogate wildlife species whose habitats are influenced by motorized access. This would occur because:

- This alternative includes management direction to substantially reduce the impact of roads on habitat effectiveness for surrogate wildlife species, and
- This alternative does not alter the current impacts that summer and winter motorized trails have on habitat effectiveness for surrogate wildlife species.

Livestock Grazing

Surrogate Wildlife Species

Direct and Indirect Effects

Grazing can influence habitats of surrogate wildlife species by removing key habitat elements (e.g., dense shrubs for MacGillivray's warbler and fox sparrow), especially in riparian habitats; alter disturbance regimes that maintain habitat structure (e.g., frequent fires in dry forests and grasslands keep open canopy for western bluebird); and influence the availability of important prey items (e.g., squirrels for golden eagles). To address the potential effects on surrogate wildlife species, the management direction regarding grazing in riparian habitat and upland habitats for each alternative was assessed.

Alternative P would include standards as management direction for riparian habitats. Presently, many riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would make a considerable improvement to the grazing impacts of livestock and allow riparian habitats to recover.

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and standards to protect unique habitats. This alternative would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. However, management direction would result in adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats. Alternative P has a high potential to improve the viability outcomes for surrogate species that are influenced by grazing.

Climate Change

Habitats that are particularly sensitive to the effects of climate change include riparian areas (including wetlands) and alpine areas (Lawler et al. 2014). A management adaptation to make these habitats more resilient to climate change is to reduce the effects of non-climatic stressors (e.g., roads, intense grazing, etc.) (Lawler et al. 2014). Alternative P includes management direction that would help to restore the resiliency of habitats that are sensitive to climate change.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Panhandle National Forests, it is managed to accommodate other public land uses, such as contributing to the viability of surrogate wildlife species. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific wildlife

habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for wildlife habitats on Federal lands that contribute to the viability of surrogate wildlife species. Alternative P includes management direction for some key habitats that would better account for the cumulative effects of grazing on wildlife habitats.

Summary

Implementation of alternative P would make a relatively high contribution to viability for surrogate wildlife species that are influenced by domestic grazing. This determination is based on:

- This alternative includes management direction (including standards) for riparian habitat that would reduce the negative effects of grazing and improve riparian habitat condition.
- This alternative would not change the number or grazing intensity, but would alter the distribution of livestock to protect some unique habitats.
- This alternative would include management direction that could make habitats that are sensitive to the effects of climate change more resilient.

Habitat Connectivity

Surrogate Wildlife Species

Direct and Indirect Effects

There are a number of forest management activities that influence habitat connectivity for surrogate wildlife species. These include the amount, patch sizes, and spatial arrangement of suitable habitats; location and density of motorized travel routes, especially in relation to riparian and LSOF habitats. These are addressed in the evaluation of how forest management alternatives would affect habitat connectivity for surrogate wildlife species.

The implementation of this alternative includes management direction to manage wildlife habitats for surrogate wildlife species toward desired conditions that are based on the historic range of variability. This means that habitats for a wide-range of species would be managed so that the amount of habitat, patch sizes, and spatial arrangement would mimic conditions under which those species evolved (Hessburg et al. 1999, Hessburg et al. 2013).

In this alternative, management direction for riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest, and would be consistent with other national forests in Region 6. Standards and guidelines would limit management activities that are allowed to occur within riparian habitats and influence habitat connectivity. Alternative P includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of alternative P would reduce the negative effects of roads on habitat connectivity for surrogate wildlife species within 10 watersheds in the short term (less than 20 years based on objectives) because roads would be closed (to meet other management objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest, considerably reducing the negative effects of roads on habitat connectivity. This alternative would result in considerable improvement to habitat connectivity for surrogate wildlife species (table 187).

Table 187. Dispersal habitat suitability for surrogate wildlife species under alternative P, by proportion of planning area (based on desired conditions)

Surrogate Species used to Assess Habitat Connectivity	Low Dispersal Habitat Suitability	Moderate Dispersal Habitat Suitability	High Dispersal Habitat Suitability
American Marten	21% (-20%)	50% (+11%)	29% (+9%)
Canada Lynx	4% (-3%)	49% (-11%)	47% (+13%)
Wolverine	5 (-3%)	40% (-8%)	55% (+11%)

Numbers in parentheses show increases (+) or decreases (-) in the proportion of the planning area in low, moderate, or high dispersal habitat suitability compared to the current condition.

1/See Singleton et al. (2002) and Gaines et al. (2017) for definition of and methods used to determine dispersal habitat suitability.

Climate Change

Maintaining and restoring ecological connectivity is the most oft-cited climate adaptation strategy for biodiversity conservation (Heller and Zavaleta 2009, Opdam and Wascher 2004, Parmesan 2006, Spies et al. 2010) and has been identified as an important adaptation strategy for wildlife in northeastern Washington (Gaines et al. 2012). This is because species' range shifts have been the primary biological response to past episodes of climatic change, yet widespread anthropogenic barriers to movement would now challenge species' ability to respond (Price 2002, Thomas and Lennon 1999, Wormworth and Mallon 2006). The implementation of alternative P addresses climate change adaptations that are recommended to maintain or restore habitat connectivity for surrogate wildlife species.

Cumulative Effects

Past, present, and reasonably foreseeable human developments and transportation infrastructure, along with land ownership patterns, create cumulative impacts that limit options to conserve and restore regional connectivity. Regional habitat connectivity has been evaluated for a variety of wildlife species, including the surrogate wildlife species used to evaluate connectivity in this planning area (Singleton et al. 2002, WWHCWG 2010). These assessments have shown the importance of the Colville National Forest in providing stepping-stone habitats between the Cascades and Selkirk Mountains (Singleton et al. 2002, WWHCWG 2010, Proctor et al. 2015). Connectivity from the Cascades to the Kettle Range to the Selkirk Mountains is interrupted by transportation corridors and human developments associated with the Okanogan, Upper Columbia, and Pend Oreille river valleys (Singleton et al. 2002, WWHCWG 2010). Additionally, connectivity planning in southern British Columbia identified linkage area that could greatly enhance wildlife movement between the Selkirk Mountains and the Purcell Mountains (Apps et al. 2007, Proctor et al. 2015).

Reducing the direct and indirect effects of roads on wildlife habitats would contribute to the maintenance and restoration of habitat connectivity, including cumulative effects. Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative P would make a relatively high contribution to providing habitat connectivity that is important for the viability of surrogate wildlife species. This conclusion is based on the following:

- Habitat amount, patch sizes, and spatial arrangement would be managed toward desired conditions based on the historic range of variability, providing conditions similar to those under which surrogate wildlife species evolved.
- The negative effects of roads on habitat connectivity, including riparian and LSOF habitats, would be considerably reduced.

Snag Habitat

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the availability of habitat for snag-dependent surrogate species include firewood cutting (Bate et al. 2007, Hollenbeck et al. 2013), the loss of snag habitat along roads and at recreation sites from hazard tree reduction (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008, FSM 7700), and removal of snags during timber harvest for safety reasons (Wisdom et al. 2008).

Implementation of alternative P includes management direction for snag habitat to address the potential loss of habitat in timber sale operations, would require that firewood cutting occur in designated areas only, and would not allow removal of snags greater than 20 inches d.b.h. outside of designated areas.

Implementation of this alternative would decrease snag habitat loss due to hazard tree removal along roads in 10 watersheds in the short term (less than 20 years based on objectives) due to reduced road densities. In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest. Overall, alternative P would provide greater habitat for snag-dependent surrogate wildlife than no action, the proposed action, and alternatives B and O, and somewhat less than alternative R.

Climate Change

Surrogate wildlife species associated with snag habitat included the pileated woodpecker, white-headed woodpecker, black-backed woodpecker, and Lewis's woodpecker, which are rated as medium sensitivity to climate change, and the western bluebird as high sensitivity (CCSD 2013). The primary effect that is anticipated from climate change is the loss of habitat due to altered disturbance regimes. The dynamic-landscape restoration approach that is emphasized in alternative P would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations, and greater use of managed fire to achieve desired conditions for landscape restoration and resiliency.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge

have management plans that reduce the negative effects of roads on wildlife habitats and more rigorous snag requirements to contribute to the viability of snag-dependent wildlife (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitats and current required snag densities make limited contribution to the viability of surrogate wildlife species. The limited management direction for snag habitat on non-Federal lands adjacent to the planning area, places additional emphasis on providing for viable populations of snag-dependent wildlife species on Federal lands. Fuels reduction projects are possible on all land ownerships, in particular where they are near residences. These can be done is such a way that they restore wildlife habitat that has been affected by fire exclusion, but treatments can lead to the loss of snag habitat for safety reasons.

Summary

Implementation of alternative P would make a relatively high contribution to the viability of snag-dependent surrogate wildlife species. This determination is based on:

- This alternative would focus on landscape restoration of habitats and disturbance regimes that directly influence the availability and condition of snag habitat.
- This alternative would make substantial reductions in the negative effects of roads on snag habitat.
- This alternative provides management direction to protect snag habitat during vegetation management activities and from being cut for firewood.

Riparian Habitats

Federally Listed Wildlife Species

Yellow-billed Cuckoo - Threatened

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent species such as the yellow-billed cuckoo include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In alternative P, management direction for watersheds and riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest, and is consistent with other national forests in Region 6. Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of alternative P would reduce the effects of roads on riparian habitat within 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions), this alternative would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest.

Overall, this alternative would provide greater habitat protections for riparian associated wildlife species, such as the yellow-billed cuckoo, than no action, the proposed action, and alternatives B and O, and similar to alternative R.

Climate Change

Climate change is expected to have an overall negative effect throughout the range of the yellow-billed cuckoo (Post et al. 2009, USFWS 2013). Riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014). The dynamic-landscape restoration approach that is emphasized in alternative P would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations. In addition, emphasis of this alternative in reducing the negative effects of roads on riparian habitats would help to make them more resilient to disturbances.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (PACFISH, INFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of alternative P would make a relatively high contribution to the recovery of the yellow-billed cuckoo. This determination is based on the following:

- This alternative would make substantial reductions in the negative effects that roads have on riparian habitats.
- This alternative would consolidate and make more consistent management direction for riparian habitats using standards and providing larger management zones than existing direction.
- This alternative would emphasize landscape restoration that would reduce the potential effects of uncharacteristically severe fires on riparian habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent surrogate species include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In this alternative, management direction for watersheds and riparian habitats is consolidated into one consistent set of plan components that applies to the entire Colville National Forest, and is consistent with other national forests in Region 6. Standards and guidelines would limit management

activities that are allowed to occur within riparian habitats. Alternative P includes greater riparian management area widths along intermittent streams, lakes, and ponds than in the areas previously covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of this alternative would reduce the effects of roads on riparian habitat within 10 watersheds in the short term (less than 20 years based on objectives). In the longer term (less than 50 years based on desired conditions), alternative P would result in road densities of 1 mile or less per square mile on 28 percent of the Forest, and 2 miles or less per square mile on 44 percent of the Forest.

Overall, alternative P would provide greater habitat protections for riparian-dependent surrogate wildlife than no action, the proposed action, alternatives B and O, and similar to alternative R. The viability outcomes for riparian-dependent surrogate wildlife species would be improved.

Climate Change

Some of the riparian-associated surrogate species are rated as high sensitivity to climate change (CCSD 2013) and riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014). The dynamic-landscape restoration approach that is emphasized in this alternative would result in landscapes, including disturbance regimes, that are more resilient to climate change through the application of strategically located restoration treatments in priority locations. In addition, emphasis of this alternative in reducing the negative effects of roads on riparian habitats would help to make them more resilient to disturbances.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (PACFISH, INFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of alternative P would make a relatively high contribution to the viability of riparian-dependent surrogate wildlife species. This determination is based on the following:

- This alternative would make substantial reductions in the negative effects that roads have on riparian habitats.

- This alternative would consolidate and make more consistent management direction for riparian habitats using standards and providing larger management zones than existing direction.
- This alternative would emphasize landscape restoration that would reduce the potential effects of uncharacteristically severe fires on riparian habitats.

Species of Management Interest

Deer and Elk

Direct and Indirect Effects

Forest management activities can influence deer and elk populations and habitat use. Vegetation management activities may affect the distribution and abundance of cover and forage. Adequate forage is particularly important during the summer and fall before the following birthing season, when this can affect the condition of pregnant females (Lenz 1997, Cook 1998, Cook 2002, Cook et al. 2004, Cook et al. 2005, Cook et al. 2013). The management of forest roads and trails can influence how deer and elk use habitats, and influence the interactions between deer and elk (Rowland et al. 2005, Wisdom et al. 2005a, b). Additionally, deer and elk can compete with domestic livestock for both food resources (Findholt et al. 2005) and space (Coe et al. 2001, Coe et al. 2005). Thus, the potential effects that vegetation management, road and trail management, and grazing management can have on deer and elk habitats and population are evaluated for each of the alternatives.

Under alternative P, cover and forage for deer and elk on winter and summer ranges would be managed commensurate with the historic range of variability. This would result in a sustainable level of cover and more emphasis on enhancement of forage conditions. Considerable research has shown that the management of deer and elk winter habitat should be less focused on the retention of thermal cover, and more focused on the availability of forage on summer and fall habitats (see Cook et al. 2005 and 2013 for a review).

This alternative would improve habitat effectiveness for deer and elk on summer and winter ranges. The Selkirk Elk Herd has a moderate level of habitat effectiveness (low level of human influence) on their winter ranges. Under alternative P, the habitat effectiveness would be improved to high (a low level of human influence). Overall, habitat effectiveness would be restored on approximately 48,000 acres of habitat on elk range under this alternative. The desired conditions for elk winter ranges would be to have a high level of habitat effectiveness (low level of human influence, less than 30 percent of the winter range in the zone of influence of an open road, motorized route, or designated ski trail).

For deer, alternative P would result in a high level of habitat effectiveness (low level of human influence) on 81 percent on the winter ranges, a moderate level on 13 percent, and a low level of habitat effectiveness on 6 percent. The desired conditions for deer winter ranges would be to have a high level of habitat effectiveness (low level of human influence, less than 30 percent of the winter range in the zone of influence of an open road, motorized route, or designated ski trail).

Current management direction for winter ranges is based on road density standards and would be changed to use of the zone of influence, based on new science (Rowland et al. 2005). Alternative P includes more robust range management direction to aid in the recovery of range conditions that are poor and slow to recover from past grazing practices.

Climate Change

Deer and elk have a low level of sensitivity to the effects of climate change due to their ability to tolerate a relatively wide range of climatic conditions, their high mobility, and as habitat generalists (CCSD 2013). However, alternatives that restore landscape pattern and functions while reducing the effects of roads on deer and elk summer and winter habitats would provide more resilience deer and elk populations. Alternative P emphasizes landscape-scale restoration and provides consistent management direction for roads that would make modest contributions to restore habitat effectiveness for deer and elk.

Cumulative Effects

The historical cattle and sheep grazing that occurred on portions of the Forest degraded range conditions (Wissmar et al. 1994, Bunting et al. 2002). These conditions, combined with current domestic (cattle) and wild ungulate grazing (primarily elk and deer), have resulted in maintenance or slow recovery of poor range conditions in some areas (Wissmar et al. 1994, Bunting et al. 2002). In turn, these poor range conditions have had negative effects on some important unique habitats such as riparian areas and meadows (Beebe et al. 2002, Evans 2006, Lehmkuhl et al. 2013). Alternative P would result in more rigorous grazing management direction that would help to address this situation.

Winter ranges for deer and elk occur on Federal lands, adjacent wildlife management areas managed by the State, and private lands. Elk herd management plans (WDFW 2014) provide guidance for elk management on State lands and make recommendations for elk management on NFS land. Management plans for deer include the White-tailed Deer Management Plan that covers the two management units on the Colville National Forest and provides direction to manage hunting to either maintain or increase white-tailed deer populations (WDFW 2010). A considerable amount of historical winter range for deer and elk is now in private land ownership or under the waters of Lake Roosevelt (created by the Grand Coulee Dam). The cumulative effects of the existing management plans (State and Federal lands) would provide for the conditions that contribute to sustainable populations of deer and elk, while considering the effects of private land development.

Summary

Implementation of alternative P would make a relatively high contribution to the conditions that support sustainable populations of deer and elk. This is based on the following:

- This alternative addresses new science that recommends de-emphasizing the importance of winter thermal cover and increasing the emphasis on summer and fall forage quality and quantity.
- This alternative provides consistent and effective direction on the management of roads and trails to restore habitat effectiveness on deer and elk summer and winter ranges.
- This alternative includes more rigorous management direction to improve the conditions of key habitats, such as riparian areas and meadows that are in poor condition due to the cumulative effects of past grazing practices, and current domestic and wild ungulate grazing.

Native Pollinators

Direct and Indirect Effects

Forest management activities can influence native pollinator populations and include vegetation management, grazing, and placement of apiaries (USDA 2015).

The dynamic landscape restoration approach that is emphasized in alternative P would result in landscape-scale restoration of forest structure and composition, and disturbance regimes. This would be accomplished through the implementation of restorative treatments such as forest thinning and prescribed fire to achieve desired conditions. Restorative treatments such as thinning and prescribed fire have been shown to enhance native plant communities, including native pollinator habitats (Dodson et al. 2008, Neill and Puettmann 2013).

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and guidelines to protect unique habitats. Alternative P would not alter the number of livestock or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment, and AUMs average about 25,000 per year. However, management direction could result in some adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats.

Alternative P includes a guideline to assure the placement of apiaries does not create competition or displace native pollinators. This alternative would result in considerable improvements in the habitat conditions for native pollinators.

Climate Change

Native pollinators are considered to be sensitive to the effects of climate change, although our understanding of climate effects is very limited. Alternatives, such as this one, that address non-climate related factors such as native vegetation restoration, reducing the impacts grazing on native plant communities, and protecting rare native pollinators from competition or displacement as a result of apiaries, are beneficial in maintaining and restoring habitat for native pollinators.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Pan Handle National Forest, it is managed to accommodate other public land uses. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for native pollinator habitats on Federal lands. Alternative P includes management direction for native plant restoration, protections of key habitats, and management direction to reduce the impacts of grazing on native plant communities. This management direction would better account for the cumulative effects of grazing on pollinator habitats.

Summary

Implementation of alternative P would make a relatively high contribution to maintenance and restoration of habitat for native pollinators. This determination is based on:

- This alternative emphasizes the restoration of native plant communities,
- This alternative would protect rare native pollinators from competition or displacement associated with apiaries, and
- This alternative would reduce impacts to native plant communities from grazing.

Alternative B

Federally Listed Wildlife Species

Grizzly Bear

Direct and Indirect Effects

Forest activities that influence the recovery of the grizzly bear include: human access that can displace bears from important seasonal habitats or increase the risk of bear-human interactions, disposal of livestock carcasses within range allotments to avoid attracting bears to a potential food source, and the storage of food and garbage at recreation sites to reduce the potential for bears to associate humans with food sources.

Management of grizzly bears does not vary between alternatives. Existing management direction provides standards for human access, disposal of livestock carcasses, and food and garbage storage within the Selkirk Grizzly Bear Recovery Area (IGBC 1998, USDA Forest Service 1988, USFWS 1993, USDI 2001). Existing standards have largely been met and would continue to be followed.

Climate Change

Grizzly bears have been identified as having a low sensitivity to climate change because they are opportunistic, eat a diverse array of food resources, and are highly adaptable (Servheen and Cross 2010, CCSD 2013). Anticipated impacts may include changes in the timing of denning due to longer snow-free periods and reduced snowpack (Lawler et al. 2014) and changes in the availability of food sources (Servheen and Cross 2010). These changes may put bears at risk of negative human interactions for a longer period of time each year (Servheen and Cross 2010). This would make education, proper food and garbage storage, carcass disposal measures, and human access management that much more important.

Cumulative Effects

The primary reasons for the low population of grizzly bears in the recovery zone are past persecution and human-caused mortality of bears. Legal protections are now in place to protect grizzly bears. Information/education programs, sanitation measures, and access management have and would continue to be used to aid in the recovery of grizzly bears in the Selkirk Recovery Area.

Past, present and reasonable foreseeable future actions that could affect grizzly bears include timber harvest and associated road construction, recreational activities that can cause disturbance to bear and create potential for human-bear conflicts, and human development that fragment grizzly bear habitat. Cumulative effects are evaluated across the recovery area by tracking activities within GBMUs. Other land managers have adopted and are following similar management direction (USDA Forest Service 2015b) and overall recovery is coordinated by the Selkirk Grizzly Bear Management Subcommittee. GBMUs that occur on the Colville National Forest include the Le Clerc, Salmo-Priest, and Sullivan-Hughes. The contribution made on Federal lands to grizzly bear recovery would help to mitigate potential cumulative effects from off-forest activities. However, because this alternative does not address reducing the negative impacts of roads on wildlife habitats like in the proposed action and alternatives R and P, it does less to mitigate cumulative effects.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance (e.g., core areas) to become more important to wildlife such as grizzly bears.

Black bear hunting on both sides of the international border within the Selkirk Recovery Area has the potential to add cumulatively to the mortality of grizzly bears. Hunters that encounter grizzly bears may mistakenly identify the bear, kill the bear in self-defense, or opportunistically poach the bear. Human access management within the recovery area is key to reducing the risk of mortality to grizzly bears from black bear hunting.

On private lands, the presence of garbage, pet food, fruit trees, or other attractants may lure bears into conflict situations. Bears that become habituated or a nuisance may lead to the bear being killed.

Summary

Alternative B would make a relatively high contribution to the recovery of grizzly bears in the Selkirk Recovery Area. This is based on the existing management direction, followed in all alternatives, that addresses:

- Human access management,
- Disposal of carcasses in range allotments that occur in the recovery area, and
- Proper storage of food, garbage and other attractants that may lead to human-bear interactions.

Canada Lynx

Direct and Indirect Effects

The forest management activities that influence the recovery and conservation of Canada lynx include: vegetation management that affect lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The Interagency Lynx Biology Team (ILBT 2013) developed conservation measures for core and secondary areas (USFWS 2005) to address each of these forest management activities, and for planners to consult when revising forest plans. These were used to evaluate the potential contribution of forest management alternatives to the recovery of Canada lynx.

When the U.S. Fish and Wildlife Service reviewed existing regulatory mechanisms to determine if listing Canada lynx as a federally protected species was warranted, they determined that existing forest plans provided inadequate protections (USFWS 2003b). Several national forests within the range of the Canada lynx subsequently amended their forest plans using the original Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) as a basis for current science. However, forest plans in Region 6 were not amended, thus, existing management plans do not address recent science and conservation recommendations (ILBT 2013), recovery objectives (USFWS 2005), or critical habitat (USFWS 2009). Alternative B does not include updated management direction for Canada lynx.

Vegetation management activities affect the distribution of lynx habitat components, can fragment habitats, and create sources of disturbance (ILBT 2013). As a result, risk factors associated with

vegetation management activities were identified and conservation measures were developed to address the risk factors (ILBT 2013). The conservation measures for vegetation management apply to lynx core areas and include use of the natural range of variability to mimic pattern and scale of natural disturbances and connectivity across the landscape while considering the future climate change (ILBT 2013). A conservation measure focused on the restoration of disturbance regimes in dry forests that occur in close proximity to lynx habitat to reduce the risk of uncharacteristically severe and frequent fires reaching lynx habitat. Finally, conservation measures were recommended to address the amount of vegetation management and the rate of habitat change (e.g., acres treated per decade) within lynx analysis units. There is no management direction in alternative B that would address these conservation measures.

Conservation measures were identified to address the effects that highways have on habitat connectivity for lynx in core areas (ILBT 2013). The Kettle-Wedge is a Core Area on the Colville National Forest. Alternative B does not address effects of highways on habitat connectivity.

Winter recreation can influence how lynx use habitats (ILBT 2013). To minimize the potential of negative effects from winter recreation, the ILBT (2013) developed conservation measures to reduce effects. Conservation measures for winter recreation in lynx core areas included reducing effects on habitat connectivity and to discourage expansion of over-the-snow routes that may influence lynx habitat use (ILBT 2013). This alternative does not address effects of over-the-snow recreation on lynx habitat.

The conservation measures for forest roads in lynx core areas include avoiding road reconstruction or upgrades that occur in lynx habitat and would result in increased traffic speeds or volumes (ILBT 2013). These measures would reduce the potential for vehicular traffic to result in a source of mortality to lynx. There is no management direction in alternative B to address this conservation measure.

The conservation measures for grazing in lynx core areas include management of riparian areas to assure adequate habitat for snowshoe hares, the primary prey species for Canada lynx (ILBT 2013). Alternative B includes management direction for grazing in riparian areas to mitigate effects to habitat for listed fish species, but does not include anything specific to Canada lynx or snowshoe hares.

Alternative B would provide limited management direction to address the direct and indirect effects of forest management activities on the recovery of Canada lynx. These direct and indirect effects include vegetation management that affect lynx habitat components (foraging, denning, travel), winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become source of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for Canada lynx. Alternative B would provide less protection for Canada lynx than the proposed action, alternatives R and P, and protection similar to no action and alternative O.

Climate Change

The potential effects of climate change on Canada lynx identified by the Interagency Lynx Biology Team (2013) included: (1) an upward shift in elevation or latitudinal distribution of lynx and prey, (2) a decrease in the amount of habitat and population size from reduced snow persistence and increased disturbance events (e.g., fires), (3) changes in demographic rates, such as survival and reproduction, and (4) changes in predator-prey relationships.

Climate change adaptations to address these effects include restoration of landscape-scale disturbance regimes to better mimic natural patterns and processes (Spies et al. 2010, Gaines et al. 2012, Lawler et al. 2014), and maintaining or restoring habitat connectivity to allow Canada lynx to adjust their ranges to changing conditions (Heller and Zavaleta 2009, ILBT 2013, Squires et al. 2013). There is limited management direction in the existing management plans to address these climate change adaptations.

Cumulative Effects

Past, present, and reasonably foreseeable actions that affect lynx habitat include timber harvest and fuels reduction, recreation, human development, and grazing on private and public lands. In addition, legal trapping of lynx, timber harvest, oil and gas development, mining and human access in British Columbia have and would continue to affect Canada lynx and their habitat.

Past vegetation management and large-scale fires on the Forest within lynx habitat have resulted in a distribution and amount of successional stages (early, mid, late) that are outside the HRV. Alternative B would not emphasize vegetation management activities to restore lynx habitats toward the HRV.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Grazing has occurred and would continue to take place on lands off of the Forest potentially impacting deciduous or riparian habitats for lynx prey species.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands from the public. This would increase the effects of human disturbance on lynx habitat and make areas that have relatively low human disturbance on NFS lands even more important for Canada lynx and other wildlife.

All Federal lands within Canada lynx core and secondary areas would use the Lynx Conservation Assessment and Strategy (LCAS) (ILBT 2013) as current science to guide project-level consultation and land management planning. The North Cascades National Park Complex recently revised their management plan to include the LCAS (NPS 2012). The Idaho Panhandle National Forests land management plan was recently revised to address the conservation measures identified in the LCAS (USDA Forest Service 2015b). The conservation of lynx on WDNR lands is guided by the Department of Natural Resources Lynx Habitat Management Plan (WDNR 1996, updated in 2002). The management plan for the Pend Oreille National Wildlife Refuge provides conservation measures to contribute to the recovery and viability of Canada lynx (USFWS 2000). Collectively, these management plans have addressed many of the conservation measures identified for Canada lynx (ILBT 2013) and would help mitigate potential cumulative effects that may occur from off-forest activities. In addition, no critical habitat was identified on the Colville National Forest or on adjacent lands (USFWS 2009).

In Canada, timber harvesting, oil and gas development, coal mining, and the proliferation of human access associated with these industries, have and would continue to affect lynx habitat. Legal trapping occurs north of the Forest in Canada and could reduce the potential for lynx to disperse into the lynx habitat on the Forest. Trapping is not legal in Idaho, Montana, or Washington.

Summary

Alternative B would make a relatively low contribution to the recovery of the Canada lynx in both the short (less than 20 years) and long (less than 50 years) term. This is because of the following:

- This alternative does not address the best available science and conservation measures identified in the recent version of the Lynx Conservation Assessment and Strategy (ILBT 2013), and USFWS Recovery Outline (USFWS 2005).
- This alternative does not address recommended climate change adaptations.
- This alternative relies on direction in existing management plans, which were found to provide inadequate regulatory mechanisms to address threats to the Canada lynx (USFWS 2003b).

Late-successional and Old Forest Habitats (Federally Listed Wildlife Species)

Woodland Caribou and Critical Habitat

Direct and Indirect Effects

The forest management activities that can influence the recovery and viability of woodland caribou include: (1) Vegetation management and natural disturbances affect the amount and connectivity of old forests of Engelmann spruce/subalpine fir and western red cedar/western hemlock, and (2) Human access that can increase the potential for poaching and cause disturbance to caribou during the critical winter period. These effects were used to evaluate the potential contribution of each alternative to the recovery of woodland caribou.

Alternative B would implement new science, recommendations from the Biological Opinion issued in 2001 (USFWS 2001) on the 1988 forest plan (USDA Forest Service 1988), and address the critical habitat designation (USFWS 2012). Vegetation management attempts to balance providing forest conditions for suitable caribou habitat while providing for timber production. Timber harvest has been cited as one of the primary factors that has reduced and fragmented old forest habitats for woodland caribou (USFWS 1994, USFWS 2012a).

A term and condition of the 2001 Biological Opinion was that the Forest develop a winter recreation strategy that protects important winter habitats for caribou while providing some level of winter recreation access. This strategy was developed (USDA Forest Service 2003) and would be fully integrated into this alternative. The strategy includes information and education about the effects of winter recreation on wildlife, monitoring and enforcement of areas closed to over-the-snow activities, and limitations on permitted over-the-snow activities. Collectively, these actions have reduced the impacts of winter recreation to caribou habitat while providing recreation opportunities in areas and at the time of the winter season when effects to caribou are minimal. However, alternative B would not emphasize reducing the negative effects of forest roads on wildlife habitat.

Climate Change

Climate change would likely alter the distribution and abundance of suitable caribou habitat, and would also change snow depths and persistence, which affect seasonal movements of mountain caribou (WDFW 2012a). The potential effects of climate change depend on the interaction, not only of seasonal temperatures and snowfall patterns, but also occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Management adaptations to address the effects of climate change include a focus on forest restoration and reducing non-climatic factors that affect wildlife populations (e.g., reducing impacts of winter recreation on habitat effectiveness for caribou). Alternative B would not implement these adaptations.

Cumulative Effects

The caribou recovery area is 1,477 square miles in size and includes the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States and 53 percent in British Columbia. The Idaho Panhandle National Forests recently revised the forest plan to address habitat and risk factors identified in the caribou recovery plan and critical habitat (USDA Forest Service 2015b). The caribou recovery team works cooperatively to address cumulative effects on woodland caribou.

Past activities on the Forest have impacted caribou habitat. Over-the-snow motorized use, prior to the implementation of the Winter Recreation Strategy (USDA Forest Service 2003), may have caused disturbance to caribou. The alternative would continue with implementation of the Winter Recreation Strategy, limiting the cumulative effects on caribou.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would not manage habitats toward HRV, and would not be as effective as the proposed action and alternative P at mitigating the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, particularly where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife such as caribou. However, because this alternative does not address the negative impacts of roads on wildlife habitat, it provides less opportunity to mitigate the cumulative effects of recreation.

Big game hunting continues on both sides of the U.S./Canada border. Encounters with hunters may result in caribou mortality as a result of mistaken identification. Legal harvest of caribou by Treaty Indians does occur, but with few statistics on the number of animals taken, it is difficult to evaluate the influence of this on the caribou population. Fatal collisions with vehicles occur on open roads in caribou habitat and are likely to continue. Predation by mountain lions, wolves, and other predators would continue, with the effect on the caribou population dependent on big game populations, predator populations, and a variety of other factors.

One important factor is how the Canadian officials decide to manage this herd. In the British Columbia portion of the recovery area, human activities that would continue to impact caribou habitat include gas, powerline, and international border corridors, recreation activities, timber harvest, and highways.

Summary

Implementation of alternative B would make a moderate contribution to the recovery of woodland caribou. The reasons for this determination are:

- This alternative addresses new science and risk factors identified in the recovery plan and critical habitat, but does not emphasize forest restoration as in the proposed action and alternative P.

- This alternative would formally adopt the winter recreation strategy for caribou habitat that was a term and condition of the 2001 Biological Opinion.
- This alternative attempts to balance the protection of caribou habitat with timber production, but does not address climate change adaptations that would enhance forest resiliency to the degree that other alternatives do.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the viability of LSOF-dependent surrogate species include: the loss of LSOF habitat from fire (Healy et al. 2008, Davis et al. 2011, 2015), vegetation treatments (e.g., timber harvest, thinning, prescribed fire) that affect forest structure (e.g., canopy closure, snags, downed wood) (Healy et al. 2008, Wisdom et al. 2008, Davis et al. 2011), management of roads that influence habitat effectiveness (Gaines et al. 2003), and protection of riparian areas that are an important element of LSOF habitats for some species (e.g., bald eagles).

Alternative B retains existing management direction for LSOF species that is based on a system of small management areas that retains LSOF habitat for specific management indicator species (e.g., American marten, barred owl, pileated woodpecker). These areas range in size from 75 to 300 acres, are relatively equally distributed, but have no way to provide for habitat connectivity between or among the small islands of habitat. These small islands of habitat are also highly susceptible to disturbances such as fire, insects, and tree diseases, with no redundancy or replacement habitat in the event they are lost. This system was based on minimizing the effects of protection of LSOF habitat on the timber harvest level. This system was deemed inadequate to provide for the viability of LSOF species, and thus, forest plans were amended with the Eastside Screens (USDA Forest Service 1995b).

The area in between the small islands of LSOF habitat is managed primarily through even-aged timber production, with some protections for elements of LSOF habitat, such as snags and downed wood. However, the combination of roads and timber harvest generally results in these areas having snag habitat below levels that would maintain viable populations of snag-dependent wildlife species. Again, the management direction in the original forest plan was deemed inadequate, thus, additional direction was adopted through the Eastside Screens (USDA Forest Service 1995b). The Eastside Screens restrict the cutting of trees larger than 21 inches in diameter.

Alternative B would not provide management direction that would reduce the negative effects of roads on wildlife habitats. Currently, there are about 4,000 miles of road, resulting in an overall road density on the roaded portion of the Forest of about 3 miles per square mile, which is considered a low level of habitat effectiveness for many surrogate species (Wisdom et al. 2000, Gaines et al. 2003).

Overall, alternative B would provide management direction for LSOF habitat that is similar to no action and alternative O, but would provide less LSOF habitat than alternatives R and P. This alternative would not improve the viability outcomes for surrogate wildlife species that are dependent on LSOF habitats in the short (less than 20 years) or long (less than 50 years) time periods.

Climate Change

The sensitivity of LSOF-associated surrogate wildlife species to the effects of climate change was identified as medium for pileated woodpecker, and high for northern goshawk and American marten

(CCSD 2013). The primary effect of climate change is the loss of LSOF habitats due to altered disturbance regimes (CCSD 2013).

Since the mid-1980s, the size and intensity of large wildfires in the western United States have increased markedly (Westerling et al. 2006), due, in part, to a reduction in fuel moisture driven by increased temperature and lower snowpack. Increases in fire risk and severity have been also been driven, in part, by increased fuel loads because of fire suppression practices used over the last century (McKenzie et al. 2004). Predicted increases in spring and summer temperature identified in many climate change models would exacerbate the frequency and intensity of disturbances such as fire (McKenzie et al. 2004, Wotton and Flannigan 1993) and defoliation caused by forest insects (Littell et al. 2009). In the interior Columbia Basin, Littell et al. (2009) predicted that the area burned is likely to double or even triple by 2050. Climate-driven changes in fire regimes would likely be the dominant driver of changes to forests and LSOF habitats in the western United States over the next century (McKenzie et al. 2004).

A landscape restoration approach is not emphasized in alternative B. Landscape-scale restoration has been identified as an adaptive strategy to create landscapes more resilient to climate change (Spies et al. 2010, Gaines et al. 2012) and to maintain LSOF habitats (Lawler et al. 2014). The emphasis on restoration of resiliency would result in landscapes, including disturbance regimes that are more resilient to climate change, through the application of strategically located restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior may be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires may be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007).

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore LSOF habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and LSOF habitat protections in the original forest plan were found to be inadequate and were amended by the Eastside Screens (USDA Forest Service 1995b).

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would not manage habitats toward HRV, and would not be as effective as the proposed action and alternative P at mitigating for the cumulative effects of off-forest timber harvest.

Fuels reduction projects are possible on all land ownerships, particularly where they are near residences.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would

increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative B would make a relatively low contribution to the viability of LSOF-dependent surrogate wildlife species. This determination is based on the following:

- The LSOF habitat provided by this alternative would provide minimal contribution to the viability of LSOF surrogate wildlife species.
- This alternative does not emphasize restoration of landscape resiliency to reduce the loss of LSOF habitats to uncharacteristically severe wildfires.
- The protection and conservation of key elements of LSOF habitat such as large trees and snags, and riparian areas is limited.
- The alternative would not result in the restoration of habitat effectiveness by reducing the negative effects of roads on LSOF habitats.

Motorized Recreation and Road Access

Proposed Species – Wolverine

Direct and Indirect Effects

Motorized recreation and the use of forest roads may influence the habitat use and populations of wolverines. These potential effects include displacement from key habitats, disturbance during critical periods, and an increased risk of mortality (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail-associated factors that influence wolverine). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative B would have limited opportunity to reduce the negative effects of roads on wolverine habitat because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and only address big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness (Wisdom et al. 2000) for wolverines.

This alternative would not reduce the impacts of winter or summer-motorized trail use on wolverine habitat effectiveness. Overall, alternative B would provide a level of habitat effectiveness for wolverines that is similar to no action and alternative O, and less than the proposed action and alternatives R and P.

Climate Change

The sensitivity of wolverine to the effects of climate change are considered to be high (CCSD 2013). An important climate change adaptation that has been recommended for wolverines is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitat can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wolverines to adjust their ranges as conditions change. The implementation of alternative B includes management direction to make very limited improvement to habitat effectiveness for wolverines by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited emphasis of alternative B on reducing the negative effects of roads on wildlife and continued development of private lands (located mostly in east-west valley bottoms that bisect the Okanogan-Wenatchee National Forest) means that management of roads and motorized trails on Federal lands is even more important to habitat for wolverine.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance, becoming more important to wolverines.

Summary

Implementation of alternative B would make a relatively low contribution to the maintenance and restoration of habitat for wolverines, and result in a May Impact determination. This would occur because:

- The alternative includes limited management direction to reduce the impact of roads on habitat effectiveness for surrogate wildlife species.
- This alternative does not reduce the impacts summer or winter-motorized trails have on habitat effectiveness for surrogate wildlife species in two watersheds.
- This alternative does little to address the cumulative effects for human access and development on wildlife habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Motorized recreation and the use of forest roads influence the viability of surrogate wildlife species. These potential effects include displacement from key habitats, disturbance during critical time periods, and the risk of mortality caused by collisions with vehicles (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wildlife). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative B would have limited opportunity to reduce the negative effects of roads on surrogate species' habitats because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and emphasize big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness for surrogate wildlife species (Wisdom et al. 2000).

This alternative would reduce summer-motorized trail use by 30 miles within two watersheds, thus, improving habitat effectiveness for surrogate species. Overall, this alternative would provide a level of habitat effectiveness for surrogate wildlife that is similar to no action and alternative O, and less than the proposed action and alternatives R and P.

Climate Change

The sensitivity of surrogate wildlife species used to assess the effects of roads and motorized recreation is rated as moderate for bighorn sheep, and high for Harlequin duck, Canada lynx, and wolverine (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats (especially riparian and wetland habitats) can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wildlife to adjust their ranges as conditions change. The implementation of this alternative includes management direction to make very limited improvement to habitat effectiveness for surrogate wildlife by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative impacts of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited management direction in the 1988 forest plan to reduce the negative effects of roads on wildlife and continued development of private lands (located mostly in north-south valley bottoms that bisect the Forest) means that management of roads and motorized trails on Federal lands is even more important to the viability of surrogate wildlife species.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative B would make a relatively low contribution to the viability of surrogate wildlife species whose habitats are influenced by motorized access. This would occur because:

- The alternative includes limited management direction to reduce the impact of roads on habitat effectiveness for surrogate wildlife species,
- This alternative does reduce the impacts summer-motorized trails have on habitat effectiveness for surrogate wildlife species in two watersheds, and
- This alternative does little to address the cumulative effects for human access and development on wildlife habitats.

Livestock Grazing

Surrogate Wildlife Species

Direct and Indirect Effects

Grazing can influence habitats of surrogate wildlife species by removing key habitat elements (e.g., dense shrubs for MacGillivray's warbler and fox sparrow), especially in riparian habitats; alter disturbance regimes that maintain habitat structure (e.g., frequent fires in dry forests and grasslands keep open canopy for western bluebird); and influence the availability of important prey items (e.g., squirrels for golden eagles). To address the potential effects on surrogate wildlife species, the management direction regarding grazing in riparian habitat and upland habitats for each alternative was assessed.

Alternative B would continue with the existing direction for riparian habitats found in the 1988 forest plan and amendment (PACFISH, USDA Forest Service 1995a). Presently, many riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would have little effect on altering the distribution of livestock that would allow riparian habitats to recover.

This alternative does not include ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) or standards to protect unique habitats. Alternative B would not alter the number of livestock, the intensity of grazing, nor the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. This alternative would make a limited contribution to the viability of surrogate wildlife species that were used to assess the effects of grazing on wildlife habitats.

Climate Change

Habitats that are particularly sensitive to the effects of climate change include riparian areas (including wetlands) and alpine areas (Lawler et al. 2014). A management adaptation to make these habitats more resilient to climate change is to reduce the effects of non-climatic stressors (e.g., roads, intense grazing, etc.) (Lawler et al. 2014). This alternative would not include management direction that would restore the resiliency of habitats that are sensitive to climate change.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Panhandle National Forests, it is managed to accommodate other public land uses, such as contributing to the viability of surrogate wildlife species. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific wildlife habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for wildlife habitats on Federal lands that contribute to the viability of surrogate wildlife species.

Alternative B does not include management direction for some key habitats that would better account for the cumulative effects of grazing on wildlife habitats.

Summary

Implementation of alternative B would make a relatively low contribution to viability for surrogate wildlife species that are influenced by domestic grazing. This determination is based on:

- This alternative does not include management direction for key habitats that would reduce the negative effects of grazing and improve riparian habitat condition, and
- This alternative would not change the number, grazing intensity, or distribution of livestock.

Habitat Connectivity

Surrogate Wildlife Species

Direct and Indirect Effects

There are a number of forest management activities that influence habitat connectivity for surrogate wildlife species. These include the amount, patch size, and spatial arrangement of suitable habitats; location and density of motorized travel routes, especially in relation to riparian and LSOF habitats.

Current management direction is used in alternative B and is focused on providing habitat connectivity for LSOF species through the identification of connectivity corridors during project planning (as per Eastside Screens, USDA Forest Service 1995b). Additional provisions for low to moderate mobility LSOF species are provided through Riparian Management Zones. There is no management direction that addresses habitat connectivity for wildlife species that are not associated with LSOF habitats (e.g., wide-ranging carnivores, Singleton et al. 2002).

Implementation of this alternative would have limited opportunity to reduce the negative effects of roads on surrogate species' habitats because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and only address big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness for surrogate wildlife species.

Alternative B would reduce summer-motorized trail use by 30 miles within two watersheds, thus, reducing impacts to surrogate species habitat effectiveness. This alternative would not result in changes to habitat connectivity compared to current conditions (table 188).

Table 188. Dispersal habitat suitability for surrogate wildlife species under alternative B, by proportion of planning area (based on desired conditions)

Surrogate Species used to Assess Habitat Connectivity	Low Dispersal Habitat Suitability	Moderate Dispersal Habitat Suitability	High Dispersal Habitat Suitability
American Marten	41%	39%	20%
Canada Lynx	7%	60%	33%
Wolverine	8%	42%	44%

1/See Singleton et al. (2002) and Gaines et al. (2017) for a definition of and methods used to determine dispersal habitat suitability.

Climate Change

Maintaining and restoring ecological connectivity is the most oft-cited climate adaptation strategy for biodiversity conservation (Heller and Zavaleta 2009, Opdam and Wascher 2004, Parmesan 2006, Spies et al. 2010) and has been identified as an important adaptation strategy for wildlife in northeastern Washington (Gaines et al. 2012). This is because species' range shifts have been the primary biological response to past episodes of climatic change, yet widespread anthropogenic barriers to movement would now challenge species' ability to respond (Price 2002, Thomas and Lennon 1999, Wormworth and Mallon 2006).

Alternative B does provide direction to address habitat connectivity for some highly mobile LSOF wildlife species. However, there is no management direction that addresses habitat connectivity for wildlife species not associated with LSOF habitats (e.g., wide-ranging carnivores), nor does this alternative address the effects of forest roads on habitat connectivity. Much has been learned about the effects of climate change on wildlife since the Forest plans were developed and amended, and this alternative does not adequately address recommended climate adaptations to maintain or restore habitat connectivity for a wide-array of wildlife species.

Cumulative Effects

Past, present, and reasonably foreseeable human developments and transportation infrastructure, along with land ownership patterns create cumulative impacts that limit options to conserve and restore regional connectivity. Regional habitat connectivity has been evaluated for a variety of wildlife species, including the surrogate wildlife species used to evaluate connectivity in this planning area (Singleton et al. 2002, WWHCWG 2010). These assessments have shown the importance of the Colville National Forest in providing stepping-stone habitats between the Cascades and Selkirk Mountains (Singleton et al. 2002, WWHCWG 2010, Proctor et al. 2015). Connectivity from the Cascades to the Kettle Range to the Selkirk Mountains is interrupted by transportation corridors and human developments associated with the Okanogan, Upper Columbia, and Pend Oreille river valleys (Singleton et al. 2002, WWHCWG 2010). Additionally, connectivity planning in southern British Columbia identified linkage areas that could greatly enhance wildlife movements between the Selkirk Mountains and the Purcell Mountains (Apps et al. 2007, Proctor et al. 2015).

Reducing the direct and indirect effects of roads on wildlife habitats would contribute to the maintenance and restoration of habitat connectivity, including cumulative effects, but is not emphasized in alternative B. Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Alternative B would provide limited direction that addresses habitat connectivity, and most is relevant to wildlife species associated with LSOF habitats. Thus, the implementation of alternative B would provide a relatively low contribution to the viability of surrogate wildlife species used to assess habitat connectivity. The primary reasons for this conclusion include:

- No management direction to address wildlife species that are not associated with LSOF habitats (e.g., wide-ranging carnivores),
- Limited management direction that addresses the effects of roads and road networks on habitat connectivity, despite this being a primary factor that influences wildlife movements.

Snag Habitat

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the availability of habitat for snag-dependent surrogate species include firewood cutting (Bate et al. 2007, Hollenbeck et al. 2013), the loss of snag habitat along roads and at recreation sites from hazard tree reduction (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008, FSM 7700), and removal of snags during timber harvest for safety reasons (Wisdom et al. 2008). The forest plan includes management direction for snag habitat to address the potential loss of habitat in timber sale operations. However, this alternative includes a 21-inch-diameter limit on the size of snags that can be cut for firewood.

Alternative B includes 44 percent of the Forest that emphasizes even-aged timber harvest, resulting in the potential loss of snag habitat for safety reasons. An additional 31 percent of the Forest would be actively managed for restoration.

Implementation of alternative B would have limited opportunity to reduce the negative effects of roads on surrogate species habitats because management direction for roads would be for no net loss of road miles (approximately 4,000 miles). Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which would result in a considerable loss of snag habitat for safety and hazard tree reduction (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008).

Overall, alternative B would provide habitat protection for snag-dependent wildlife similar to no action and alternative O, but less than the proposed action and alternatives R and P. The viability outcomes for surrogate wildlife species dependent on snag habitat would not be improved and would remain below the historical capability.

Climate Change

Surrogate wildlife species associated with snag habitats include the pileated woodpecker, white-headed woodpecker, black-backed woodpecker, and Lewis's woodpecker, which are rated as medium sensitivity to climate change, and the western bluebird as high sensitivity (CCSD 2013). The primary effect that is anticipated from climate change is the loss of habitat due to altered disturbance regimes. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for snag-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change, loss of snag habitat from relatively intense timber harvest, and loss of snag habitat associated with hazard tree removal along roads. The increase in fire associated with climate change could create a short-term gain in snag habitat followed by a long-term (80 to 100 years, Harrod et al. 1998) reduction as snags attrition occurs.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and more rigorous snag requirements to contribute to the viability of snag-dependent wildlife (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitats and current required snag

densities make limited contribution to the viability of surrogate wildlife species. The limited management direction for snag habitat on non-Federal lands adjacent to the planning area, places additional emphasis on providing for viability populations of snag-dependent wildlife species on Federal lands. Fuels reduction projects are possible on all land ownerships, particularly where they are near residences. These can be done in such a way that they restore wildlife habitat affected by fire exclusion, but treatments can lead to the loss of snag habitat for safety reasons.

Summary

Implementation of alternative B would make a relatively low contribution to the viability of snag-dependent surrogate wildlife species. This determination is based on:

- This alternative would not focus on landscape restoration of habitats and disturbance regimes that influence the availability and condition of snag habitat.
- This alternative would make limited reductions in the negative effects of roads on snag habitat.
- Snag habitat would be reduced due to timber harvest and active management, and an extensive road network would further reduce snag habitat for safety reasons.

Riparian Habitats

Federally Listed Wildlife Species

Yellow-billed Cuckoo - Threatened

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent species such as the yellow-billed cuckoo include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In this alternative, management direction for watersheds and riparian habitats is not consolidated into one consistent set of plan components (e.g., direction is in both the 1988 forest plan and in the INFISH amendment). Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. Alternative B includes smaller riparian management area widths along intermittent streams, lakes, and ponds in the areas covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of alternative B would provide limited management direction to reduce the effects of roads on riparian habitats. Overall, this alternative would provide habitat protection for riparian-associated wildlife that is more than no action and alternative O, similar to the Proposed action, and much less than alternatives R and P.

Climate Change

Climate change is expected to have an overall negative effect throughout the range of the yellow-billed cuckoo (Post et al. 2009, USFWS 2013). Riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The emphasis of alternative B is on relatively intensive timber management. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be

emphasized. Thus, habitat for the yellow-billed cuckoo is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and some loss of riparian habitat from timber harvest. In addition, a climate change adaptation for riparian habitats is to restore their resiliency by reducing the negative effects of roads (Lawler et al. 2014). However, this alternative has limited opportunity for managers to reduce road effects on riparian habitats.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995; ACS-USDA Forest Service 1994).

On private lands, Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian-associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections that occur on private lands.

Summary

The implementation of alternative B would make a relatively low contribution to the recovery of the yellow-billed cuckoo. This determination is based on the following:

- This alternative would not address the negative effects that roads have on riparian habitats.
- This alternative would not consolidate and make more consistent management direction for riparian habitats using standards (as in alternatives R and P) and would have smaller riparian management areas.
- This alternative would not emphasize landscape restoration that would reduce the potential effects of uncharacteristically severe fires on riparian habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent surrogate species include management of roads, recreation sites, grazing, and vegetation treatments that occur within riparian habitats.

In alternative B, management direction for watersheds and riparian habitats is not consolidated into one consistent set of plan components (e.g., direction is in both the 1988 forest plan and in the INFISH amendment). Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes smaller riparian management area widths (compared to other alternatives except no action) along intermittent streams, lakes, and ponds in the areas covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of this alternative would provide limited management direction to reduce the effects of roads on riparian habitats. Overall, this alternative would provide habitat protection for riparian-associated wildlife that is similar to the no action alternative, less than the proposed action and alternative O, and much less than alternatives R and P. The viability outcome for surrogate wildlife species would not be improved and would remain below the historical capability.

Climate Change

Some of the riparian-associated surrogate species are rated as high sensitivity to climate change (CCSD 2013) and riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The emphasis of alternative B is on timber management. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for riparian-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and some loss of riparian habitat from timber harvest. In addition, an important adaptation for climate change for riparian habitats is to restore their resiliency by reducing the negative effects of roads (Lawler et al. 2013). However, this alternative has limited opportunity for managers to use to reduce road effects on riparian habitats and does not emphasize watershed restoration.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995, ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections and cumulative effects that occur on private lands.

Summary

Implementation of alternative B would make a relatively low contribution to the viability of riparian-dependent surrogate wildlife species. This determination is based on the following:

- This alternative would not address the negative effects that roads have on riparian habitats.
- This alternative would not consolidate and make more consistent management direction for riparian habitats using standards and would have smaller riparian management areas.
- This alternative would not emphasize landscape restoration that would reduce the potential effects of uncharacteristically severe fires on riparian habitats.

Species of Management Interest

Deer and Elk

Direct and Indirect Effects

Forest management activities can influence deer and elk populations and habitat use. Vegetation management activities may affect the distribution and abundance of cover and forage. Adequate forage is particularly important during the summer and fall before the following birthing season when this can have a positive effect on the condition of pregnant females (Lenz 1997, Cook 1998, Cook 2002, Cook et al. 2004, Cook et al. 2005, Cook et al. 2013). The management of forest roads and trails can influence how deer and elk use habitats, and influence the interactions between deer and elk (Rowland et al. 2005, Wisdom et al. 2005a, b). Additionally, deer and elk can compete with domestic livestock for both food resources (Findholt et al. 2005) and space (Coe et al. 2001, Coe et al. 2005). Thus, the potential effects that vegetation management, road and trail management, and grazing management can have on deer and elk habitats and population are evaluated for each of the alternatives.

Under alternative B, cover and forage for deer and elk on winter ranges emphasize the retention of winter thermal cover. Considerable research has shown that the management of deer and elk winter habitat should be less focused on the retention of thermal cover, and more focused on the availability of forage on summer and fall habitats (see Cook et al. 2005 and 2013 for a review). This alternative would not incorporate the current science about the role of providing adequate forage quality and quantity in providing for deer and elk populations.

This alternative would not alter the current habitat effectiveness for deer and winter ranges through road management. The Selkirk Elk Herd has a moderate level of habitat effectiveness (moderate level of human influence) on their winter ranges. Currently, in 38 percent of the watersheds, winter habitat for deer has a high habitat effectiveness index (low level of human influence), 38 percent habitat a moderate level of habitat effectiveness (moderate level of human influence), and 24 percent habitat a low level of habitat effectiveness (high level of human influence). Management direction for winter ranges is based on road density standards. Rowland et al. (2005) found road density to be a poor indicator of habitat use by deer and elk and recommended the use of the zone of influence instead. This is incorporated into the proposed action and alternatives R and P.

Under alternative B, there would be no changes to current grazing practices that occur on national forest allotments. Degraded range conditions would be maintained or slowly be improved, likely having effects to deer and elk habitat use and populations (Coe et al. 2001, 2005, Findholt et al. 2005). More robust range management direction (as in the other alternatives) would not be adopted.

Climate Change

Deer and elk have a low level of sensitivity to the effects of climate change due to their ability to tolerate a relatively wide range of climatic conditions, their high mobility, and as habitat generalists (CCSD 2013). However, alternatives that restore landscape pattern and functions while reducing the effects of roads on deer and elk summer and winter habitats would provide more resilient deer and elk populations. Alternative B does not emphasize landscape-scale restoration, nor does it provide consistent and effective management direction for roads that would restore habitat effectiveness for deer and elk.

Cumulative Effects

The historical cattle and sheep grazing that occurred on portions of the Forest severely degraded range conditions (Wissmar et al. 1994, Bunting et al. 2002). These conditions, combined with current domestic (cattle) and wild ungulate grazing (primarily elk and deer), have resulted in maintenance or slow recovery of poor range conditions in some areas (Wissmar et al. 1994, Bunting et al. 2002). In turn, these poor range conditions have had negative effects on some important unique habitats such as riparian areas and meadows (Beebe et al. 2002, Evans 2006, Lehmkuhl et al. 2013). This alternative would not result in more rigorous grazing management direction that would help to address this situation.

Winter ranges for deer and elk occur on Federal lands, adjacent wildlife management areas managed by the State, and private lands. Elk herd management plans (WDFW 2014) provide guidance for elk management on State lands and make recommendations for elk management on NFS lands. Management plans for deer include the White-tailed Deer Management Plan that provides direction to manage hunting to either maintain deer populations (WDFW 2010) and a general plan for mule deer (WDFW 2016), which are widely distributed across the Forest. A considerable amount of historical winter range for deer and elk is now in private land ownership or under the waters of Lake Roosevelt (created by the Grand Coulee Dam). The cumulative effects of existing management plans (State and Federal lands) would provide for conditions that contribute to sustainable populations of deer and elk, while considering the effects of private land development.

Summary

Implementation of alternative B would make a relatively low contribution to the conditions that support sustainable populations of deer and elk. This is based on the following:

- This alternative would not address new science that recommends de-emphasizing the importance of winter thermal cover and increasing the emphasis on summer and fall forage quality and quantity.
- This alternative does not provide consistent and effective direction on the management of roads and trails to restore habitat effectiveness on deer and elk summer and winter ranges.
- This alternative would not include more rigorous management direction to improve the conditions of key habitats, such as riparian areas and meadows that are in poor condition due to the cumulative effects of past grazing practices, and current domestic and wild ungulate grazing.

Native Pollinators

Direct and Indirect Effects

Forest management activities can influence native pollinator populations and include vegetation management, grazing, and placement of apiaries (USDA 2015).

Alternative B does not include desired conditions to restore forest structure and composition at the landscape scale. This alternative does not emphasize the restoration of disturbance regimes or the application of restorative treatments that enhance native plant communities and native pollinator habitats (Dodson et al. 2008, Neill and Puettmann 2013).

While this alternative does promote the restoration of native plant communities, it does not include ecologically based desired conditions for vegetation or standards to protect unique habitat from grazing that are based on more recent science and monitoring. Alternative B would not alter the

number of livestock, intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year.

This alternative does not include plan direction for the placement of apiaries that would reduce the potential for non-native pollinators to compete with rare native pollinators.

Climate Change

Native pollinators are considered to be sensitive to the effects of climate change, although our understanding of climate effects is very limited. Alternatives that address non-climate-related factors such as native vegetation restoration (proposed action and alternative P) and reducing the impacts of grazing would be more beneficial than this alternative in maintaining and restoring habitat for native pollinators.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Pan Handle National Forest, it is managed to accommodate other public land uses. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for native pollinator habitats on Federal lands. This alternative does not include management direction for some key habitats that would better account for the cumulative effects of grazing on pollinator habitats.

Summary

The implementation of alternative B would make a relatively low contribution to maintenance and restoration of habitat for native pollinators. This determination is based on:

- While this alternative does promote the restoration of native plant communities, other action alternatives (proposed action and alternative P) place a greater emphasis on landscape-scale restoration.
- This alternative would not change the number, grazing intensity or distribution of livestock.
- This alternative does not include plan direction to guide the placement of apiaries that would reduce the potential for competition between non-native and rare native pollinators.

Alternative O

Federally Listed Wildlife Species

Grizzly Bear

Direct and Indirect Effects

Forest activities that influence the recovery of the grizzly bear include: human access that can displace bears from important seasonal habitats or increase the risk of bear-human interactions, disposal of livestock carcasses within range allotments to avoid attracting bears to a potential food source, and the storage of food and garbage at recreation sites to reduce the potential for bears to associate humans with food sources.

Management of grizzly bears does not vary between alternatives. Existing management direction provides standards for human access, disposal of livestock carcasses, and food and garbage storage

within the Selkirk Grizzly Bear Recovery Area (IGBC 1998, USDA Forest Service 1988, USFWS 1993, USDI 2001). Existing standards have largely been met and would continue to be followed.

Climate Change

Grizzly bears have been identified as having a low sensitivity to climate change because they are opportunistic, eat a diverse array of food resources, and are highly adaptable (Servheen and Cross 2010, CCSD 2013). Anticipated impacts may include changes in the timing of denning due to longer snow-free periods and reduced snowpack (Lawler et al. 2014) and changes in the availability of food sources (Servheen and Cross 2010). These changes may put bears at risk of negative human interactions for a longer period of time each year (Servheen and Cross 2010). This would make education, proper food and garbage storage, carcass disposal measures, and human access management that much more important.

Cumulative Effects

The primary reasons for the low population of grizzly bears in the recovery zone are past persecution and human-caused mortality of bears. Legal protections are now in place to protect grizzly bears. Information and education programs, sanitation measures, and access management have and would continue to be used to aid in the recovery of grizzly bears in the Selkirk Recovery Area.

Past, present, and reasonable foreseeable future actions that could affect grizzly bears include timber harvest and associated road construction, recreational activities that can cause disturbance to bear and create potential for human-bear conflicts, and human development that fragments grizzly bear habitat. Cumulative effects are evaluated across the recovery area by tracking activities within GBMUs. Other land managers have adopted and are following similar management direction (USDA Forest Service 2015b), and overall recovery is coordinated by the Selkirk Grizzly Bear Management Subcommittee. GBMUs that occur on the Colville National Forest include the Le Clerc, Salmo-Priest, and Sullivan-Hughes. The contribution made on Federal lands to grizzly bear recovery would help to mitigate potential cumulative effects from off-forest activities. However, because alternative O does not address reducing the negative impacts of roads on wildlife habitats like the proposed action and alternatives R and P, it does less to mitigate cumulative effects.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, particularly where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance (e.g., core areas) to become more important to wildlife, such as grizzly bears.

Black bear hunting on both sides of the international border within the Selkirk Recovery Area has the potential to add cumulatively to the mortality of grizzly bears. Hunters that encounter grizzly bears may mistakenly identify the bear, kill the bear in self-defense, or opportunistically poach the bear. Human access management within the recovery area is key to reducing the risk of mortality to grizzly bears from black bear hunting.

On private lands, the presence of garbage, pet food, fruit trees, or other attractants may lure bears into conflict situations. Bears that become habituated or a nuisance may lead to the bear being killed.

Summary

Alternative O would make a relatively high contribution to the recovery of grizzly bears in the Selkirk Recovery Area. This is based on the existing management direction, followed in all alternatives, that addresses:

- Human access management,
- Disposal of carcasses in range allotments that occur in the recovery area, and
- Proper storage of food, garbage and other attractants that may lead to human-bear interactions.

Canada Lynx

Direct and Indirect Effects

The forest management activities that influence the recovery and conservation of Canada lynx include: vegetation management that affects lynx habitat components, winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become sources of lynx mortality at high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx (ILBT 2013). The Interagency Lynx Biology Team (ILBT 2013) developed conservation measures for core and secondary areas (USFWS 2005) to address each of these forest management activities, and for planners to consult when revising forest plans. These were used to evaluate the potential contribution of forest management alternatives to the recovery of Canada lynx.

When the U.S. Fish and Wildlife Service reviewed existing regulatory mechanisms to determine if listing Canada lynx as a federally protected species was warranted, they determined that existing forest plans provided inadequate protections (USFWS 2003b). Several national forests within the range of the Canada lynx subsequently amended their forest plans using the original Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000) as a basis for current science. However, forest plans in Region 6 were not amended, thus, existing management plans do not address recent science and conservation recommendations (ILBT 2013), recovery objectives (USFWS 2005), or critical habitat (USFWS 2009). Alternative O does not include management direction for Canada lynx.

Vegetation management activities affect the distribution of lynx habitat components, can fragment habitats, and create sources of disturbance (ILBT 2013). The LCAS-recommended conservation measures for vegetation management apply to lynx core areas and include use of the natural range of variability to mimic pattern and scale of natural disturbances and connectivity across the landscape while considering the future climate change (ILBT 2013). A conservation measure focused on the restoration of disturbance regimes in dry forests, which occur in close proximity to lynx habitat, to reduce the risk of uncharacteristically severe and frequent fires reaching lynx habitat. A final recommendation in the LCAS is a conservation measure to limit the amount of vegetation management and the rate of habitat change (e.g., acres treated per decade) within lynx analysis units. There is no management direction in alternative O that addresses these conservation measures.

Conservation measures were identified to address the effects that highways have on habitat connectivity for lynx in core areas (ILBT 2013). The Kettle-Wedge is a Core Area on the Colville National Forest.

Winter recreation can influence how lynx use habitats (ILBT 2013). To minimize the potential negative effects from winter recreation, the ILBT (2013) developed conservation measures for lynx

core areas that include reducing effects on habitat connectivity and discouraging expansion of over-the-snow routes that may influence lynx habitat use (ILBT 2013). This alternative does not address effects of over-the-snow recreation on lynx habitat.

The conservation measures for forest roads in lynx core areas include avoiding road reconstruction or upgrades that occur in lynx habitat and would result in increased traffic speeds or volumes (ILBT 2013). These measures would reduce the potential for vehicular traffic to result in a source of mortality to lynx. There is no management direction in alternative O to address this conservation measure.

The conservation measures for grazing in lynx core areas include management of riparian areas to assure adequate habitat for snowshoe hares, the primary prey species for Canada lynx (ILBT 2013). This alternative includes management direction for grazing in riparian areas to provide for habitat for listed fish species, but does not include anything specific to Canada lynx or snowshoe hares.

Alternative O would provide limited management direction to address the direct and indirect effects of forest management activities on the recovery of Canada lynx. Forest management activities that can have direct and indirect effects on Canada lynx include vegetation management that affects lynx habitat components (foraging, denning, travel), winter recreation that influences habitat connectivity and lynx habitat use, forest roads that can become source of lynx mortality as high traffic volumes and speeds, and grazing effects to riparian areas that provide habitat for snowshoe hares, a primary food resource for lynx. Alternative O would make limited contributions to the recovery of Canada lynx, less than the proposed action and alternatives R and P, and similar to no action and alternative B.

Climate Change

The potential effects of climate change on Canada lynx identified by the Interagency Lynx Biology Team (2013) included: (1) An upward shift in elevation or latitudinal distribution of lynx and prey; (2) A decrease in the amount of habitat and population size from reduced snow persistence and increased disturbance events (e.g., fires); (3) Changes in demographic rates, such as survival and reproduction; and (4) Changes in predator-prey relationships.

Climate change adaptations to address these effects include restoration of landscape-scale disturbance regimes to better mimic natural patterns and processes (Spies et al. 2010, Gaines et al. 2012, Lawler et al. 2014), and maintaining or restoring habitat connectivity to allow Canada lynx to adjust their ranges to changing conditions (Heller and Zavaleta 2009, ILBT 2013, Squires et al. 2013). There is limited management direction in alternative O to address these climate change adaptations.

Cumulative Effects

Past, present, and reasonably foreseeable actions that affect lynx habitat include timber harvest and fuels reduction, recreation, human development, and grazing on private and public lands. In addition, legal trapping of lynx, timber harvest, oil and gas development, mining and human access in British Columbia have and would continue to affect Canada lynx and their habitat.

Past vegetation management and large-scale fires on the Forest within lynx habitat have resulted in a distribution and amount of successional stages (early, mid, late) that are outside the HRV. Alternative O would not emphasize vegetation management activities to restore lynx habitats toward the HRV.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Grazing has occurred and would continue to take place on lands off of the Forest, potentially impacting deciduous or riparian habitats for lynx prey species.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands from the public. This would increase the effects of human disturbance on lynx habitat and make areas that have relatively low human disturbance on NFS lands even more important to Canada lynx and other wildlife.

All Federal lands within Canada lynx core and secondary areas would use the Lynx Conservation Assessment and Strategy (LCAS) (ILBT 2013) as current science to guide project-level consultation and land management planning. The North Cascades National Park Complex recently revised their management plan to include the LCAS (NPS 2012). The Idaho Panhandle National Forests land management plan was recently revised to address the conservation measures identified in the LCAS (USDA Forest Service 2015b). The conservation of lynx on WDNR lands is guided by the Department of Natural Resources Lynx Habitat Management Plan (WDNR 1996, updated in 2002). The management plan for the Pend Oreille National Wildlife Refuge provides conservation measures to contribute to the recovery and viability of Canada lynx (USFWS 2000). Collectively, these management plans have addressed many of the conservation measures identified for Canada lynx (ILBT 2013) and would help mitigate potential cumulative effects that may occur from off-forest activities. In addition, no critical habitat was identified on the Colville National Forest or on adjacent lands (USFWS 2009).

In Canada, timber harvesting, oil and gas development, coal mining, and the proliferation of human access associated with these industries, have and would continue to affect lynx habitat. Legal trapping occurs north of the Forest in Canada and could reduce the potential for lynx to disperse into the lynx habitat on the Forest. Trapping is not legal in Idaho, Montana, or Washington.

Summary

Alternative O would make a relatively low contribution to the recovery of the Canada lynx in both the short (less than 20 years) and long (less than 50 years) term. This is because of the following:

- This alternative does not address the best available science and conservation measures identified in the recent version of the Lynx Conservation Assessment and Strategy (ILBT 2013), or USFWS Recovery Outline (USFWS 2005);
- This alternative does not address recommended climate change adaptations; and
- Existing regulatory mechanisms (management plans) were found to be inadequate to address the threats to Canada lynx (USFWS 2003b).

Late-successional and Old Forest Habitats (Federally Listed Wildlife Species)

Woodland Caribou and Critical Habitat

Direct and Indirect Effects

The forest management activities that can influence the recovery and viability of woodland caribou include: (1) Vegetation management and natural disturbances that affect the amount and connectivity of late-successional and old forest habitats of Engelmann spruce/subalpine fir and western redcedar/western hemlock, and (2) Human access can increase the potential for poaching and cause disturbance to caribou during the critical winter period. These effects were used to evaluate the potential contribution of each alternative to the recovery of woodland caribou.

Alternative O would implement new science, recommendations from the Biological Opinion issued in 2001 (USFWS 2001) on the 1988 forest plan (USDA Forest Service 1988), and address the critical habitat designation (USFWS 2012). Vegetation management attempts to balance providing forest conditions for suitable caribou habitat while providing for timber production. Timber harvest has been cited as one of the primary factors that has reduced and fragmented old forest habitats for woodland caribou (USFWS 1994, USFWS 2012).

A term and condition of the 2001 Biological Opinion was that the Forest develop a winter recreation strategy that protects important winter habitats for caribou, while providing some level of winter recreation access. The strategy includes information and education about the effects of winter recreation on wildlife, monitoring and enforcement of areas closed to over-the-snow activities, and limitations on permitted over-the-snow activities. Collectively, these actions have reduced the impacts of winter recreation on caribou habitat, while providing recreational opportunities in areas and at the time of the winter season when effects to caribou are minimal. This strategy was developed (USDA Forest Service 2003) and would be fully integrated into alternative O. However, this alternative would not emphasize reducing the negative effects of forest roads on wildlife habitat.

Climate Change

Climate change would likely alter the distribution and abundance of suitable caribou habitat, and would change snow depths and persistence, which affect seasonal movements of mountain caribou (WDFW 2012). The potential effects of climate change depend on the interaction of seasonal temperatures and snowfall patterns and occurrence of wildfires, outbreaks of forest insects, and diseases (Mountain Caribou Science Team 2005). Management adaptations to address the effects of climate change include a focus on forest restoration and reducing non-climatic factors that affect wildlife populations (e.g., restoring habitat effectiveness impacted by roads). Alternative O would not implement these adaptations.

Cumulative Effects

The caribou recovery area is 1,477 square miles in size and includes the Colville National Forest, Idaho Panhandle National Forests, Idaho Department of Lands, and British Columbia. About 47 percent of the recovery area is in the United States and 53 percent is in British Columbia. The Idaho Panhandle National Forests recently revised the forest plan to address habitat and risk factors identified in the caribou recovery plan and critical habitat (USDA Forest Service 2015b). The caribou recovery team works cooperatively to address cumulative effects on woodland caribou.

Past activities on the Forest have impacted caribou habitat. Over-the-snow motorized use, prior to the implementation of the Winter Recreation Strategy (USDA Forest Service 2003), may have caused

disturbance to caribou. Alternative O would continue with implementation of the Winter Recreation Strategy, limiting the cumulative effects on caribou.

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would not manage habitats toward HRV, and would not be as effective as the proposed action and alternative P at mitigating for the cumulative effects of off-forest timber harvest.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities.

Fuels reduction projects are possible on all land ownerships, particularly where they are near residences.

Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife such as caribou. However, because this alternative does not address the negative impacts of roads on wildlife habitat, it provides less opportunity to mitigate the cumulative effects of recreation.

Big game hunting continues on both sides of the U.S./Canada border. Encounters with hunters may result in caribou mortality as a result of mistaken identification. Legal harvest of caribou by Treaty Indians does occur, but with few statistics on the number of animals taken, it is difficult to evaluate the influence of this on the caribou population. Fatal collisions with vehicles occur on open roads in caribou habitat and are likely to continue. Predation by mountain lions, wolves, and other predators would continue, with the effect on the caribou population dependent on big game populations, predator populations, and a variety of other factors.

One important factor is how the Canadian officials decide to manage this herd. In the British Columbia portion of the recovery area, human activities that have and would continue to impact caribou habitat include gas, powerline, and international border corridors, recreation activities, timber harvest, and highways.

Summary

Implementation of alternative O would make a moderate contribution to the recovery of woodland caribou. The reasons for this determination are:

- This alternative would address new science and risk factors identified in the recovery plan and critical habitat, but does not emphasize forest restoration as in the proposed action and alternative P.
- This alternative would formally adopt the winter recreation strategy for caribou habitat that was a term and condition of the 2001 Biological Opinion.
- This alternative attempts to balance the protection of caribou habitat with timber production, but does not address expected climate change effects that would enhance forest resiliency to the degree that other alternatives do.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the viability of LSOF-dependent surrogate species include: the loss of LSOF habitat from fire (Healy et al. 2008, Davis et al. 2011, 2015), vegetation treatments (e.g., timber harvest, thinning, prescribed fire) that affect forest structure (e.g., canopy closure, snags, downed wood) (Healy et al. 2008, Wisdom et al. 2008, Davis et al. 2011), management of roads that influence habitat effectiveness (Gaines et al. 2003), and protection of riparian areas that are an important element of LSOF habitats for some species (e.g., bald eagles).

The management direction for LSOF species is similar to no action, and is based on a system of small management areas that retain LSOF habitat for specific management indicator species (e.g., American marten, barred owl, pileated woodpecker). These areas range in size from 75 to 300 acres, are relatively equally distributed, but have no way to provide for habitat connectivity between or among the small islands of habitat. These small islands of habitat are also highly susceptible to disturbances such as fire, insects, and tree diseases, with no redundancy or replacement habitat in the event they are lost. This system was based on minimizing the effects of protection of LSOF habitat on the timber harvest level. This system was deemed inadequate to provide for the viability of LSOF species, and thus, forest plans were amended with the Eastside Screens (USDA Forest Service 1995b).

The area in between the small islands of LSOF habitat is managed primarily through even-aged timber production, with some protections for elements of LSOF habitat, such as snags and downed wood. However, the combination of roads and timber harvest generally results in these areas having snag habitat below levels that would maintain viable populations of snag-dependent wildlife species. Again, the management direction in the original forest plan, and used in this alternative, was deemed inadequate, thus additional direction was adopted through the Eastside Screens (USDA Forest Service 1995b). The Eastside Screens restrict the cutting of trees larger than 21 inches in diameter.

Alternative O would not provide management direction that would reduce the negative effects of roads on wildlife habitats. Currently, there are about 4,000 miles of road, resulting in an overall road density on the roaded portion of the Forest of about 3 miles per square mile, which is considered a low level of habitat effectiveness for many surrogate species (Wisdom et al. 2000, Gaines et al. 2003).

Overall, alternative O would provide management direction for LSOF habitat that is similar to no action and alternative B, but would provide less habitat than alternatives R and P. This alternative would not improve the viability outcomes for surrogate wildlife species that are dependent on LSOF habitats in the short (less than 20 years) and long (less than 50 years) time periods.

Climate Change

The sensitivity of LSOF-associated surrogate wildlife species to the effects of climate change were identified as medium for pileated woodpecker, and high for northern goshawk and American marten (CCSD 2013). The primary effect of climate change is the loss of LSOF habitats due to altered disturbance regimes (CCSD 2013).

Since the mid-1980s, the size and intensity of large wildfires in the western United States have increased markedly (Westerling et al. 2006), due, in part, to a reduction in fuel moisture driven by increased temperature and lower snowpack. Increases in fire risk and severity have been also been driven, in part, by increased fuel loads because of fire suppression practices used over the last

century (McKenzie et al. 2004). Predicted increases in spring and summer temperature identified in many climate change models would exacerbate the frequency and intensity of disturbances such as fire (McKenzie et al. 2004, Wotton and Flannigan 1993) and defoliation caused by forest insects (Littell et al. 2009). In the interior Columbia Basin, Littell et al. (2009) predicted that the area burned is likely to double or even triple by 2050. Climate-driven changes in fire regimes would likely be the dominant driver of changes to forests and LSOF habitats in the western United States over the next century (McKenzie et al. 2004).

A landscape restoration approach is not emphasized in alternative O. Landscape-scale restoration has been identified as an adaptive strategy to create landscapes more resilient to climate change (Spies et al. 2010, Gaines et al. 2012) and to maintain LSOF habitat structures (Lawler et al. 2014). The emphasis on restoration of resiliency would result in landscapes, including disturbance regimes that are more resilient to climate change through the application of strategically located restoration treatments in priority locations (Noss et al. 2006, Spies et al. 2006, Gaines et al. 2010, Franklin and Johnson 2012). By strategically locating restoration treatments, landscape-scale fire behavior may be altered to be more similar to native disturbance regimes and the risk of loss of LSOF habitat to uncharacteristically severe fires may be reduced (Finney 2001, Finney et al. 2006, Ager et al. 2007, Lehmkuhl et al. 2007).

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore LSOF habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and LSOF habitat protections in the original forest plan were found to be inadequate and were amended by the Eastside Screens (USDA Forest Service 1995b).

Past vegetation management and disturbances on the Forest have resulted in the distribution and arrangement of successional stages (early, mid, late) that are outside the HRV. Presently, more of the landscape is in mid-successional and less in late-successional habitats compared to HRV. This alternative would not manage habitats toward HRV, and would not be as effective as the proposed action and alternative P at mitigating for the cumulative effects of off-forest timber harvest.

Fuels reduction projects are possible on all land ownerships, in particular where they are near residences.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative O would make a relatively low contribution to the viability of LSOF-dependent surrogate wildlife species. This determination is based on the following:

- The LSOF habitat provided by this alternative would not maintain viable populations of LSOF surrogate wildlife species.
- This alternative does not emphasize restoration of landscape resiliency to reduce the loss of LSOF habitats to uncharacteristically severe wildfires.
- The protection and conservation of key elements of LSOF habitat such as large trees and snags, and riparian areas is minimal.
- The alternative would not result in the restoration of habitat effectiveness by reducing the negative effects of roads on LSOF habitats.

Motorized Recreation and Road Access

Proposed Species – Wolverine

Direct and Indirect Effects

Motorized recreation and the use of forest roads may influence the habitat use and populations of wolverines. These potential effects include displacement from key habitats, disturbance during critical periods, and an increased risk of mortality (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wolverine). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative O would have limited opportunity to reduce the negative effects of roads on wolverine habitat because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and only address big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness (Wisdom et al. 2000) for wolverines.

This alternative would not reduce the impacts of winter or summer-motorized trail use on wolverine habitat effectiveness. Overall, alternative O would provide a level of habitat effectiveness for wolverines that is similar to no action and alternative B, and less than the proposed action and alternatives R and P.

Climate Change

The sensitivity of wolverine to the effects of climate change is considered to be high (CCSD 2013). An important climate change adaptation that has been recommended for wolverines is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitat can become more resilient to the effects of climate change, and habitat connectivity can be restored allowing wolverines to adjust their ranges as conditions change. Implementation of alternative O includes management direction to make very limited improvement to habitat effectiveness for wolverines by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee

National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited emphasis of this alternative on reducing the negative effects of roads on wildlife and continued development of private lands (located mostly in east-west valley bottoms that bisect the Okanogan-Wenatchee National Forest) means that management of roads and motorized trails on Federal lands is even more important to habitat for wolverine.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance, becoming more important to wolverines.

Summary

Implementation of alternative O would make a relatively low contribution to the maintenance and restoration of habitat for wolverines, and result in a May Impact determination. This would occur because:

- The alternative includes limited management direction to reduce the impact of roads on habitat effectiveness for surrogate wildlife species.
- This alternative does not reduce the impacts summer or winter-motorized trails have on habitat effectiveness for surrogate wildlife species in two watersheds.
- This alternative does little to address the cumulative effects for human access and development on wildlife habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Motorized recreation and the use of forest roads influence the viability of surrogate wildlife species. These potential effects include displacement from key habitats, disturbance during critical periods, and the risk of mortality caused by collisions with vehicles (see Wisdom et al. 2000 and Gaines et al. 2003 for a complete list of road and trail associated factors that influence wildlife). The effects of motorized recreation and roads can occur during the non-winter period or during the winter period when snowmobiling or ski-trail grooming occurs.

Implementation of alternative O would have limited opportunity to reduce the negative effects of roads on surrogate species' habitats because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and only address big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness (Wisdom et al. 2000) for surrogate wildlife species.

This alternative would not reduce the impacts of winter or summer-motorized trail use on surrogate species habitat effectiveness. Overall, alternative O would provide a level of habitat effectiveness for surrogate wildlife that is similar to no action and alternative B, and less than the proposed action and alternatives R and P. This alternative would not improve the viability outcome for surrogate species used to assess the effects of roads and motorized trails.

Climate Change

The sensitivity of surrogate wildlife species used to assess the effects of roads and motorized recreation is rated as moderate for bighorn sheep, and high for Harlequin duck, Canada lynx, and wolverine (CCSD 2013). An important climate change adaptation that has been recommended for wildlife is to reduce the negative effects of roads (and trails) on habitat (Gaines et al. 2012, Lawler et al. 2014). By reducing the negative effects of roads, habitats (especially riparian and wetland habitats) can become more resilient to the effects of climate change, and habitat connectivity can be restored, allowing wildlife to adjust their ranges as conditions change. The implementation of alternative O includes management direction to make very limited improvement to habitat effectiveness for surrogate wildlife by reducing road impacts and densities.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and restore habitat effectiveness (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, mostly focused on big-game species.

The limited emphasis of alternative O on reducing the negative effects of roads on wildlife and continued development of private lands (located mostly in east-west valley bottoms that bisect the Okanogan-Wenatchee National Forest) means that management of roads and motorized trails on Federal lands is even more important to the viability of surrogate wildlife species.

Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Implementation of alternative O would make a relatively low contribution to the viability of surrogate wildlife species whose habitats are influenced by motorized access. This would occur because:

- The alternative includes limited management direction to reduce the impact of roads on habitat effectiveness for surrogate wildlife species.
- This alternative does not reduce the impacts summer or winter-motorized trails have on habitat effectiveness for surrogate wildlife species in two watersheds.
- This alternative does little to address the cumulative effects for human access and development on wildlife habitats.

Livestock Grazing

Surrogate Wildlife Species

Direct and Indirect Effects

Grazing can influence habitats of surrogate wildlife species by removing key habitat elements (e.g., dense shrubs for MacGillivray's warbler and fox sparrow), especially in riparian habitats. It can also alter disturbance regimes that maintain habitat structure (e.g., frequent fires in dry forests and grasslands keep open canopy for western bluebird), and influence the availability of important prey items (e.g., squirrels for golden eagles). To address the potential effects on surrogate wildlife species, the management direction regarding grazing in riparian habitat and upland habitats for each alternative was assessed.

Alternative O would include management direction for riparian habitats relying mostly on guidelines (not standards, as in alternatives R and P). Presently, some riparian habitats are in poor condition due to the effects of past and current grazing. The plan direction for this alternative would make a modest improvement on altering the distribution of livestock that would allow riparian habitats to recover.

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and guidelines to protect unique habitats. This alternative would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment, and AUMs average about 25,000 per year. However, management direction could result in some adjustments to the distribution of cattle and the intensity of grazing within specific habitats, such as unique habitats. Alternative O would make modest improvement to the viability outcomes for surrogate wildlife species used to assess the effects of grazing.

Climate Change

Habitats that are particularly sensitive to the effects of climate change include riparian areas (including wetlands) and alpine areas (Lawler et al. 2014). A management adaptation to make these habitats more resilient to climate change is to reduce the effects of non-climatic stressors (e.g., roads, intense grazing, etc.) (Lawler et al. 2014). Alternative O includes management direction that would help to restore the resiliency of habitats that are sensitive to climate change.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Panhandle National Forests, it is managed to accommodate other public land uses, such as contributing to the viability of surrogate wildlife species. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats, and is currently only used to achieve specific wildlife habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for wildlife habitats on Federal lands that contribute to the viability of surrogate wildlife species. Alternative O includes management direction for some key habitats that would better account for the cumulative effects of grazing on wildlife habitats.

Summary

Implementation of alternative O would make a moderate contribution to viability for surrogate wildlife species that are influenced by domestic grazing. This determination is based on:

- This alternative does include management direction for riparian habitat that would reduce the negative effects of grazing and improve riparian habitat condition.
- This alternative would not change the number or grazing intensity, but may alter the distribution of livestock to protect some unique habitats.
- This alternative would include management direction that could make habitats that are sensitive to the effects of climate change more resilient.

Habitat Connectivity

Surrogate Wildlife Species

Direct and Indirect Effects

A number of forest management activities influence habitat connectivity for surrogate wildlife species. These include the amount, patch sizes, and spatial arrangement of suitable habitats; location and density of motorized travel routes, especially in relation to riparian and LSOF habitats.

Alternative O emphasizes providing habitat connectivity for LSOF species through the identification of connectivity corridors during project planning (as per Eastside Screens, USDA Forest Service 1995b). Additional provisions for low to moderate mobility LSOF species are provided through riparian management zones. No management direction addresses habitat connectivity for wildlife species that are not associated with LSOF habitats (e.g., wide-ranging carnivores, Singleton et al. 2002).

Implementation of alternative O would have limited opportunity to reduce the negative effects of roads on surrogate species' habitats because management direction for roads would be for no net loss of road miles (approximately 4,000 miles) and emphasizes mostly big-game species. Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which is a low level of habitat effectiveness for surrogate wildlife species (Wisdom et al. 2000). Habitat connectivity would be improved compared to the current condition (table 189).

Table 189. Dispersal habitat suitability for surrogate wildlife species under alternative O, by proportion of planning area (based on desired conditions)

Surrogate Species used to Assess Habitat Connectivity	Low Dispersal Habitat Suitability	Moderate Dispersal Habitat Suitability	High Dispersal Habitat Suitability
American Marten	41%	39%	20%
Canada Lynx	7%	60%	33%
Wolverine	8%	42%	44%

1/See Singleton et al. (2002) and Gaines et al. (2017) for a definition of and methods used to determine dispersal habitat suitability.

Climate Change

Maintaining and restoring ecological connectivity is the most oft-cited climate adaptation strategy for biodiversity conservation (Heller and Zavaleta 2009, Opdam and Wascher 2004, Parmesan 2006, Spies et al. 2010) and has been identified as an important adaptation strategy for wildlife in northeastern Washington (Gaines et al. 2012). This is because species' range shifts have been the primary biological response to past episodes of climatic change, yet widespread anthropogenic

barriers to movement would now challenge species' ability to respond (Price 2002, Thomas and Lennon 1999, Wormworth and Mallon 2006).

Alternative O does provide direction to address habitat connectivity for some highly mobile LSOF wildlife species. However, there is no management direction that addresses habitat connectivity for wildlife species not associated with LSOF habitats (e.g., wide-ranging carnivores), nor does this alternative address the effects of forest roads on habitat connectivity.

Cumulative Effects

Past, present, and reasonably foreseeable human developments and transportation infrastructure, along with land ownership patterns create cumulative impacts that limit options to conserve and restore regional connectivity. Regional habitat connectivity has been evaluated for a variety of wildlife species, including the surrogate wildlife species used to evaluate connectivity in this planning area (Singleton et al. 2002, WWHCWG 2010, Proctor et al. 2015). These assessments have shown the importance of the Colville National Forest in providing stepping-stone habitats between the Cascades and Selkirk Mountains (Singleton et al. 2002, WWHCWG 2010). Connectivity from the Cascades to the Kettle Range to the Selkirk Mountains is interrupted by transportation corridors and human developments associated with the Okanogan, Upper Columbia, and Pend Oreille river valleys (Singleton et al. 2002, WWHCWG 2010). Additionally, connectivity planning in southern British Columbia identified linkage areas that could greatly enhance wildlife movements between the Selkirk Mountains and Purcell Mountains (Apps et al. 2007, Proctor et al. 2015).

Reducing the direct and indirect effects of roads on wildlife habitats would contribute to the maintenance and restoration of habitat connectivity, including cumulative effects, but is not well addressed in alternative O. Border Patrol activities on the Forest have the potential to cause disturbance through use of roads or trails that are normally closed to motorized use. The exact extent or amount of the impact over the life of the plan is difficult to predict because many factors could influence Border Patrol activities. Recreation is likely to increase on all land ownerships due to increasing demands. This would increase human disturbance and result in NFS lands that have relatively low human disturbance to become more important to wildlife.

Summary

Alternative O would provide limited direction that addresses habitat connectivity, and most is relevant to wildlife species associated with LSOF habitats. Thus, the implementation of alternative O would provide a low contribution to the viability of surrogate wildlife species used to assess habitat connectivity. The primary reasons for this conclusion include:

- No management direction to address wildlife species that are not associated with LSOF habitats (e.g., wide-ranging carnivores),
- Limited management direction that addresses the effects of roads and road networks on habitat connectivity, despite this being a primary factor that influences wildlife movements.

Snag Habitat

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the availability of habitat for snag-dependent surrogate species include firewood cutting (Bate et al. 2007, Hollenbeck et al. 2013), the loss of snag habitat

along roads and at recreation sites from hazard tree reduction (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008, FSM 7700), and removal of snags during timber harvest for safety reasons (Wisdom et al. 2008). The forest plan includes management direction for snag habitat to address the potential loss of habitat in timber sale operations. However, this alternative includes a 21-inch diameter limit on the size of snags that can be cut for firewood.

Alternative O includes 39 percent of the Forest that would be managed for even-aged timber harvest, resulting in the potential loss of snag habitat for safety reasons. An additional 34 percent of the Forest would be actively managed for restoration.

Implementation of this alternative would have limited opportunity to reduce the negative effects of roads on surrogate species' habitats because management direction for roads would be for no net loss of road miles (approximately 4,000 miles). Currently, the average road density (not counting the wilderness and recommended wilderness) is about 3.0 miles per square mile, which would result in a considerable loss of snag habitat for safety and hazard tree reduction (Bate et al. 2007, Hollenbeck et al. 2013, Wisdom et al. 2008).

Overall, alternative O would provide habitat protections for snag-dependent wildlife that are similar to no action and alternative B, but less than the proposed action and alternatives R and P. This alternative would not improve the viability outcomes for snag-dependent surrogate wildlife species.

Climate Change

Surrogate wildlife species associated with snag habitats include the pileated woodpecker, white-headed woodpecker, black-backed woodpecker, and Lewis's woodpecker. These species are rated as medium sensitivity to climate change and the western bluebird as high sensitivity (CCSD 2013). The primary effect anticipated from climate change is the loss of habitat due to altered disturbance regimes. Because alternative O does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for snag-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and loss of snag habitat in the Responsible MA from relatively intense timber harvest. The increase in fire associated with climate change could create a short-term gain in snag habitat followed by a long-term (80 to 100 years, Harrod et al. 1998) reduction as snags attrition occurs.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and more rigorous snag requirements to contribute to the viability of snag-dependent wildlife (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitats and current required snag densities make limited contribution to the viability of surrogate wildlife species. The limited management direction for snag habitat on non-Federal lands adjacent to the planning area, places additional emphasis on providing for viable populations of snag-dependent wildlife species on Federal lands. Fuels reduction projects are possible on all land ownerships, particularly where they are near residences. These can be designed in such a way that they restore wildlife habitat that has been affected by fire exclusion, but treatments can lead to the loss of snag habitat for safety reasons.

Summary

Implementation of alternative O would make a relatively low contribution to the viability of snag-dependent surrogate wildlife species. This determination is based on:

- This alternative would not emphasize landscape restoration of habitats and disturbance regimes that directly influence the availability and condition of snag habitat.
- This alternative would make no reductions in the negative effects of roads on snag habitat.
- Snag habitat would be reduced due to extensive timber harvest and active management, and an extensive road network would further reduce snag habitat for safety reasons.

Riparian Habitats

Federally Listed Wildlife Species

Yellow-billed Cuckoo - Threatened

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent species such as the yellow-billed cuckoo include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In alternative O, management direction for watersheds and riparian habitats is not consolidated into one consistent set of plan components (e.g., direction is in both the 1988 forest plan and in the INFISH amendment). Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes smaller riparian management area widths along intermittent streams, lakes, and ponds in the areas covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

The implementation of alternative O would provide limited management direction to reduce the effects of roads on riparian habitats. Overall, this alternative would provide habitat protection for riparian-associated wildlife that is more than no action and alternative B, similar to the proposed action, and much less than alternatives R and P.

Climate Change

Climate change is expected to have an overall negative effect throughout the range of the yellow-billed cuckoo (Post et al. 2009, USFWS 2013). Riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The emphasis of alternative O is on relatively intensive timber management. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for the yellow-billed cuckoo is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and some loss of riparian habitat from timber harvest. In addition, a climate change adaptation for riparian habitats is to restore their resiliency by reducing the negative effects of roads (Lawler et al. 2014). However, this alternative has limited opportunity for managers to reduce road effects on riparian habitats.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995; ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an "all lands" approach to enhance coordination across landowners and may enhance conditions for riparian-associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections that occur on private lands.

Summary

The implementation of alternative O would make a relatively low contribution to the recovery of the yellow-billed cuckoo. This determination is based on the following:

- This alternative would not address the negative effects that roads have on riparian habitats.
- This alternative would not consolidate and make more consistent management direction for riparian habitats using standards (as in alternatives R and P) and would have smaller riparian management areas.
- This alternative would not emphasize landscape restoration that would reduce the potential effects of uncharacteristically severe fires on riparian habitats.

Surrogate Wildlife Species

Direct and Indirect Effects

Forest activities that directly influence the quality and availability of habitat for riparian-dependent surrogate species include management of roads, recreation sites, and vegetation treatments that occur within riparian habitats.

In alternative O, management direction for watersheds and riparian habitats is not consolidated into one consistent set of plan components (e.g., direction is in both the 1988 forest plan and in the INFISH amendment). Standards and guidelines would limit management activities that are allowed to occur within riparian habitats. This alternative includes smaller riparian management area widths along intermittent streams, lakes, and ponds in the areas covered by the INFISH forest plan amendment (USDA Forest Service 1995a).

Implementation of this alternative would provide limited management direction to reduce the effects of roads on riparian habitats. Overall, alternative O would provide habitat protection for riparian-associated wildlife that is more than no action and alternative B, similar to the proposed action, and much less than alternatives R and P. This alternative would result in modest improvement to the viability outcomes for riparian-dependent surrogate species.

Climate Change

Some of the riparian-associated surrogate species are rated as high sensitivity to climate change (CCSD 2013) and riparian habitats are considered vulnerable to the anticipated effects of climate change (Lawler et al. 2014). The primary effects anticipated from climate change are the loss of habitat and reduced connectivity of riparian habitats due to altered hydrologic and disturbance (fire) regimes (Lawler et al. 2014).

The emphasis of alternative O is on relatively intensive timber management. Because this alternative does not focus on landscape-scale restoration, the restoration of disturbance regimes would not be emphasized. Thus, habitat for riparian-dependent surrogate wildlife is likely to be lost at an accelerated rate due to increased disturbances associated with climate change and some loss of riparian habitat from relatively intense timber harvest. In addition, a climate change adaptation for riparian habitats is to restore their resiliency by reducing the negative effects of roads (Lawler et al. 2013). However, this alternative has limited opportunity for managers to reduce road effects on riparian habitats.

Cumulative Effects

The adjacent Federal land managers include the Okanogan-Wenatchee National Forest to the west, the Idaho Panhandle National Forests to the east, and the Pend Oreille National Wildlife Refuge to the southeast. The Idaho Panhandle National Forests and the Pend Oreille National Wildlife Refuge have management plans that reduce the negative effects of roads on wildlife habitats and to protect and restore riparian habitats (USFWS 2000, USDA Forest Service 2015b). The Okanogan-Wenatchee National Forest plan provides limited management direction to reduce the effects of roads on wildlife habitat, and riparian habitat protections in the original forest plan were found to be inadequate and were amended (INFISH, PACFISH-USDA Forest Service 1995; ACS-USDA Forest Service 1994).

On private lands, the Washington State Forestry Practices Act provides some limited protections for riparian habitats. Management of priority watersheds emphasizes using an “all lands” approach to enhance coordination across landowners and may enhance conditions for riparian associated wildlife species. However, habitat protections for riparian habitats on Federal lands would help to mitigate for the limited protections that occur on private lands.

Summary

Implementation of alternative O would make a relatively low contribution to the viability of riparian-dependent surrogate wildlife species. This determination is based on the following:

- This alternative would not address the negative effects that roads have on riparian habitats.
- This alternative would not consolidate and make more consistent management direction for riparian habitats using standards (as in alternatives R and P) and would have smaller riparian management areas.
- This alternative would not emphasize landscape restoration that would reduce the potential effects of uncharacteristically severe fires on riparian habitats.

Species of Management Interest

Deer and Elk

Direct and Indirect Effects

Forest management activities can influence deer and elk populations and habitat use. Vegetation management activities may affect the distribution and abundance of cover and forage. Adequate forage is particularly important during the summer and fall before the following birthing season when this can have a positive effect on the condition of pregnant females (Lenz 1997, Cook 1998, Cook 2002, Cook et al. 2004, Cook et al. 2005, Cook et al. 2013). The management of forest roads and trails can influence how deer and elk use habitats, and influence the interactions between deer and elk (Rowland et al. 2005, Wisdom et al. 2005a, b). Additionally, deer and elk can compete with domestic livestock for both food resources (Findholt et al. 2005) and space (Coe et al. 2001, Coe et al. 2005). Thus, the potential effects that vegetation management, road and trail management, and grazing management can have on deer and elk habitats and population are evaluated for each of the alternatives.

Under alternative O, cover and forage for deer and elk on winter ranges emphasizes the retention of winter thermal cover. Considerable research has shown that the management of deer and elk winter habitat should be less focused on the retention of thermal cover, and more focused on the availability of forage on summer and fall habitats (see Cook et al. 2005 and 2013 for a review). This alternative would not incorporate the current science about the role of winter thermal cover in providing for deer and elk populations.

This alternative would not alter the current habitat effectiveness for deer and elk on summer and winter ranges through road management. The Selkirk Elk Herd has a moderate level of habitat effectiveness (moderate level of human influence) on their winter ranges. Currently, in 38 percent of the watersheds, winter habitat for deer has a high habitat effectiveness index (low level of human influence), 38 percent habitat a moderate level of habitat effectiveness (moderate level of human influence), and 24 percent habitat a low level of habitat effectiveness (high level of human influence). Current management direction for winter ranges is based on road density standards. Rowland et al. (2005) found road density to be a poor indicator of habitat use by deer and elk and recommended the use of the zone of influence instead. This is incorporated into the proposed action and alternatives R and P, but not alternative O.

Under alternative O, there would be no changes to current grazing practices that occur on national forest allotments. Degraded range conditions would be maintained or slowly improved, likely having effects on deer and elk habitat use and populations (Coe et al. 2001, 2005, Findholt et al. 2005). Somewhat more robust range management direction would be adopted.

Climate Change

Deer and elk have a low level of sensitivity to the effects of climate change due to their ability to tolerate a relatively wide range of climatic conditions, their high mobility, and as habitat generalists (CCSD 2013). However, alternatives that restore landscape pattern and functions while reducing the effects of roads on deer and elk summer and winter habitats would provide more resilient deer and elk populations. Alternative O does not emphasize landscape-scale restoration, nor does it provide consistent and effective management direction for roads that would restore habitat effectiveness for deer and elk.

Cumulative Effects

The historical cattle and sheep grazing that occurred on portions of the Forest degraded range conditions (Wissmar et al. 1994, Bunting et al. 2002). These conditions, combined with current domestic (cattle) and wild ungulate grazing (primarily elk and deer), have resulted in maintenance or slow recovery of poor range conditions in some areas (Wissmar et al. 1994, Bunting et al. 2002). These poor range conditions can have negative effects on some important unique habitats such as riparian areas and meadows. Alternative O would result in more rigorous grazing management direction that would help address this situation.

Winter ranges for deer and elk occur on Federal lands, adjacent wildlife management areas managed by the State, and private lands. Elk herd management plans (WDFW 2014) provide guidance for elk management on State lands and make recommendations for elk management on NFS lands. Management plans for deer include the White-tailed Deer Management Plan that provides direction to manage hunting to either maintain deer populations (WDFW 2010) and a general plan for mule deer (WDFW 2016), which are widely distributed across the Forest. A considerable amount of historical winter range for deer and elk is now in private land ownership or under the waters of Lake Roosevelt (created by the Grand Coulee Dam). The cumulative effects of the existing management plans (State and Federal lands) would provide for the conditions that contribute to sustainable populations of deer and elk, while considering the effects of private land development.

Summary

Implementation of alternative O would make a relatively low contribution to the conditions that support sustainable populations of deer and elk. This is based on the following:

- This alternative would not address new science that recommends de-emphasizing the importance of winter thermal cover and increasing the emphasis on summer and fall forage quality and quantity.
- This alternative does not provide consistent and effective direction on the management of roads and trails to restore habitat effectiveness on deer and elk summer and winter ranges.
- This alternative would include somewhat more rigorous management direction to improve the conditions of key habitats, such as riparian areas and meadows that are in poor condition due to the cumulative effects of past grazing practices, and current domestic and wild ungulate grazing.

Native Pollinators

Direct and Indirect Effects

Forest management activities can influence native pollinator populations and include vegetation management, grazing, and placement of apiaries (USDA 2015).

Alternative O does not emphasize the restoration of disturbance regimes or the application of restorative treatments that enhance native plant communities and native pollinator habitats (Dodson et al. 2008, Neill and Puettmann 2013).

This alternative includes ecologically based desired conditions for upland non-forest habitats (e.g., rangeland and alpine habitats) and guidelines to protect unique habitats. Alternative O would not alter the number of livestock, the intensity of grazing, or the amount of area grazed. Presently, 68 percent of the Forest is in a livestock allotment and AUMs average about 25,000 per year. However, management direction could result in some adjustments to the distribution of cattle and the

intensity of grazing within specific habitats, such as unique habitats. This alternative would make modest improvements in the habitat conditions for native pollinators.

This alternative does not include plan direction for the placement of apiaries that would reduce the potential for non-native pollinators to compete with rare native pollinators.

Climate Change

Native pollinators are considered to be sensitive to the effects of climate change, although our understanding of climate effects is very limited. Alternatives, such as this one, that address non-climate-related factors, such as native vegetation restoration and reducing the impacts of grazing, are beneficial in maintaining and restoring habitat for native pollinators.

Cumulative Effects

Grazing occurs on nearby private, State, Tribal, and Federal lands. Where grazing is allowed on the adjacent Okanogan-Wenatchee National Forest and Idaho Pan Handle National Forest, it is managed to accommodate other public land uses. On the adjacent Little Pend Oreille Wildlife Refuge, livestock grazing was reduced over time to allow restoration of riparian habitats and is currently only used to achieve specific habitat objectives (USFWS 2000). Grazing on non-Federal lands increases the need to provide for native pollinator habitats on Federal lands. This alternative includes management direction to restore native plants, protect key habitats, and reduce the impacts of grazing on native plant communities. This management direction would better account for the cumulative effects of grazing on pollinator habitats.

Summary

The implementation of alternative O would make a relatively low contribution to maintenance and restoration of habitat for native pollinators. This determination is based on:

- This alternative does not emphasize landscape restoration of native plant communities.
- This alternative would reduce impacts to native plant communities from grazing.
- This alternative does not include plan direction for the placement of apiaries that would reduce the potential for competition between non-native and rare native pollinators

Social and Economic Conditions

Introduction

The social and economic implications of land management on the Forest are of interest to local residents surrounding the Forest, users of the Forest, and to people throughout the country who value or are interested in national forest resources. Historically, individuals in local communities developed strong place attachments to public lands that provided recreational, aesthetic, employment, and other contributions to their social environment. Work, place, and lifestyles became an integral part of the culture and social characteristics of such communities. These communities developed particular interests in the interactions of public lands with their ways of life and their economic present and future. These interests are expressed in their interactions with public lands in addition to the actions and comments of local interest groups.

The public also has interests and concerns about public lands in general as well as particular public lands such as those of the Forest. These interests are expressed in public comments to management actions as well as in direct experiences recreating, visiting, or otherwise using public lands. Some people also express their interest through national organizations with both broad-based concerns about the management of public lands and in specific resources such as old growth forests, or threatened and endangered species. Thus, they are part of the social environment of public lands through the values and beliefs that motivate actions about particular places and by their comments and actions related to these places.

Policy decisions that influence the management of national forests attempt to balance the wide variety of uses and values individuals hold for forest resources. It is unlikely that any alternative selected in this process will answer the needs of all those interested in management of the Forest. Each alternative will be a compromise between the competing uses and values of the Forest.

The following analysis describes the potential social and economic impacts to different interests and values of the Forest resources by alternative. The analysis includes a description of the analysis area, demographics and trends within Washington, environmental justice considerations, and potential social and economic impacts by alternative on various Forest interests and values and resource user groups.

Economic Resources

The Colville National Forest contributes to the local economy through the supply of products, services and uses, as well as directly hiring employees and spending budgetary dollars. These activities support direct, indirect, and induced jobs. Industry-level employment and income data are derived using IMPLAN 2010 model software and data at the county scale (MIG 2012). For this analysis, impacts are limited to the three-county socioeconomic impact zone comprising Ferry County, Pend Oreille County, and Stevens County.

Three criteria were considered to develop the impact zone: (1) the number of Forest Service-administered acres in each county, which relates to county payments; (2) trade flows of national forest products and by-products moving to and between local processing facilities; and (3) interconnected county economies. More information about the county selection process is available from the project record (Phillips 2010).

The following sections summarize the economic impacts related to recreation, livestock grazing and wood products, Forest Service expenditures, and revenue sharing and payments to counties from the socioeconomic specialist report (Philips and Jaworski 2017). Not covered are minerals and non-timber forest products uses. National forest plan revision decisions minimally affect mineral production. Non-timber forest products use and production data are limited and are not in a format useful for economic impact analysis in forest planning.

Affected Environment

National forest management affects traditions, lifestyles, and the economic livelihood of residents and communities. Those who depend on the national forests for their livelihoods and recreational pursuits are concerned that their relationship with the national forests may be compromised by other uses and restrictions. Forest Service managers depend on their relationships with local communities, people, and their institutions to help manage the national forests. Communities provide a skilled workforce, labor, manufacturing infrastructure, business support, and other services. All of these

relationships are important to sustaining and restoring the ecological integrity of the national forests as well as the social and economic wellbeing of the communities.

The Colville National Forest contributes to the local economy and social conditions in a variety of ways. These contributions include the supply of products, services and uses, as well as directly hiring employees and spending budgetary dollars. These activities support jobs and income in each of the Forest's socioeconomic impact zones. Not all resource outputs and purchases result in local economic activity. For example, logs harvested from one national forest may be sent to processing mills outside of its socioeconomic impact zone. Similarly, a national forest may purchase goods and services from businesses located outside its socioeconomic impact zone. Restoration work contracted with non-local businesses or helicopter logging services by non-local firms would not be included as direct jobs in the local economy.

The following sections discuss the economic impacts related to recreation, livestock grazing, and wood products; Forest Service expenditures; and revenue sharing and payments to counties. All dollar amounts are presented in 2012 dollars unless otherwise noted.

Recreation

Visitors to national forests have the opportunity to participate in a variety of activities in developed and dispersed settings. These activities include hiking, camping, and driving for pleasure as well as wildlife and fish use, such as hunting, fishing, and wildlife viewing. In addition to economic benefits, recreation activities contribute to social and economic well-being in the socioeconomic impact zone since recreation opportunities within the national forest enhance the quality of life for nearby residents.

The National Visitor Use Monitoring (NVUM) system collects and analyzes data about Forest Service recreation use. The first survey collected data between 2000 and 2003. The second round of NVUM collected data for the Colville National Forest in 2009 (USDA Forest Service 2010b). The scientists managing the NVUM survey state that comparisons of the first and second round results are not appropriate due to changes in the study protocols. Round 2 results estimated a total of 335,706 visits annually.

Recreation economic effects are based on expenditures for goods and services including shopping at convenience stores or purchasing gasoline, food, lodging, outfitter guides, and sporting goods within 50 miles of the national forest. Expenditures are based on the procedures identified in "Estimation of national forest visitor spending averages from national visitor use monitoring: round 2" (White et al. 2012). Six primary market segments and two segments for downhill skiing are used to identify key differences in spending patterns of visitors (table 190). There are two key differences in the market segments. The first identifies local and non-local visitors to identify dollars (new money) brought into the socioeconomic impact zone.

The second difference identifies overnight stays either within the national forest or overnight stays outside the national forest. The classifications are important because recreation expenditures and their effects on local economies are different. Trip expenditures by local day visitors are less than expenditures by non-local visitors staying overnight. Day use visitors do not require lodging and typically spend less on other goods and services.

Table 190. Market segments of Colville National Forest visitors (2009)

Market Segment	Annual Visits
Non-local day	48,949
Non-local overnight within the national forest	18,034
Non-local overnight outside of the national forest	12,881
Local day	152,000
Local overnight within the national forest	20,610
Local overnight outside of the national forest	5,153
Downhill skiing day	71,052
Downhill skiing overnight	7,027
Total	**335,706**

The Forest Service crosswalked the recreational expenditures to IMPLAN model sectors to estimate the economic effects of recreational uses based on NVUM survey results. Each of the six market segments has a unique expenditure profile (what people spend while recreating). The expenditure profile is combined with the number of recreation visits estimated for each market segment to estimate the direct, indirect and induced (total) employment and income effects (table 191).

Table 191. Colville National Forest recreation, wildlife, and fish visits, total economic impacts

	Average Annual Impact
Non-local recreation use	
Jobs	115
Labor Income	$1,986,000
Non-local wildlife recreation use	
Jobs	5
Labor Income	$112,000
Local recreation use	
Jobs	71
Labor Income	$1,368,000
Local wildlife recreation use	
Jobs	4
Labor Income	$90,000

Rangeland and Grazing

Livestock grazing on the Colville National Forest is an important use to the local ranching industry. Grazing on public lands contributes directly to livestock forage needs, but the total contribution is greater because it affords ranchers the opportunity to grow forage on other ranch lands for feeding livestock during winter months.

The economic analysis of grazing uses data on animal unit months (AUMs). One AUM is the amount of forage a 1,000-pound mature cow and a calf consume in a 30-day period, which is about 780 pounds of dry weight. Permitted AUMs are measures of planned capacity and are the number of

AUMs specified by the grazing permit for the duration of the permit (USDA Forest Service, n.d., section 2230.5). The permit is usually valid for 10 years (USDA Forest Service, n.d., section 2231.03). Authorized AUMs is the amount of forage permittees pay for to use in a given year. Authorized AUMs indicate how much of the planned capacity is used. It is the authorized use amount which contributes to jobs and income.

The amount of livestock forage consumed by animals authorized to graze on Forest Service allotments is the basis of the economic activity associated with Forest Service livestock grazing. Table 192 shows the average grazing data for 2012 through 2014 for the Colville National Forest. These data are used with the direct effects of 1,000 AUMs based on the revised BLM grazing impacts methodology (USDI 2012, page 201). These data are then combined with IMPLAN model multipliers to identify the indirect and induced effects for employment and income contributed by the Colville National Forest. The BLM methodology is used because it is based on the type of livestock typically grazed on public lands and includes unpaid and family labor.

Table 192. Average authorized livestock grazing data on the Colville National Forest for 2012 through 2014

Livestock	Animal unit months
Cattle	27,428
Sheep and Goats	0

Table 193 displays the average annual jobs and income associated with current Colville National Forest livestock grazing. The effects were estimated based on the average authorized grazing as displayed in table 192 and the IMPLAN 2012 model data year. The data are totals for direct, indirect, and induced effects.

Table 193. Colville livestock grazing total economic impacts for the socioeconomic impact zone

	Average Annual Impact
Jobs	98
Labor Income	$1,515,000

Forest Products

The Colville National Forest has a long history of providing timber and other forest products in support of local community and national needs. Communities throughout the socioeconomic impact zones had strong economic components related to the wood products industry. However, increased environmental protection, a focus on sustaining and restoring a broader range of resources, and changing mill technology have resulted in significant declines in the timber industry and in the businesses that support the timber industry.

Annual timber volume harvested from the Colville, excluding fuelwood, has declined substantially, from a high of almost 135 million board feet per year during the late 1980s to less than one-third of this volume. Harvest on all other ownerships has also declined during the same period. Table 194 displays the 2012 through 2014 average timber harvest by product type. Non-sawtimber includes pulpwood and green biomass, such as clean chips. Fuelwood includes both personal and commercial use.

Table 194. Timber harvest volume three-year average

Timber Product	Colville (Average 2012-14), CCF
Sawtimber	47,237
Nonsawtimber	13,577
Poles	17
Fuelwood	7,325
Totals	**68,157**

CCF = hundred cubic feet
Source: USDA FS 2014a

From the late 1990s through 2007, sawmill and plywood-veneer processing capacity in eastern Washington decreased by about 50 percent (Ehinger 2008). A recent inventory of wood products mills in the area shows little change (Loewen 2014). Processing capacity is important for several reasons. It generates value added jobs and income in addition to those jobs associated with logging. Local processing capacity increases the net value of stumpage since it costs more to ship logs to distant mills. A higher stumpage value means timber harvest projects are more likely to be economically viable.

The economic activity associated with timber harvest is based on the flows of logs through logging companies including transportation; primary processors, such as sawmills, veneer and plywood mills; and pulp and paper manufactures. The direct economic effect of the timber program is derived using mill survey data (Alward et al. 2010). The direct job effect of timber harvest was determined by dividing the total employment in an industry, such as sawmills, by the timber volume processed or handled by that industry. The calculation provides a direct response coefficient for jobs per unit of wood volume. The response was then integrated with coefficients of the IMPLAN models for the socioeconomic impact zone to calculate the indirect and induced employment and income effects for the timber industry and supporting businesses that exist in the socioeconomic impact zone.

Table 195 shows the amount of timber harvest from the Forest processed locally. Most of the sawtimber and all of the non-sawtimber from the Colville NFS lands are currently processed within the Colville socioeconomic impact zone. It is noteworthy that 20 percent of the volume harvested from the Okanogan-Wenatchee National Forest is also processed within the Colville socioeconomic impact zone.

Table 195. Area where Colville National Forest timber harvest is processed

Process area	Sawtimber	Nonsawtimber	Posts, Poles, Fuelwood
Colville impact zone	96%	100%	100%
Not processed locally	4%	0%	0%

Source: Rinke 2012

Table 196 shows the total economic contributions associated with the timber harvested from the Colville National Forest in its socioeconomic impact zone.

Table 196. Colville National Forest timber harvest economic impacts

Impact	Average Annual Impact
Jobs	273
Labor Income	$15,969,000

The sawtimber and nonsawtimber volume from the Okanogan-Wenatchee processed in the Colville socioeconomic impact zone generates an additional 62 jobs and $3,099,000 income.

National Forest Expenditures

Forest Service employees, budgets, buildings, and other infrastructure contribute to the economic well-being in the communities making up the Colville National Forest socioeconomic impact zone. Forest management requires a budget that is spent on employees, contractors, goods and services, and the construction and maintenance of infrastructure. In addition to the day-to-day scheduled management activities, the Forest Service also spends funds for unplanned activities, such as wildfire suppression. Table 197 shows the expenditures divided into salary and non-salary components and including and excluding wildfire suppression costs. The data are presented as the 2009 to 2011 average, the latest years for which the data are formatted for use with IMPLAN.

Table 197. Average annual Colville National Forest expenditures for 2009 through 2011

Expenditure	Average Annual Amount
Salary excluding fire suppression	$11,325,410
Non-salary excluding fire suppression	$6,937,960
Salary including fire suppression	$12,175,070
Non-salary including fire suppression	$7,744,050

Table 198 shows the economic effects of salary and non-salary expenditures for the Colville National Forest. Forest Service employees account for 225 or about 80 percent of all jobs. Non-salary expenditures and indirect and induced effects of Forest Service salary and non-salary expenditures generate the other 53 jobs. The economic impacts are estimated using the disposable income spent by Forest Service employees and the agency's expenditures spent on materials, contracts, and services. The economic impacts are calculated using budgets excluding fire suppression costs. The reason for not identifying the economic effects associated with fire suppression expenditures is because suppression activities are not predictable, and most of the fire suppression dollars are spent on resources from outside of the national forest's socioeconomic impact zone. The portion spent locally is unknown.

Table 198. The economic impacts of the Colville National Forest budget, 2009-2011 average

Impact	Average Annual Impact
Jobs	278
Labor Income	$13,314,000

Excludes fire suppression activities

Revenue Sharing and Payments to Counties

Counties receive Federal payments based on revenue sharing under the Payments to States Act, also known as 25-percent receipts. They also receive money under the Payments in Lieu of Taxes (PILT) program based on the percentage of federally administered land. Due to declining revenues from timber receipts, the Secure Rural Schools and Communities Self-Determination Act (SRS) was enacted to supplement the Payments to States Act. SRS money is divided into three separate parts identified as Title 1, Title 2 and Title 3. Title 1 money, about 80 percent of the total, is spent on local roads and schools based on a 50-50 split. The remaining money is spent on ecosystem management projects on NFS lands and local government projects enhancing environmental education, public safety, and other projects. PILT money can be spent on any local government purpose.

The last payment under the original SRS was planned for 2006. An extension of the SRS payments was signed into law in 2007, and the next year, the Emergency Stabilization Act of 2008 was signed into law authorizing the SRS payments through 2011. The SRS payment was extended again for 2012 and again for 2013. Congress has reauthorized SRS payments through 2016. Because SRS payments subject to congressional approval, an analysis of potential revenue sharing is provided without the SRS adjustment.

Table 199 displays the average amounts of SRS and PILT money paid from 2012 to 2014 to the counties in the socioeconomic impact zone. The PILT payment amount is based on the total Forest Service acres in each county identified in the PILT database for the Colville National Forest. The SRS payment is the total payment to each county in the socioeconomic impact zone. SRS payments are calculated on proclaimed national forest acres rather than acres administered by a national forest. For example, the Colville administers portions of the Kaniksu National Forest in Pend Oreille and Stevens Counties.

Table 199. Total Forest Service SRS and PILT payments to Colville National Forest counties

Payment Type	Average Payment, 2012–2014
SRS	$1,719,580
PILT	$1,313,300
Totals	**$3,032,880**

Source: USDA Forest Service 2014c and USDI 2014

Since it is unknown whether the SRS payments would continue into the future, an estimate of payments to states based on the pre-SRS mechanism of 25 percent of the average timber receipts is provided in table 200. This estimated payment shows a drop of about 80 percent from the Colville SRS average payment presented in table 199.

Table 200. Reconstructed Forest Service 25-percent payments to Colville National Forest counties

Payment Type	Amount
25-percent (reconstructed)	$352,230

Based on 2007–2013 average data
Source: USDA Forest Service 2014c

SRS and PILT payments to counties are a component of local government expenditures. In order to calculate the economic contribution of the payments, the money is applied to several economic sectors using the IMPLAN model. All of the PILT payment is applied to the non-schools local government sector. The SRS payment was split four ways, applying about 40 percent to highway construction and maintenance to capture the county roads portion, and 40 percent applied to the schools sector of local government for Title 1; 10 percent is applied to ecosystem management projects on NFS lands for Title 2; and 10 percent is applied to the local government sector for Title 3.

Table 201 identifies the jobs and income impacts associated with Federal payments to counties associated with the Colville National Forest.

Table 201. Economic impacts of Forest Service payments to counties for the Colville National Forest

Impact	Average Annual Impact
Jobs	36
Labor Income	$1,368,000

For year 2011

If the SRS payments are not extended and payments are instead based on 25-percent revenue sharing, the jobs and income contributions would be reduced. PILT and 25-percent payments would support approximately 20 jobs and $751,000 in labor income annually.

Economic Contributions Summary

Table 202 shows the economic effects of recreation, livestock grazing, timber, agency expenditures, and payments to counties combined for Colville National Forest and its socioeconomic impact zone. The data for jobs and income contributed by the Forest Service are compared to the total jobs and income by industry sector in the zone to identify the relative importance of the national forest to that sector and to the socioeconomic impact zone overall.

The economic relationship of the Colville National Forest to its socioeconomic impact zone shows moderate economic ties. The Colville shows about a 5 percent overall contribution to total employment and about a 6 percent contribution to labor income. Seven industrial sectors show 5 percent or more Colville National Forest-related job contributions. Highest of these is agriculture, which includes logging and grazing-related employment. Other important sectors are manufacturing including wood processing employment and recreation-related sectors. The jobs and income supported through Forest Service management activities are important components of the socioeconomic impact zone's well-being.

Table 202. Current contribution of the Colville National Forest to its socioeconomic impact zone

Industry	Employment (jobs)			Labor Income ($1,000s)		
	Impact zone Totals	National Forest Related	National Forest Percent of Total	Impact zone Totals	National Forest Related	National Forest Percent of Total
Agriculture	2,108	191	9.06%	$44,391	$6,346	14.30%
Mining	195	3	1.71%	$17,089	$60	0.35%
Utilities	92	1	1.61%	$12,022	$187	1.56%

Industry	Employment (jobs)			Labor Income ($1,000s)		
	Impact zone Totals	National Forest Related	National Forest Percent of Total	Impact zone Totals	National Forest Related	National Forest Percent of Total
Construction	1,572	11	0.69%	$38,806	$261	0.67%
Manufacturing	1,472	107	7.26%	$92,582	$7,767	8.39%
Wholesale trade	293	13	4.45%	$14,515	$713	4.91%
Transportation and warehousing	583	14	2.34%	$16,675	$487	2.92%
Retail trade	2,079	46	2.20%	$57,689	$1,382	2.39%
Information	198	4	2.07%	$6,295	$144	2.29%
Finance and insurance	515	7	1.42%	$14,930	$327	2.19%
Real estate and rental and leasing	314	8	2.55%	$4,244	$173	4.08%
Professional, scientific, and technical services	641	11	1.75%	$23,445	$455	1.94%
Management of companies	13	1	5.53%	$829	$55	6.61%
Administrative, waste management, and removal services	393	10	2.60%	$10,411	$215	2.06%
Educational services	223	2	0.99%	$1,990	$29	1.48%
Health care and social assistance	1,975	24	1.23%	$88,788	$1,168	1.31%
Arts, entertainment, and recreation	755	58	7.75%	$3,480	$264	7.58%
Accommodation and food services	1,182	90	7.60%	$17,427	$1,273	7.30%
Other services	1,334	21	1.61%	$35,312	$726	2.05%
Government	5,098	259	5.08%	$302,024	$13,801	4.57%
Totals	21,035	883	4.20%	$802,942	$35,833	4.46%

Excludes fire suppression dollars

Methods

Data Sources and Methods

Management approaches to addressing the issues (chapter 2) have socioeconomic consequences. Public comment identified concerns about the potential effects including those on local economies and social conditions. Economic impacts were the result of potential changes in vegetative outputs (such as firewood and commercial timber), recreation use, and grazing. These concerns, along with differences in recreation access, species viability, risk of wildfire, and climate change also result in social impacts.

Industry-level employment and income data are derived using IMPLAN 2012 model software and data at the county scale (MIG 2012). The IMPLAN data and analysis system provides a level of specificity for employment and income at a finer industry scale than data reported by the Bureau of Economic Analysis. The IMPLAN data and analysis system is also a useful tool to estimate the

impacts of alternative management strategies on local economies. Additional information is provided about data sources and methods as they are discussed in the following sections.

Counties are large, and using data at this level often masks social and economic conditions and trends occurring at the sub-county or individual community level. Potential sub-county changes are not discussed because they are generally not quantifiable given the broad scale of forest plan decisions. The social and economic effects related to a national forest's management activities are addressed within the socioeconomic zone and normally do not address the potential economic relationships that exist in other areas. However, since large portions of the sawlog timber harvested on the Okanogan-Wenatchee National Forest are processed within the Colville National Forest socioeconomic impact zone, these effects have been identified.

Assumptions

- The Colville National Forest's budget continues at current levels for all alternatives.
- Recreation uses displaced in one part of the Colville National Forest are accommodated elsewhere on the Forest.

Incomplete and Unavailable Information

The levels of supply and demand for national forest goods, services, and uses are difficult to predict and they vary over time. Future market conditions are also uncertain. In order to address estimation error and variability, job and income impacts associated with a small increment of a good, service or use in the discussion of alternative effects are included. This information provides the reader an indication of how sensitive the economic impacts are to predictions of goods, services and uses, and to address potential "what if" scenarios. Also discussed are additional cautions about information completeness and availability in the affected environment section.

Spatial and Temporal Context for Effects Analysis

The spatial context for the social and economic impacts analysis includes Ferry, Pend Oreille, and Stevens Counties. Due to the programmatic nature of forest planning, we do not estimate site-specific consequences. The economic impacts are identified at the broader three-county level, the social-economic impact zone.

The temporal context for the economic impact analysis is the life of a forest plan, which is expected to be 15 years.

Economic Consequences

This section describes the potential direct, indirect, and cumulative effects of management of the Colville National Forest on economic well-being. The analysis focuses on how changes in management activities by alternative affect goods and services, and how those changes affect the economic contribution of the Forest on the local economies in its socioeconomic impact zone. The outputs used for this analysis include estimated timber harvest volume, grazing use, and recreation use. These outputs are used in the input-output model to estimate the resulting employment and income contributions. Employment and income contributions from Forest Service budgets, and revenue sharing and payments to counties are also included to provide a broader picture of the economic relationship of the Forest to its surrounding communities.

The amount of goods, services, and uses estimated to be produced under each alternative drive the level of economic impacts. However, aside from timber harvest, there is little variation in the amount of the jobs and income impacts by alternative. Even though the economic impacts for many

resources do not vary by alternative, there are other qualitative and quantitative differences. Those effects are addressed in the social and other resource sections.

The alternative impacts of separate issue categories for this economic impact analysis have been combined. For example, direction to address the recommended wilderness issue would likely affect levels of timber harvest. However, the primary issue category affecting timber harvest is Old Forest Management. Likewise, Livestock Grazing and Road Density affect recreational opportunities; however, Motorized Recreation is the primary issue category impacting recreational opportunities. Table 210, at the end of this section on economics, displays the estimated economic contribution of each alternative by program area.

Forest Products

Using the projected wood sale quantity (PWSQ) the amount of economic activity for each alternative was estimated. PWSQ is the estimated quantity of timber and all other woods products expected to be harvested for any purpose from all lands in the plan area. PWSQ is based on consistency with the plan components as well as the planning unit's fiscal and organizational capacity. The key components of timber harvest includes sawtimber used primarily in sawmills and in plywood and veneer manufacturing; non-sawtimber such as pulpwood and biomass used in processing pulp and paper as well as composite board; fuelwood which includes both commercial and personal use; and small amounts of posts and poles.

Table 203. Estimated annual timber harvest (PWSQ) by alternative and by product type in CCF

Product Type	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Sawtimber	56,466	99,574	19,310	99,087	49,551	50,775
Nonsawtimber	17,365	17,365	6,308	17,365	17,365	17,365
Fuelwood	8,914	8,914	3,231	8,914	8,914	8,914
Posts and Poles	13	13	0	13	13	13
Total	**82,758**	**125,866**	**28,849**	**125,379**	**75,843**	**77,067**

CCF = hundred cubic feet

The harvest level by product type displayed in table 203 is one part of determining the employment and income by alternative. The other part is the proportion of the harvest processed by wood products manufacturing sectors within the socioeconomic impact zone. The distribution of forest harvest was shown previously in table 195 in the affected environment section. Table 204 displays the estimated timber-related economic effects.

Table 204. Estimated jobs and income supported by timber harvest by alternative (annual average)

Alternative	Average Annual Timber-related Employment	Average Annual Timber-related Labor Income
No action	330	$19,335,000
Proposed action	539	$31,224,000
R	114	$6,692,000
P	537	$31,089,000
B	297	$17,428,000
O	303	$17,765,000

No action and alternatives B and O would support local employment and income in the timber sector at levels similar to current conditions. These alternatives are unlikely to affect the economic well-being of individuals employed in timber harvesting and processing firms relative to existing conditions. The proposed action and alternative P would increase timber-related employment and labor income in the local economy. These alternatives may improve the economic well-being of unemployed individuals with the skills to work in forest products sectors. Alternative R would measurably decrease annual timber harvested from the Colville National Forest. The proposed action would support nearly five times more timber-related employment and income than alternative R. Households that rely on earnings from the timber industry may experience a shock to their economic well-being under alternative R.

Congress determines Forest Service budgets annually. At times, there are budget increases to produce more products and services from national forests or there are reductions to produce less. To address this variability, the following data are provided to analyze an incremental change. A budget amount of $40,000 for timber harvest produces about 1,000 CCF (0.5 MMBF) of sawtimber and non-sawtimber harvest. This supports about five jobs and $273,000 in wage income. These effects are based on the current distribution between sawtimber and non-sawtimber, and where the harvested wood is processed.

Recreation Management

Although recreational opportunities vary by alternative, current recreation use totaling 335,700 visits, including wildlife-related and local visits to the Colville National Forest, is not expected to vary across alternatives. The forestwide supply of recreational opportunities would generally meet or exceed demand during the life of the revised forest plan. With no changes in use, there is no estimated change to the overall level of recreation-related expenditures, and no differences in the jobs and income supported by the expenditures (table 205). However, differences in economic effects at smaller spatial scales are possible.

Use patterns and access would change on the Colville by alternative. For example, reductions in mountain bike access under alternative B may cause distributional effects and mountain bikers relocate to other areas on and off the forest. However, the total amount of recreation-related spending attributable to activities on the Forest is not expected to change. This forestwide economic evaluation only addresses total effects across the entire socioeconomic impact zone. Additional recreation-related impacts are addressed in the recreation and social sections of this chapter.

Table 205. Estimated jobs and income supported by recreation expenditures, annual average

Alternative	Average Annual Employment	Average Annual Labor Income
All alternatives	195	$3,556,000

Projections of recreational supply and demand are not precise. An estimate of the economic impacts associated with and increment of 10,000 visits, about 3 percent of current use has been provided. This number of visits supports about five jobs and $100,000 in labor income. For this assessment, the current proportions of local, non-local, recreation, and fish and wildlife-related recreation visits was used to distribute the 10,000-visit change.

Livestock Grazing and Rangeland Vegetation Management

Projections of cattle grazing are the same across all alternatives. However, the management of potential impacts of livestock grazing on riparian-based recreation settings and nationally designated trail systems may increase costs to grazing permittees. Likewise, recommended wilderness, non-motorized recreation, and reduced road density management may also increase the cost of livestock grazing management. Forage potentially available for domestic sheep could vary especially under alternatives B and O. These alternatives use no risk protection measures for bighorn sheep, which may modify or eliminate domestic sheep grazing. However, modification of sheep grazing numbers is made at the project planning scale rather than at the forest plan scale. In addition, the Forest currently has no active sheep grazing, so changes in domestic sheep grazing are not projected. Future decisions to authorize domestic sheep would need to follow national guidance to analyze the risk of contact between bighorn sheep and domestic sheep allotments. The following table displays the projected amounts of authorized cattle and sheep grazing.

Table 206. Estimated cattle and sheep permitted animal unit months (AUM) by alternative, annual average

Alternative	Estimated Cattle authorized AUMs	Estimated Sheep authorized AUMs	Total
All alternatives	27,580	0	27,580

The economic effects of the alternatives based on authorized cattle and sheep grazing use has been estimated. Table 207 displays the total jobs and wage income supported by cattle and sheep grazing for the alternatives. These totals are the direct, indirect, and induced economic impacts including estimates for unpaid or family labor contributions. Since there is no variation in AUMs by alternative, the job and income economic impacts are the same across the alternatives.

Table 207. Estimated jobs and income supported by grazing, annual average

Alternative	Average Annual Grazing Related Employment	Average Annual Grazing Related Labor Income
All alternatives	98	$1,524,000

Environmental conditions and management needs may affect grazing use. Actual use numbers may be more or less than the projected use in any year. Therefore, the following data is provided to estimate the impacts of a 1,000 AUM change in cattle use, which is about 3 percent of current use. The amount supports about 4 full and part-time jobs and $53,000 in wage-related income.

National Forest Expenditures

Salary and non-salary expenditures comprise national forest budgets. Non-salary expenditures are the purchases of goods and services, including contracting for restoration activities, and they are for acquiring and maintaining facilities and other infrastructure. Salary and non-salary expenditures were not projected to vary by alternative. The current annual budget level of $18.3 million would continue during the plan period. This budget amount does not include expenditures for fire suppression, which averaged about $1.7 million during the years 2009 through 2011. These dollars are not included because they are not predictable, and often spent on resources from outside of the Colville National Forest socioeconomic area. Table 208 displays the job and income effects of the total budget without fire suppression.

Table 208. Estimated jobs and income supported by budget expenditures (annual average)

Economic Impact	Average Annual Impact
Employment (full and part time jobs)	278
Labor Income	$13,314,000

Forest Service employees account for 225 or about 80 percent of all jobs. Non-salary expenditures and indirect and induced effects of Forest Service salary and non-salary expenditures generate the other 53 jobs.

Revenue Sharing and Payments to Counties

Even though there may be future variations in payments based on PILT and SRS formula requirements, these are not linked to the forest plan. Therefore, no differences in the SRS and PILT payments were projected by alternative.

It is unknown whether the SRS payment would continue into the future. To address this issue, we provide an estimate of the revenue sharing amount under the Payments to States Act (25-percent receipts). The reconstructed 25-percent receipts payment is $352,228 estimated from average receipts for fiscal years 2007 through 2013. This payment would be approximately 80 percent lower than recent SRS payments.

Table 209. Estimated 25-percent payments

County	Average Receipts, 2007–2013	Estimated County Share of 25-percent Payments
Ferry County	$446,331	$111,583
Pend Oreille County	$744,877	$186,219
Stevens County	$217,705	$54,426
Three-County Total	$1,408,913	$352,228

Source: USDA Forest Service (2014c)

The 25-percent receipts based payments could vary by alternative and support different levels of jobs and income. Alternatives producing more revenue-generating outputs and uses would, in turn, provide larger payments to counties. The commercial wood products are the largest generator of receipts and are greatest cause of differences in payments. Therefore, alternative R, which would support the lowest levels of commercial timber harvest, could decrease Forest Service payments to counties. Since a reversion to 25-percent payments is unforeseeable, this analysis does not estimate employment and income variation between alternatives associated with payments to states and counties.

Cumulative Economic Effects

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Economic cumulative effects are associated with the management activities of adjoining land managers and community infrastructure, as well as the past, present and reasonably foreseeable activities on NFS lands. The supply of goods, services, and uses similar to those supplied by the Colville National Forest are components of the overall economic picture. The major land ownerships that were considered in the cumulative effects analysis are the Okanogan-Wenatchee and Idaho

Panhandle National Forests, the Spokane District of the BLM, Tribal lands including the Confederated Tribes of the Colville Reservation, the Kalispel Tribe of Indians, and the Spokane Tribe of Indians, and privately held forest lands.

Community infrastructure is important to support national forest management activities and to process goods and services. Having local capacity for wood products processing increases the value of national forest wood fiber. Having knowledgeable local operators and equipment lowers the cost of ecosystem restoration activities. Changes in the local infrastructure affect the amount of job and income impacts that occur in the economic impact area.

The jobs and income supported through national forest management activities are important components of well-being in the socioeconomic impact zone. The Forest Service currently contributes about 5 percent of employment and 6 percent of labor income in the socioeconomic impact zone. National forest timber harvest, expenditures, and recreation uses make up the majority of these jobs and the associated income (table 210).

Current trends in timber harvests from non-Forest Service ownerships do not indicate a reversal from the major decline between 2002 and 2003 and the additional declines since the recession of 2007. Recent revisions of the Idaho Panhandle National Forests plan and the potential revision to the Okanogan-Wenatchee Forest Plan are not expected to change local timber supplies either. Eastern Washington timber supply is expected to remain near current levels.

The Colville National Forest budget would also remain at current levels, and recreation use and related expenditure would not differ. The Forest's current economic role would be the same in importance across all of the alternatives during the life of the revised forest plan.

Table 210. Total jobs and income supported by Colville National Forest activities and programs by alternative for the Colville socioeconomic impact zone, annual average

Estimated Employment Contribution (direct, indirect, and induced)

Activity	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Recreation	195	195	195	195	195	195
Livestock grazing	98	98	98	98	98	98
Timber	330	539	114	537	297	303
Expenditures	278	278	278	278	278	278
County payments	36	36	36	36	36	36
Totals	**937**	**1,146**	**721**	**1,144**	**904**	**910**

Estimated Wage Income Contribution ($1,000s) (direct, indirect, and induced)

Activity	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Recreation	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556
Livestock grazing	$1,524	$1,524	$1,524	$1,524	$1,524	$1,524
Timber	$19,335	$31,224	$6,692	$31,089	$17,428	$17,765
Expenditures	$13,383	$13,383	$13,383	$13,383	$13,383	$13,383
County payments	$1,368	$1,368	$1,368	$1,368	$1,368	$1,368
Totals	**$39,166**	**$51,055**	**$26,523**	**$50,920**	**$37,259**	**$37,596**

Social Resources

The Colville National Forest is in northeastern Washington, extending to Ferry, Pend Oreille, and Stevens Counties. These three counties form the socioeconomic impact zone. Towns near the Forest include Republic, Marcus, Kettle Falls, Colville, Northport, Metaline, Metaline Falls, Ione, Chewelah, Cusick, Springdale, and Newport.

The following analysis considers existing socioeconomic conditions, trends, and resource uses in the socioeconomic impact zone. In some cases, community-level data are available to document within-county conditions and trends. However, data availability and reliability decrease as the units of analysis become smaller. Therefore, most of the socioeconomic data are presented at the county-level. National and State-level socioeconomic data are presented for context.

Affected Environment

Population Growth

In 2010, the population of the socioeconomic impact zone was approximately 64,000. As table 211**Error! Reference source not found.** reveals, county populations within the socioeconomic impact zone vary considerably, with nearly six people in Stevens County for every one person in Ferry County. Population variation between counties highlights the importance of presenting disaggregated county-level data. Trends in Stevens County may mask changes in smaller counties in data aggregations.

Table 211. Current population and growth trends in the socioeconomic impact zone

Location	1990 Population	2000 Population	Change, 1990–2000 (percent)	2010 Population	Change, 2000–2010 (percent)
Ferry County	6,295	7,260	15.3%	7,551	4.0%
Pend Oreille County	8,915	11,732	31.6%	13,001	10.8%
Stevens County	30,948	40,066	29.5%	43,531	8.6%
Socio-economic impact zone	46,158	59,058	27.9%	64,083	8.5%
Washington State	4,866,692	5,894,121	21.1%	6,724,540	14.1%
United States	248,709,873	281,421,906	13.2%	308,745,538	9.7%

Source: U.S. Census Bureau, 1990, 2000, and 2010

As table 211 shows, the socioeconomic impact zone grew dramatically between 1990 and 2000—surpassing both the state and national growth rates. However, the past decade has seen much more muted growth rates. Overall, the socioeconomic impact zone grew at a slower pace between 2000 and 2010 than either the state or Nation.

The largest communities in the socioeconomic impact zone (populations exceeding 1,000) are Colville (4,673), Chewelah (2,607), Newport (2,126), Kettle Falls (1,595), and Republic (1,073) (U.S. Census Bureau 2010).

Slower growth may indicate limited economic opportunities, aging populations, or a shift in location preferences. However, population growth rates do not tell a complete story. Neither high nor low growth rates can be used alone to demonstrate positive or negative changes in a county. As Grinspoon and Phillips (2007) explain, high population growth rates may lead to economic growth

and diversity. However, they may also strain community capacity (e.g., physical and civic infrastructure) and lead to conflict between long-time residents and newcomers. The remaining analysis would seek to add context and clarity to trends and potential issues in the socioeconomic impact zone.

Population Density

Population density can serve as an indicator for a number of socioeconomic factors of interest—urbanization, availability of open space, socioeconomic diversity, and civic infrastructure (Grinspoon and Phillips 2007, Horne and Haynes 1999). More densely populated areas are generally more urban, diverse, and offer better access to infrastructure. In contrast, less densely populated areas provide more open space, which may offer amenity values to residents and visitors.

Table 212 gives population densities in the socioeconomic impact zone. All three counties are much less densely populated than either the state or Nation. In general, Washington is a densely populated state—it is more densely populated than the Nation as a whole. However, several counties in western Washington are primarily responsible for the state's high density. King and Kitsap counties in the Seattle metropolitan area and Clark County in the Portland, Oregon, metropolitan area have more than 500 people per square mile (U.S. Census Bureau 2010).

Table 212. Population density for the socioeconomic impact zone, 2010

Location	People per Square Mile
Ferry County	3.4
Pend Oreille County	9.3
Stevens County	17.6
Washington State	94.3
United States	87.2

Source: U.S. Census Bureau 2010

Ferry and Pend Oreille Counties have particularly low population densities, with fewer than 10 people per square mile. These are among the least dense counties in the state. These counties are clustered in the far northeastern area of Washington, which suggests that these counties may be particularly isolated. Residents in isolated counties generally have limited access to services, fewer economic opportunities, and face higher transportation costs.

Although population density may suggest urban or rural status in a county, it cannot indicate the concentration of urban and rural areas within a county. Wide disparities between urban and rural areas remain in terms of economic conditions, access to infrastructure and services, opportunities for socioeconomic mobility, and control over natural resources (Grinspoon and Phillips 2007). Disparities are caused by natural differences, political decisions, and social factors

The Economic Research Service classifies all counties on a rural-urban continuum using nine codes (1 is the most urban; 9 is the most rural). Pend Oreille and Stevens counties are in the Spokane metropolitan area, and are, therefore, classified as urban counties. However, Ferry County is classified as entirely rural (ERS 2015). These data reaffirm the findings discussed under population density.

Median Age

Median age can reveal information relevant to land management decisions. Areas with a large proportion of retirees may have different needs and preferences than communities populated primarily with working age families. The following table provides the median age by county as well as the state and national averages.

Table 213. Median age of socioeconomic impact zone counties, 2010

Location	Median Age
Ferry County	47.3
Pend Oreille County	47.8
Stevens County	45.0
Washington State	37.3
United States	37.2

Source: U.S. Census Bureau 2010, Table DP-1

Median age in the socioeconomic impact zone is substantially older than the state and the Nation. People living in the socioeconomic impact zone are, on average, approximately 10 years older than the state and Nation. This suggests that these counties have relatively high proportions of retirees and comparatively few young adults and families with children at home. (Note: this prediction is borne out in the labor versus non-labor income data presented below. All three counties have large shares of non-labor income.) Of the communities within 10 miles of the Colville National Forest, only Kettle Falls, Springdale, and Newport have median ages that approximate the state and national medians (U.S. Census Bureau 2010). The remaining communities have median ages that are substantially higher than the state and national medians. These data suggest that forest access for older individuals may be linked to community and household well-being.

Educational Attainment

Educational attainment, the measure of people with at least a high school diploma or bachelor's degree, is an important indicator of an area's social and economic opportunities and its ability to adapt to change. The following table lists the percentage of the adult population with a high school diploma and a bachelor's degree.

Table 214. Educational attainment, percentage of persons age 25 and over of socioeconomic impact zone counties, 2010

Location	High School Graduate or Higher (percent)	Bachelor's Degree or Higher (percent)
Ferry County	88.6	16.7
Pend Oreille County	87.7	17.9
Stevens County	90.2	19.2
Washington	89.6	31.0
United States	85.0	27.9

Source: U.S. Census Bureau 2010, Table DP-02

The percentage of adults with at least a high school diploma in the socioeconomic impact zone is similar to the state and national averages. The population with at least a bachelor's degree, however,

is low compared to the state and Nation. The adult population with at least a bachelor's degree in the socioeconomic impact zone is approximately 10 percentage points lower than the national average. These data may indicate that the counties in the socioeconomic impact zone provide few opportunities for highly educated workers. The presence of highly educated adults may be self-reinforcing: a highly educated population is a signal that an area provides economic and cultural opportunities, which attracts additional college-educated adults to the area. This process leads to further economic development and job creation. In contrast, areas with low levels of educational attainment have lower levels of human capital, which reduces an area's ability to capitalize on economic change (Florida 2002).

Income and Earnings

Income data are key indicators of the economic well-being of a county. High per capita income and mean earnings may signal greater job opportunities, highly skilled residents, economic resilience, and well-developed infrastructure. Per capita income measures both labor income (i.e., wage and salary payments) and non-labor income (i.e., dividends, rents, and transfer payments) divided by the total number of people in a county. Mean earnings data consider only wage and salary payments to the working population in a county.

Table 215. Per capita income and mean earnings of socioeconomic impact zone counties, 2012

Location	Per Capita Income	Mean Earnings
Ferry County	$19,320	$48,305
Pend Oreille County	$22,647	$55,017
Stevens County	$21,928	$53,101
Washington	$30,661	$77,586
United States	$28,051	$74,373

Source: U.S. Census Bureau 2012b

Across the socioeconomic impact zone, both per capita income and mean earnings are considerably below the state and national figures. These data suggest that the socioeconomic impact zone provides limited economic opportunities.

Table 216 displays the contribution of labor (i.e., wage and salary) and non-labor (i.e., rents, dividends, and transfer payments) sources of income to total personal income in the socioeconomic impact zone. All three counties derive the majority of personal income from non-labor sources, which indicates that a large number of retirees reside in the area. In contrast, nearly two-thirds of personal income in both the state and Nation come from labor earnings. These data are consistent with the finding that the socioeconomic impact zone residents are, on average, older than residents of the state and Nation.

Table 216. Contribution of labor and non-labor income to total personal income of socioeconomic impact zone counties, 2012

Location	Labor (percent)	Non-labor (percent)
Ferry County	41.0	59.0
Pend Oreille County	45.2	54.8
Stevens County	46.5	53.5

Location	Labor (percent)	Non-labor (percent)
Washington	64.7	35.3
United States	64.6	35.4

Source: U.S. Bureau of Economic Analysis 2012

Non-labor income can provide economic stability in an area, as it is not directly tied to employment. However, reliance on non-labor income also has drawbacks: first, as the latest recession illustrated, asset markets can be high risk. Dramatic changes in the value of homes and investment portfolios may significantly decrease non-labor income. Second, some forms of non-labor income, particularly transfer payments (e.g., Social Security), are contingent on government policy. Changes in policy would affect this type of income. Third, the types of goods and services bought with non-labor income would affect the economic impact. For instance, a county that has a high rate of amenity retiree part-year residents is likely to experience growth in related industries, such as tourism and recreation. Jobs in these industries are often low wage and seasonal, which may increase employment, but decrease mean earnings.

Economic Diversity

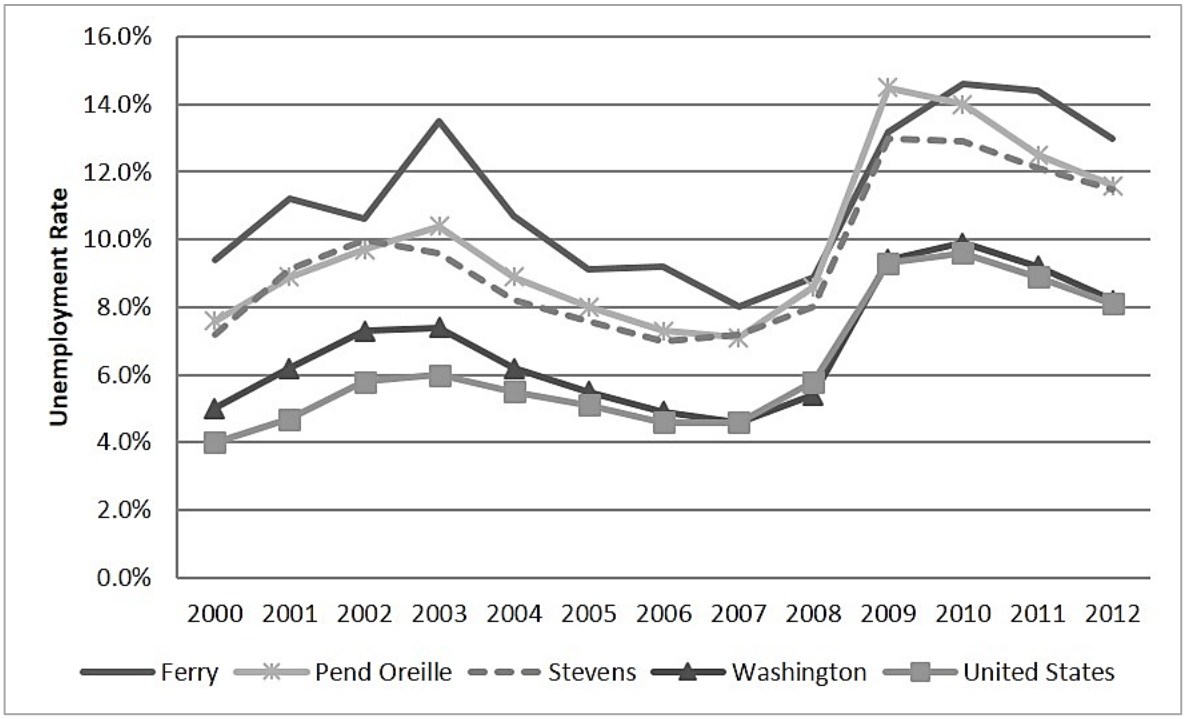
Economic diversity generally promotes stability and offers greater employment opportunities. Highly specialized economies (i.e., those that depend on very few industries for the bulk of employment and income) are more prone to cyclical fluctuations and offer more limited job opportunities. Determining the degree of specialization in an economy is important for decision-makers, particularly when the dominant industry can be significantly affected by changes in policy. For Forest Service decision-makers, this is likely to be the case where the forest products industry or the tourism and recreation industries, for instance, are reliant on the local national forest.

Government is the dominant employer, accounting for more than one-quarter of employment in the socioeconomic impact zone. Nationally, approximately 14 percent of employment is with the government (all levels). The socioeconomic impact zone is also specialized in agriculture, forestry, fishing and hunting, which accounts for 9 percent of employment. For context, this sector is responsible for less than 2 percent of national employment (IMPLAN 2010).

Economists, borrowing from ecologists, use a diversity index (variously called the Shannon Index, Shannon-Weiner Index, and Shannon-Weaver Index) to assess the degree of economic specialization. The index ranges from zero (most specialized) to one (most diverse). The socioeconomic impact zone scores 0.67 on this index. In contrast, Washington scores 0.74 and the U.S. scores 0.76 (IMPLAN 2010). A low economic diversity rating may indicate lower economic resilience.

Unemployment

The unemployment rate provides insight into the correspondence between residents' skills and employment opportunities. The "natural" rate of unemployment has been posited to be around 5 percent. This is the so-called natural rate because this is a level that allows for movement between jobs and industries, but does not signal broad economic distress. The national unemployment rate has stayed substantially above this rate since 2009. Figure 13 shows the unemployment trends for the Nation, state, and the counties making up the socioeconomic impact zone since 2000.



Source: U.S. Bureau of Labor Statistics 2013

Figure 13. Unemployment rate of socioeconomic impact zone counties, 2010

Since the middle of the decade, Washington's unemployment rate has converged with the national rate. In contrast, the unemployment rate in the socioeconomic impact zone has consistently exceeded the national and state unemployment rates since 2000. These data suggest that the socioeconomic impact zone may be less able to adapt to economic changes.

Environmental Justice

In 1994, President Clinton issued E.O. 12898 (Office of the President 1994). This order mandates that all Federal agencies analyze the potential for their actions to disproportionately affect minority and low-income populations. The Council on Environmental Quality (CEQ) issued supplemental guidance to assist agencies' compliance (CEQ 1997). The CEQ suggests the following criteria for identifying potential environmental justice populations:

> "Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis..."
>
> "Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census Current Population Reports, Series P -60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."

According to the Census data from 2010, Native American populations meet the environmental justice criterion as a minority population meaningfully greater than the general population. Therefore, decision makers should give particular consideration to the potential impacts of management actions on Native American populations.

More than 15 percent of Ferry County's population identifies as Native American or Alaska Native, indicating that effects on Tribal uses and values should be thoroughly analyzed. Pend Oreille and Stevens Counties also have large Native American/Alaska Native populations relative to Washington and the United States. Compared to the state and Nation, the socioeconomic impact zone has fewer individuals who identify as Hispanic/Latino, Black/African American, or Asian.

The following table shows the share of individuals living in poverty in 2010. All three counties have poverty rates that exceed the state and national rates. The relatively high poverty rates across the socioeconomic impact zone highlight the importance of considering potential environmental justice impacts in the decision-making process.

Table 217. Poverty rates of socioeconomic impact zone counties, 2012

Location	People Living in Poverty (percent)
Ferry County	20.8
Pend Oreille County	18.3
Stevens County	15.1
Washington State	12.1
United States	13.8

Source: U.S. Census Bureau 2012a

Ferry County has the highest poverty rate, with approximately one-fifth of residents living in poverty. Ferry County also has the highest percentage of minority residents in the socioeconomic impact zone, suggesting overlap between race and poverty. Tribal land uses in Ferry County (e.g., subsistence gathering on the Forest) would be analyzed in the context of high poverty rates.

Table 218 displays the poverty rate by race and ethnicity for each of the three counties, Washington, and the United States. As the table reveals, the poverty rate often varies substantially across races and ethnicities. In all considered geographies, non-Hispanic white residents experience the lowest levels of poverty. Overall, the table indicates a strong correlation between minority status and poverty in the socioeconomic impact zone.

Native American/Alaska Native individuals experience the highest rates of poverty in the socioeconomic impact zone, with approximately one-quarter of these individuals living below the poverty line. Each instance of the poverty rate exceeding 25 percent is highlighted gray.

Table 218. Poverty by race and ethnicity of socioeconomic impact zone counties, 2000

Location	White, Not Hispanic	Black, African American	Native American, Alaska Native	Asian	Native Hawaiian, Pacific Islander	Latino, Hispanic
Ferry County	17.2%	N/A	24.1%	N/A	N/A	N/A
Pend Oreille County	17.5%	N/A	29.0%	N/A	N/A	18.7%
Stevens County	14.7%	14.7%	25.5%	18.5%	N/A	26.5%
Washington State	8.2%	18.6%	21.1%	12.2%	13.3%	24.2%
United States	7.9%	23.4%	22.3%	12.3%	15.7%	22.1%

Source: U.S. Census Bureau 2000. Each instance of the poverty rate exceeding 25 percent is highlighted gray.
Note: N/A indicates that this data was not available from the Census Bureau. To protect the identity of respondents, the Census Bureau does not report data where fewer than 100 individuals compose the sample.

A low prevalence of minority residents, poverty, or both, should not be construed as evidence that environmental justice issues would not arise as a result of forest planning decisions. All decisions would be scrutinized for any potential adverse impacts on vulnerable populations, wherever they reside in the socioeconomic impact zone.

Three federally recognized Tribes are engaged in the plan revision process at varied levels: the Colville Confederated Tribes, the Spokane Tribe of Indians, and the Kalispel Tribe of Indians.

Values, Beliefs, and Attitudes

Values are "relatively general, yet enduring, conceptions of what is good or bad, right or wrong, desirable or undesirable."

Beliefs are "judgments about what is true or false—judgments about what attributes are linked to a given object. Beliefs can also link actions to effects."

Attitudes are "tendencies to react favorably or unfavorably to a situation, individual, object, or concept. They arise in part from a person's values and beliefs regarding the attitude object" (Allen et al. 2009).

The James Kent Associates (JKA) report, "Community Field Reports in Support of the Upcoming Land Use Planning for the Spokane District Office of the Bureau of Land Management," (JKA 2010) outlines values, beliefs, and attitudes expressed by eastern Washington residents toward public lands management. Although this report focuses on BLM management, much of the information is also relevant for Forest Service decision makers in northeastern Washington. The report divides area into "human resource units." The relevant unit for the socioeconomic impact zone is the Colville human resource unit.

A common theme across northeastern Washington residents was an appreciation for public lands because of outdoor recreation activities, such as hiking, skiing, and OHV use. However, the local economy in the Colville human resource unit remains reliant on public land resources. Timber, agriculture, and mining are socially and economically important sectors. The varied uses of public lands have the potential to give rise to conflict between residents. The Colville human resource unit is traditionally based on cattle grazing, timber production, and mining. Despite the growth in recreation participation in the socioeconomic impact zone, some residents believe recreation to be

less important to the local economy due to the perception that it "does not add directly to local government revenue the way that traditional economic sectors do" (JKA 2010, pg. 132).

Changes in outdoor recreation habits have led to conflict between users with different recreation values. Motorized and non-motorized users often express different recreation values, which can lead to conflict on the trails. Some respondents expressed a belief that all areas should be open to OHV use, which has been curtailed in many areas as a result of implementing the Travel Management Rule. In contrast, non-motorized users expressed concern that motorized users jeopardized the safety of other users and the ecological values of the land.

A dominant trend across human resource units in the JKA report is the social and economic changes occurring across the socioeconomic impact zone. While many of these changes benefit local residents through outdoor recreation opportunities and economic growth, many residents feel that these changes are compromising traditional values in the community. Residents who rely on public lands for a living are witnessing a shift in attitudes in their communities about how public lands should be used. Whereas, commodity uses such as grazing and timber were once dominant, the growth in outdoor recreation can come into conflict with commodity values.

In addition to the JKA report, a sample of public comments related to social and economic conditions was reviewed. Sixteen interest areas were identified and used to code the comments. These include: fire and fuels management, citizen involvement, mineral extraction, economic development, wilderness designation, ecosystem services, access, livestock grazing, motorized recreation, non-motorized recreation, road and trail maintenance, multiple use management, hunting and fishing, timber and forestry, forest health, and roadless areas. These interest areas are closely aligned with the values expressed in the comments. Promotion of forest health, protection and expansion of diverse recreation opportunities, economic development, preservation of public access to NFS lands, and public involvement in agency decision-making are values that were present in one or more of the comments in the sample.

A number of public comments expressed a belief that closures and restrictions are antithetical to public lands. For these forest users, continued access for recreation and grazing—via motorized and non-motorized means—is the paramount concern. One member of the public commented, "We already don't have enough riding areas to enjoy with our families and now there is more 'take away'? When will it end?" This sentiment was common among Forest users who believe that wilderness recommendations would limit access to their favorite places.

Some individuals argued that because they contribute to trail maintenance, they have a right to Forest access. These users believe that they act as stewards of the Forest, and efforts to limit their access do not recognize the contributions they make.

Others comments prioritized forest health over public access. These individuals expressed a belief that wilderness designation protects forests and ecosystem services for future generations. One comment claimed that there is an imbalance in the quality of the recreation experience for motorized and non-motorized users—those who value "solitude, quiet, and fresh clean air," have fewer opportunities.

Community Resilience

Defining Community Resilience

Community (or socioeconomic) resilience relates to humans' ability to adapt to social and economic changes. Quigley et al. (1996b) define community resilience as: "the capacity of humans to change

their behavior, redefine economic relationships, and alter social institutions so that economic viability is maintained and social stresses are minimized." Numerous studies have attempted to measure community resilience in the Pacific Northwest. The Interior Columbia Basin Ecosystem Management Plan (ICBEMP) assessed the community resilience of all 100 counties in its planning area. Community resilience is a particularly salient topic for Forest Service managers in this region, where many local communities rely on forests for income, employment, and leisure. Forest-dependent communities are more likely to experience social and economic consequences due to changes in forest management.

Community Resilience Indicators

Unfortunately, the definition of community resilience does not offer tools for its measurement. Therefore, indicators are needed to serve as proxies for resilience. Ecologists have found that ecological diversity contributes to ecosystem resilience. This finding can translate to the social sciences—more diverse communities generally adapt to and integrate change more rapidly and successfully than their less diverse counterparts. Using this assumption as a starting point, social scientists have developed numerous measurable indicators to assess community resilience.

Horne and Haynes (1999) use three indicators to measure community resilience for the ICBEMP: economic resilience, lifestyle diversity, and civic infrastructure. An economic diversity index is used as a proxy for economic resilience. Scores on this index range from zero (no diversity) to one (perfect diversity). Table 219 presents the economic diversity index for counties in the socioeconomic impact zone. Economic diversity ratings are determined relative to the state's diversity index. Washington scores 0.740 on the economic diversity index. "High" ratings are assigned to counties with indices at least 95 percent of the state's index (0.703 or higher). "Medium" ratings are given to counties with indices between 85 percent and 95 percent of the state (0.629 to 0.702). "Low" ratings are assigned to counties that are less than 85 percent as diverse as the state (below 0.629).

Table 219. Economic diversity index of socioeconomic impact zone counties, 2010

Location	Diversity Index	Rating
Ferry County	0.596	Low
Pend Oreille County	0.594	Low
Stevens County	0.674	Medium

Source: IMPLAN 2010

None of the counties have high levels of economic diversity. Nevertheless, there is variation within the socioeconomic impact zone. Stevens County is significantly more economically diverse than Ferry and Pend Oreille Counties, which have low levels of economic diversity. These findings are consistent with the population data presented at the beginning of this section, which found that Ferry and Pend Oreille Counties have low population densities. As described earlier, rural areas typically offer fewer economic opportunities.

Lifestyle diversity presents a greater measurement challenge. Horne and Haynes (1999) used the PRIZM market segmentation database. More recently, a Forest Service study was conducted to measure the socioeconomic resilience of Washington counties (Daniels 2004). Rather than relying on a single database, Daniels creates a composite measure of lifestyle diversity. Mobility, ethnicity, degree of urbanness, race, income, and education are used as proxies for lifestyle diversity. Daniels' findings are copied in table 220, for the socioeconomic impact zone.

Table 220. Location diversity rating of socioeconomic impact zone counties, 2004

Location	Diversity Rating
Ferry County	Low
Pend Oreille County	Low
Stevens County	Low

Source: Daniels 2004, pg. 15

Lifestyle diversity ratings in all counties in the socioeconomic impact zone are categorized as "low." These findings are consistent with the population density, educational attainment, and race and ethnicity data discussed earlier.

Civic infrastructure includes community leadership and preparedness for change. Given the difficultly of directly measuring civic infrastructure, Horne and Haynes (1999) use population density as a proxy for civic infrastructure. Daniels (2004) explains the intuition for this proxy: "the relative isolation of (low population density) counties results in a lower propensity to establish elements of civic infrastructure" (pg. 18). Density data were previously presented (in the Population Density section). All socioeconomic impact zone counties are much less densely populated than the state. These data suggest that the socioeconomic impact zone has low levels of civic infrastructure.

Following Daniels' (2004) method, counties with fewer than 10 people per square mile are given "lowest" ratings, which confer a zero score in the composite calculations. Two socioeconomic impact zone counties (Ferry and Pend Oreille counties) fall in this category. Counties with population densities between 10 and 30 are given "low" ratings. Stevens County is in this category. No counties in the Colville National Forest socioeconomic impact zone are in the "medium" or "high" categories.

Composite Community Resilience Measures

The three community resilience indicators—economic resilience, lifestyle diversity, and civic infrastructure—re-averaged to calculate composite community resilience ratings. Counties are scored on a zero to three scale (zero is the least resilient). The following table presents the community resilience ratings for the socioeconomic impact zone.

Table 221. Composite community resilience measures of socioeconomic impact zone counties

Location	Economic Diversity	Lifestyle Diversity	Civic Infrastructure	Composite Score
Ferry County	Low	Low	Lowest	0.67
Pend Oreille County	Low	Low	Lowest	0.67
Stevens County	Medium	Low	Low	1.33

Source: Daniels 2004; Horne and Haynes 1999

In analyzing the community resilience information, it is important to keep in mind that low resilience ratings are not synonymous with "bad," just as high resilience ratings do not confer superior status. Some residents of low resilience counties may value elements of their counties that are not captured in resilience analysis. For instance, "traditional" social and economic lifestyles may be compromised as a community moves from low to high resilience. This trend was discussed in the Values, Beliefs, and Attitudes section. Community resilience information is relevant for Forest Service managers in considering the consequences of social and economic change. Management actions that alter social or economic activities in low resilience counties are more likely to have pronounced impacts.

Ferry and Pend Oreille counties have the lowest community resilience ratings, both scoring 0.67. This indicates that these counties would be least able to successfully adapt to social and economic changes. Stevens County has a somewhat higher, though still low, community resilience rating. These findings suggest that Forest Service management actions on the Colville National Forest that affect social and economic conditions in the surrounding communities may be difficult to assimilate. The ability of the communities to adapt to, and benefit from, social and economic change is expected to be low.

Forest Dependence

Community resilience data, without further context, may not be particularly useful for estimating the social and economic consequences of Forest Service management actions. Assessing the degree to which the socioeconomic impact zone benefits from forest land is essential to understand the resilience of local communities to Forest Service actions. Counties derive income and employment from the forest products and tourism industries. Additionally, local residents use forests for recreation, spiritual and cultural activities. Frequently, forests also anchor sense of place, which contributes to social well-being. The following table provides the percentage of land in each county that is forested (note: this includes all forest land, not just National Forest System lands).

Table 222. Forested lands of socioeconomic impact zone counties

Location	Forest Land Area, Percentage of Total Land
Ferry County	86.78%
Pend Oreille County	75.76%
Stevens County	75.69%

Source: Daniels 2004, pg. 24

Counties of particular concern are those with low resilience ratings and high forest dependence. Ferry, Pend Oreille, and Stevens Counties have very high percentages of forest land, which accounts for at least three-quarters of the land base in each county. Ferry and Pend Oreille Counties also have the lowest community resilience ratings. The combination of these factors suggests that Colville National Forest managers should pay particular attention to how management actions would affect the social and economic conditions in these counties.

The percentage of forest land is not a complete measure of dependence on forest resources. The importance of forest-related economic sectors also provides insight into the role of forest lands in the socioeconomic impact zone. Table 223 shows the contribution of the forestry and commercial logging sectors to employment and income, by county. These findings are consistent with the percentages of forest land by county. Ferry, Pend Oreille, and Stevens Counties are all comparatively more reliant on timber-related employment than the state. Furthermore, the forestry and commercial logging industry is more dominant in Washington than it is in the Nation as a whole (IMPLAN 2010).

Table 223. Forestry and commercial logging employment and income of socioeconomic impact zone counties, 2010, percentage of total

Location	Forestry and Commercial Logging Employment (percentage of total)	Forestry and Commercial Logging Employee Compensation (percentage of total)
Ferry County	2.2%	2.6%
Pend Oreille County	4.3%	10.3%
Stevens County	5.8%	9.9%
Washington State	0.7%	0.9%

Source: IMPLAN 2010

However, timber is not the sole forest resource that contributes to the local economy. Recreation and wildlife-related visits are major contributors to local employment and income. Activities on the Forest, both consumptive (e.g., logging) and non-consumptive (e.g., wildlife viewing), support the local economy. Many of the communities adjacent to the Colville National Forest are reliant on employment in the natural resources sectors (agriculture, forestry, fishing and hunting, and mining). More than one-third of employment in Ione is in natural resources; approximately 10 percent of Kettle Falls, Republic, Metaline Falls, and Newport residents are employed in natural resource sectors (U.S. Census Bureau 2012). The Economic Specialist Report contains an assessment of the economic contribution of Forest Service activities to the local economy and is summarized in the economic section of this chapter.

Access and Use

Visitor Use Data

Table 224 presents a breakdown of visitor activities on the Colville National Forest. Activity participation is reported according to the percentage of visitors who engaged in that activity (either alone or in combination with other activities) and the percentage of visitors who reported the activity as their main use of the Forest during their visit. The most commonly reported activities are not necessarily the most frequently reported main activities. For instance, one-fifth (20.9 percent) of Forest visitors reported that they viewed wildlife during their visit. However, only approximately one-half of one percent (0.4 percent) of visitors indicated that wildlife viewing was their primary trip purpose.

The most common activities (by main activity) are downhill skiing and viewing natural features, which were each reported as the main activity by more than 10 percent of visitors. Hiking/walking, relaxing, developed camping, gathering forest products, fishing, and snowmobiling were each the main activities for more than 5 percent of visitors.

The activity participation breakdown indicates that forest users engage in a diverse range of activities. Both motorized (e.g., snowmobiling) and non-motorized activities (e.g., hiking/walking) are common. Furthermore, forest resources provide diverse types of value. Consumptive uses (e.g., fishing and gathering forest products) exist alongside non-consumptive uses (e.g., viewing natural features). This diversity makes it difficult to generalize about forest uses. The available data suggest that multiple-use management of the forests is consistent with existing use patterns.

Table 224. Activity participation on the Colville National Forest

Activity	Participation (percent)	Main Activity (percent)
Viewing Natural Features	30.7	12.0
Hiking/Walking	29.0	7.8
Relaxing	28.3	5.7
Downhill Skiing	24.0	23.3
Driving for Pleasure	21.9	2.0
Viewing Wildlife	20.9	0.4
Developed Camping	18.5	8.5
Gathering Forest Products	13.8	8.6
Fishing	13.6	5.5
Picnicking	13.3	0.4
Other Non-motorized	9.1	2.5
Motorized Trail Activity	8.3	4.3
Snowmobiling	7.7	7.2
OHV Use	6.6	1.4
Primitive Camping	6.0	1.7
Motorized Water Activities	6.0	2.2
Bicycling	5.1	1.0
Nature Study	4.9	0.7
Non-motorized Water	4.2	1.1
Hunting	3.6	1.6
Visiting Historic Sites	3.2	0.0
Nature Center Activities	3.1	0.0
Cross-country Skiing	2.6	1.6
Backpacking	2.5	0.4
Resort Use	2.0	0.0
Some Other Activity	1.3	0.4
Other Motorized Activity	0.8	0.7
Horseback Riding	0.7	0.1
No Activity Reported	0.3	0.3

Source: USDA Forest Service 2012a

Firewood

The Colville National Forest provides firewood permits for personal and (limited) commercial use. The following table displays the volume and value of firewood cut and sold on the Forest in fiscal year 2012.

Table 225. Cut and sold firewood, volume and value, on the Colville National Forest, FY2012

Forest	Sold Volume (CCF)	Sold Value	Cut Volume (CCF)	Cut Value
Colville National Forest	10,242.50	$60,250.00	10,400.60	$61,240.00

Source: USDA Forest Service 2012b

For households in the socioeconomic impact zone, firewood from the Forest may provide an affordable source of heating. Table 226 lists the percentage of households in each county that report using wood as their primary heating source. The three Colville National Forest counties—Ferry, Pend Oreille, and Stevens—have a substantially higher reliance on firewood compared to the state as a whole. Indeed, more than half of households in Ferry County use firewood as their primary heat source. These data suggest that changes to firewood availability on the Colville National Forest would have the potential to affect the well-being of households in the socioeconomic impact zone.

Table 226. Percentage of households with wood as primary heating fuel of socioeconomic impact zone counties, 2010

Location	Households with Wood as Primary Heating Source (percent)
Ferry County	52.7%
Pend Oreille County	29.2%
Stevens County	32.2%
Washington State	4.5%

Source: U.S. Census Bureau 2012a

Several of the communities adjacent to the Colville National Forest are particularly reliant on wood as the primary home heating source. Approximately 60 percent of households in Springdale and Marcus use wood as the primary heating source. Nearly half of households in Republic and Northport rely on wood heating (U.S. Census Bureau 2012). Changes to firewood availability on the Colville National Forest could affect household well-being in these communities by affecting the cost of home heating.

Forest Access

NFS lands provide commercial, cultural, and leisure opportunities. Access to these lands is often a chief concern voiced by the public. Approximately 41 percent of the public comments reviewed (7 of 17 unique comments) expressed a primary interest in forest access. Most of these comments addressed the desire for continued access to favorite recreation areas. Both motorized and non-motorized recreation participants expressed concerns related to forest access.

A number of access-related comments argued against recommending additional wilderness areas. One comment claimed that wilderness designation blocks use and enjoyment of the forest by the majority of people. Inventoried roadless areas and travel management limit the ability of motorized users to recreate on public lands without restrictions, and some motorized users commented that they feel their recreation opportunities on the forests are being eroded. However, another comment stressed the importance of regulating access so that those who desire quiet and solitude do not need to compete with motorized and mechanized recreation users. Other comments addressed the trade-off between unencumbered access and forest health.

Wildfire and the Wildland-urban Interface

Annually, millions of dollars are spent suppressing wildfires in the United States. In 2007, there were 27 large fires in the United States that cost $547 million to suppress (WFLC 2010). Between 2000 and 2008, the percentage of the Forest Service budget spent on extinguishing wildfires expanded from 25 to 44 percent (WFLC 2010). Furthermore, suppression costs account for only a fraction of the total cost of wildfires. The Western Forestry Leadership Coalition estimates that total wildfire-related expenses range from 2 to 30 times the reported suppression costs (2010).

A principal reason for the increasing cost is the growing number of homes located in the wildland-urban interface (WUI). Suppression activities are frequently undertaken when wildfire threatens private property. A century of fire suppression has led to increased frequency of high-intensity wildfire. Expansion of the WUI has increased the probability that wildfires would occur near private residences. These two factors—the growth of the WUI and the use of suppression tactics—increase the cost of wildfire. The following table presents the extent of the WUI and wildfire risk in the socioeconomic impact zone.

Table 227. Homes in wildland-urban interface (WUI) and wildfire risk of socioeconomic impact zone counties

Location	WUI Homes as Percentage of Total Homes	West-wide Rank by Existing Risk (of 413 counties)	West-wide Rank by Potential Risk (of 413 counties)
Ferry County	21.2%	115	46
Pend Oreille County	34.8%	81	58
Stevens County	18.6%	41	10
Washington State	8.1%	--	--

Source: Gude et al. 2008

WUI development is a major land use in Ferry, Pend Oreille, and Stevens Counties. Wildfire and fire management activities, therefore, are likely to affect private property and quality of life in communities near the Colville National Forest. While the WUI is correlated with wildfire risk, Forest Service activities, such as fuel reduction projects and late structure management, may also influence the risk and hazard of wildfire.

Environmental Consequences

Methodology

Assumptions

- Assume the budget levels would continue along current trend lines, with the possibility of the amount varying by 20 percent, plus or minus.
- The identification of social values relies on the James Kent Associates report (JKA 2010), public scoping comments, and discussions with Forest staff.
- The effects of recommended wilderness areas are based on the assumption that these areas would be designated as wilderness by Congress.
- Higher road density improves forest access for both commercial and recreational forest users.
- Economic and leisure opportunities on the forest are utilized at levels similar to existing conditions.

Methods of analysis

The social analysis combines Forest Service data on resource use (recreation, grazing, forest products, and minerals) with information on social values to estimate how changes in forest management would affect human well-being.

The Forest Service resource data were obtained from: National visitor use monitoring program (recreation), cut and sold reports (forest products), and Natural Resources Manager (minerals and grazing).

Information on social values, as described in the Affected Environment section, is based on public comments and the report on the attitudes of eastern Washington residents toward public lands (JKA 2010).

The evaluation criteria and indicators used in this analysis are described at the beginning of this section.

Incomplete and Unavailable Information

Uncertainty about future demographic change, social values and norms, and market conditions constrain the reliability of projections of the social environment in 15 years.

Spatial and Temporal Context for Effects Analysis

The spatial context for the social effects analysis includes Ferry, Pend Oreille, and Stevens Counties. Due to the programmatic nature of forest planning, site-specific consequences cannot typically be estimated. Therefore, the social analysis estimates effects for the socioeconomic impact zone (three-county area).

The temporal context for the analysis extends 15 years, which is the expected life of a forest plan.

The cumulative effects analysis considers actions on the Confederated Tribes of the Colville Reservation, Kalispel Tribe Reservation lands, lands administered by the Okanogan-Wenatchee and Idaho Panhandle National Forests; other Federal and State land; and lands of other ownership both within and adjacent to the Colville National Forest boundaries.

No Action Alternative

The no action alternative is less likely to protect old forests and their associated social values than the proposed action. As a result, the flow of ecosystem services to adjacent communities may decrease, while the risk of wildfire to private property and human health could increase. Access, recreational opportunities, and other forest uses that support quality of life and community resilience would not change relative to current conditions. Lower forest resilience may decrease the production of culturally important foods, which may affect Tribal interests and well-being.

Old Forest Management and Timber Production

The no action alternative would not alter old forest management on the Colville National Forest. Old forest management areas and the Eastside Screens would continue to regulate forest activities to protect old forest habitat. The old forest reserves would continue to account for approximately 3 percent of the Colville National Forest. However, old forests are expected to decline due to disturbances such as fire and insects, competition for water and nutrients, and age. Wildfire risk to adjacent communities would continue, which may affect private property and human health. Climate change is expected to exacerbate tree mortality and threats to human health and property (Gaines et al. 2012). Under the no action alternative, only 23 percent of the Colville National Forest would be within the historical range. This alternative has the highest risk of uncharacteristic wildfire to communities adjacent to the forest.

The no action alternative would do less to protect old forests than the proposed action. Forest visitors and interest groups value old forest for wildlife viewing, spiritual opportunities, and non-use values

(e.g., knowing that old forests exist and may be seen by future generations). The no action alternative would be less likely to sustain a flow of ecosystem services related to old forests—including wildlife habitat and spiritual values—than the proposed action. Therefore, communities that rely on the Colville National Forest for ecosystem services may see their quality of life decline compared to management under the proposed action alternative.

The no action alternative estimates timber harvest of approximately 41 million board feet annually. Wood products harvested from the Colville National Forest supports employment and income in the local economy, as described in the economics section of this chapter. The no action alternative would not affect firewood harvesting. Firewood would continue to be removed from the Forest, in quantities similar to current conditions. As described in the Affected Environment section, firewood is an important home heating source in the socioeconomic impact zone. The no action alternative would not change the availability of firewood in nearby communities. Therefore, no changes to quality of life or household expenditures related to home heating and firewood are expected as a result of this alternative.

Motorized Recreation Trails

Currently, 11 percent of the Colville National Forest is designated as backcountry non-motorized areas. This designation, together with the 3 percent of the Forest in designated wilderness, does not allow roads or motorized trails. The no action alternative would maintain the existing levels of these designations, making about 15 percent of the Forest off-limits to motorized recreation. Non-motorized designations may positively affect social values related to ecological health and opportunities for solitude. Such designation may adversely affect the quality of life for motorized recreation users and those with commercial interests in the forests, whose access may be inhibited by non-motorized designations. The no action alternative would not change non-motorized designations from existing levels; therefore, no change in human well-being related to motorized recreation is expected as a result of this alternative. However, this alternative would limit the potential for future expansion of motorized backcountry recreation relative to the proposed action, which would inhibit the Forest's ability to respond to changes in recreation demand and may reduce quality of life for visitors who value those opportunities.

Recreation activities that rely on motorized roads and trails—driving for pleasure, motorized trail activity, snowmobiling, OHV use, other motorized activity—account for 15.6 percent of individuals' main purpose for visiting the Colville National Forest. The overall participation in these activities is approximately 45 percent (USDA Forest Service 2012a). The participation rate in motorized activities and the quality of the visit are not expected to change based on management actions under the no action alternative.

Access

The no action alternative would continue to follow 1988 forest plan direction and policy related to road density, including limits on road construction in deer and elk winter range and the 2001 Roadless Area Conservation Rule, which prohibits road construction and timber cutting, sale and removal in inventoried roadless areas, unless certain, limited exceptions are met. Management actions related to road density under the no action alternative are not expected to meaningfully affect individuals' ability to access and enjoy the Colville National Forest. Therefore, no changes to quality of life or community resilience are expected to occur.

Recommended Wilderness Areas

The no action alternative would maintain current designated wilderness at 31,400 acres, which is approximately 3 percent of the Colville National Forest. The NVUM survey estimates that less than 1 percent of visits to the Forest are to a designated wilderness area (USDA Forest Service 2012a). None of the survey respondents reported overcrowding in designated wilderness during their visit. These findings suggest that current designated wilderness is adequate to satisfy recreational demand for wilderness.

The social value of designated wilderness is not limited to recreation. Wilderness designation may provide amenity values to nearby residents and landowners, support ecosystem service provision (e.g., clean water and carbon sequestration), and offer opportunities for research and environmental education. Designated wilderness may protect "non-use" values. Non-use values arise not from the consumption of goods or services provided by wilderness areas, but from the value of knowing it exists or preserving the option to visit in the future. Among all the considered alternatives, the no action alternative would do the least to support social values related to designated wilderness.

Environmental Justice

The largest minority group in the socioeconomic impact zone is Native Americans. The Tribal Resources section of this chapter describes potential consequences to Native American populations in the vicinity of the Colville National Forest.

Communities in proximity to the Colville National Forest have higher rates of poverty than the state and the Nation. Therefore, actions that adversely affect employment, income, or the cost of participating in activities on the Forest may disproportionately affect low-income individuals. The no action alternative is not expected to change employment, income, or the cost of participating in activities on the Forest relative to current conditions. Therefore, the no action alternative would not adversely or disproportionately affect low-income individuals.

Cumulative Effects

Lower forest resilience may interact with residential development on private lands adjacent to the Colville National Forest to increase risks to private property and human health from wildfire.

Disturbances on adjacent Federal lands, such as disease and insects, may exacerbate threats to the provision of ecosystem services, including culturally significant foods. The cumulative effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities diminishes.

Monitoring Recommendations

The Forest Service may contribute to community resilience and well-being. Monitoring of human communities should evaluate whether management actions are contributing to social and economic sustainability. This may be measured along the following dimensions:

- Resource use patterns
    - ♦ Visitor use and distribution
    - ♦ Firewood collection
    - ♦ Timber harvest
    - ♦ AUMs

- Population characteristics and change
    - ♦ Population growth
    - ♦ Income changes
    - ♦ Educational attainment
- Employment and income from resource uses
- Revenue to states and counties
    - ♦ PILT
    - ♦ Revenue sharing
- Wildfire risk to adjacent communities
    - ♦ Total acres burned
    - ♦ Acres burned near wildland-urban interface.

Proposed Action

A public comment argues that *"Because of the lack of active management of timber harvest, our forest has insect infestations, disease and stand replacing wildfires…"*

The proposed action would improve old forest resilience. As a result, the flow of ecosystem services to adjacent communities would be sustained and the risk of wildfire to private property and human health would decrease. The proposed action would moderately affect access and motorized recreation opportunities, although the effect to quality of life and visitor satisfaction is expected to be small. Increased forest resilience may support the production of culturally important foods, which may affect Tribal interests and well-being.

Old Forest Management and Timber Production

The proposed action would manage 23 percent of the Forest for focused restoration and 49 percent of the Forest for general restoration. Both focused and general restoration management would aim to restore ecological integrity and improve ecosystem function. Focused restoration emphasizes the protection of important fish and wildlife habitats. Restoration may improve resilience to fire, insects, and disease. Increased forest resilience to climate change and other stressors may reduce wildfire risk in adjacent communities (Gaines et al. 2012). Under the proposed action, 27 percent of the Colville National Forest would be within the historical range. This could lower the risk of uncharacteristic wildfire to affect communities adjacent to the Forest compared to the no action alternative. Reduced wildfire risk promotes social values related to health and safety, the protection of private property, and preservation of aesthetic quality.

Restoration would also provide commercially valuable forest products. The proposed action estimates timber harvest of approximately 62 million board feet annually. This is an increase in harvest volume compared to no action. The local economic consequences of wood product harvesting are described in the economics section. In addition to supporting economic activity, the landscape-level approach to old forest management would protect the flow of ecosystem services related to old forests. As discussed above, old forests provide numerous values such as recreation, spiritual fulfillment, and species viability.

The proposed action does not retain the Eastside Screens, which may concern individuals and groups who value the protection of large-diameter trees. However, the proposed action would protect late

forest structure at a landscape level. The desired conditions for late forest structure under the proposed action would ameliorate social concerns related to loss of large-diameter trees.

Under the proposed action, the quantity of firewood harvested from the Colville National Forest annually would be similar to current conditions. Firewood would continue to be an important source of home heating in the socioeconomic impact zone. No changes to quality of life or household expenditures related to home heating and firewood are expected as a result of this alternative.

Motorized Recreation Trails

The proposed action would expand backcountry motorized opportunities from 1 percent of the Forest to 6 percent. This increase in backcountry motorized opportunities may improve quality of life for motorized recreation users who value undeveloped sites. Overall, the proposed action would reduce total forest acres open to summer and winter motorized recreation relative to no action. Approximately 686,900 acres would be open to winter motorized recreation and 874,700 acres would be open to summer motorized recreation. These acreages reflect reductions of approximately 30,000 and 90,000 acres, respectively. The increase in recommended wilderness would place limits on future development of motorized activities relative to no action. On balance, the proposed action is not expected to measurably change visitation or visitor satisfaction relative to existing conditions.

Access

The desired road density under the proposed action is between 2 and 3 miles of roads per square mile. This density is somewhat lower than current conditions; therefore, management actions related to road density under the proposed action may affect some individuals' ability to access and enjoy the Colville National Forest. Reduced access may adversely affect quality of life and community resilience, due to increased costs (time and fuel) of participating in activities, such as recreation and firewood collection, on the Forest. Individuals who are elderly or have disabilities may be particularly likely to be adversely affected by reduced access, due to mobility limitations.

Recommended Wilderness Areas

The proposed action would recommend an additional 101,400 acres of wilderness, which represents approximately 9 percent of the Colville National Forest. The NVUM survey estimates that less than 1 percent of visits to the Forest are to a designated wilderness area (USDA Forest Service 2012a). None of the survey respondents reported overcrowding in designated wilderness during their visit. These findings suggest that current designated wilderness is adequate to satisfy recreational demand for wilderness.

The social value of designated wilderness is not limited to recreation. Wilderness designation may provide amenity values to nearby residents and landowners, support ecosystem service provision (e.g., clean water and carbon sequestration), and offer opportunities for research and environmental education. Designated wilderness may protect "non-use" values. Non-use values arise not from the consumption of goods or services provided by wilderness areas, but from the value of knowing it exists or preserving the option to visit in the future. The proposed action would do more to support social values related to designated wilderness than no action and alternatives P and O.

Environmental Justice

The largest minority group in all three counties of the socioeconomic impact zone is Native Americans. The Tribal Resources section of this chapter describes potential consequences to Native American populations in the vicinity of the Colville National Forest. Unlike no action, the proposed action would be more likely to provide culturally significant foods, due to improved forest resilience

to disease and insects. However, the proposed action would decrease road density and Forest access relative to current conditions, which may particularly affect the ability of elders to access cultural sites, hunting and fishing grounds, and gathering areas.

Communities in proximity to the Colville National Forest have higher rates of poverty than the state and the Nation. Therefore, actions that adversely affect employment, income, or the cost of participating in activities on the Forest may disproportionately affect low-income individuals. The proposed action is not expected to change employment or income relative to current conditions. However, the increase in recommended wilderness and reduced road density may increase the cost of accessing the Forest, which may disproportionately affect low-income individuals.

The increased areas open to the harvesting of firewood could benefit low-income individuals, as they may need to spend fewer resources traveling to an area on the Forest where they can harvest firewood for home heating.

Cumulative Effects

Residential development on private lands adjacent to the Colville National Forest may inhibit the use of prescribed fire as a forest restoration tool, due to social concerns about smoke emissions. Therefore, private land development could make it more difficult and costly to increase forest resilience.

Disturbances on adjacent Federal lands, such as disease and insects, may affect the health of the Colville National Forest. For example, invasive vegetation on adjacent lands may spread to the Colville National Forest. However, other Federal actions to improve forest resilience would support the provision of ecosystem services, including culturally significant foods on both the Colville National Forest and adjacent Federal lands. The cumulative effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities changes.

Monitoring Recommendations

The monitoring recommendations are consistent with those identified for no action.

Alternative R

Stakeholders noted that *many species rely on mature or old-growth forests to survive, so these types of forests must be protected and actively managed.*

Alternative R responds to public comments that support old forest protection through static late forest structure reserve land allocations and a 21-inch upper diameter limit on cutting live trees. It also addresses comments advocating for increased wilderness, fewer miles of motorized trail, and additional protections for wildlife. This alternative is based on a management option developed by a coalition of conservation groups.

Alternative R would increase the acres dedicated to late forest structure, which would support social well-being related to wildlife habitat and existence values. However, alternative R would be the least supportive of commodity and other consumptive uses of the Forest among all considered alternatives, due to decreased access and motorized recreation opportunities, the expansion of recommended wilderness, and limitations on the collection of firewood. Alternative R would appeal to individuals who value limited human interference in the Forest.

Old Forest Management and Timber Production

Alternative R would maintain the current reserve management approach to maintaining late forest structure. Alternative R would increase the late forest structure areas to approximately 51 percent of the Forest. This management would promote species viability and related social values, such as recreation and spiritual fulfillment. However, high stand density in the old forest reserves may increase the potential for uncharacteristic insect outbreaks, fire, and tree mortality. Fires adjacent to communities may adversely affect private property and human health. Climate change would exacerbate these threats and reduce well-being in communities near the Forest (Gaines et al. 2012).

Outside the late forest structure areas, general restoration would be used to provide a resilient forest. Alternative R would manage 22 percent of the Forest for general restoration, which may improve resilience to fire, insects, and disease. Increased forest resilience may reduce wildfire risk in adjacent communities. Reduced wildfire risk promotes social values related to health and safety, the protection of private property, and preservation of aesthetic quality. Under alternative R, 39 percent of the Colville National Forest would be within the historical range.

Restoration would also provide commercially valuable forest products. Alternative R estimates timber harvest of approximately 14 million board feet annually. This is the lowest average annual harvest volume among all alternatives. The local economic consequences of wood product harvesting on the Colville National Forest are described in the economics section. Alternative R would impose more restrictions on harvesting of firewood than the proposed action. Approximately 3,200 CCF (hundred cubic feet) of firewood would be harvested annually under alternative R, compared to 8,900 CCF under all other alternatives. These restrictions may increase the difficulty of accessing and harvesting firewood for personal use. These restrictions may increase the cost (e.g., time) of harvesting firewood from the Colville National Forest. These restrictions may adversely affect household well-being in communities adjacent to the Forest.

Motorized Recreation Trails

Alternative R would reduce the share of the Forest open to motorized recreation. Fewer motorized recreation opportunities may reduce visitor satisfaction and quality of life for motorized recreation users. The reduction in motorized opportunities may increase the pressure on available motorized roads and trails. Crowding may reduce visitor satisfaction and may result in resource damage along trails. However, non-motorized recreation users may benefit from decreased potential for interaction with motorized users, which may promote social values related to safety, solitude, and resource protection in the backcountry.

Summer and winter motorized use would be more limited under alternative R compared to no action and the proposed action. Acres open to summer and winter motorized use would be similar to the acres open under alternative B. Approximately 838,900 acres would be open for summer motorized use and 653,600 acres would be open for winter motorized use. Individuals and groups who value motorized recreation on the Colville National Forest may experience reductions in quality of life under this alternative.

Access

The desired road density under alternative R is between 1 and 2 miles per square mile, which is a reduction in density relative to current conditions. Lower road density may affect Forest access, which is valuable to many individuals who recreate or engage in economic activities (e.g., firewood collection) on the Forest. Lower road density may negatively affect quality of life for individuals who value the Forest for motorized recreation and livelihood activities. Individuals who are elderly

or have disabilities may be particularly likely to be adversely affected by reduced access, due to mobility limitations. However, reduced road density may positively affect social values related to ecological integrity and ecosystem services. Fewer roads may decrease sedimentation, habitat fragmentation, and disturbance to non-motorized forest visitors.

Recommended Wilderness Areas

Alternative R would recommend an additional 209,000 acres of wilderness, which represents approximately 19 percent of the Colville National Forest. The NVUM survey estimates that less than 1 percent of visits to the Forest are to a designated wilderness area (USDA Forest Service 2012e). None of the survey respondents reported overcrowding in designated wilderness during their visit. These findings suggest that current designated wilderness is adequate to satisfy recreational demand for wilderness.

The social value of designated wilderness is not limited to recreation. Wilderness designation may provide amenity values to nearby residents and landowners, support ecosystem service provision (e.g., clean water and carbon sequestration), and offer opportunities for research and environmental education. Designated wilderness may protect "non-use" values. Non-use values arise not from the consumption of goods or services provided by wilderness areas, but from the value of knowing it exists or preserving the option to visit in the future. Alternative R would do the second most (after alternative B) to support social values related to designated wilderness.

Environmental Justice

The largest minority group in all three counties of the socioeconomic impact zone is Native Americans. The Tribal Resources section of this chapter describes potential consequences to Native American populations in the vicinity of the Colville National Forest. Alternative R would decrease road density and Forest access relative to current conditions, which may particularly affect the ability of elders to access cultural sites, hunting and fishing grounds, and gathering areas.

Communities in proximity to the Colville National Forest have higher rates of poverty than the state and the Nation. Therefore, actions that adversely affect employment, income, or the cost of participating in activities on the Forest may disproportionately affect low-income individuals. Alternative R is expected to reduce employment and income associated with timber harvesting on the Forest relative to current conditions. Additionally, the increase in recommended wilderness and reduced road density may increase the cost of accessing the Forest, which may disproportionately affect low-income individuals.

The expected reductions in firewood harvest could disproportionately affect low-income individuals in communities adjacent to the Colville National Forest, as it may be more costly to access and cut firewood for home heating.

Cumulative Effects

Vegetation management actions may interact with residential development on private lands adjacent to the Colville National Forest to increase risks to private property and human health from wildfire. Additionally, disturbances on adjacent Federal lands, such as disease and insects, may exacerbate threats to the provision of ecosystem services, including culturally significant foods. The cumulative effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities diminishes.

The expansion of resource protections under alternative R—particularly reduced road density and increased recommended wilderness acreage—may offset social concerns about the loss of forest

lands elsewhere in the socioeconomic impact zone, particularly related to the conversion of private forest land for residential development.

Monitoring Recommendations

The monitoring recommendations are consistent with those identified for no action.

Alternative P

A public comment noted that, *"(M)y perception so far is that wilderness eliminates mountain bikes, mechanical trail maintenance, forest management, fire response ability, any form of motorized shared use, and doesnt seem to play well with the cattle grazers or other land users."*

Many public comments expressed concern that wilderness designation may result in lower revenue to local economies due to reduced recreational opportunities. This alternative utilizes many plan components from the proposed action, while also addressing economic concerns associated with wilderness.

Alternative P would improve old forests' resilience relative to no action. As a result, the flow of ecosystem services to adjacent communities would be sustained, and the risk of wildfire to private property and human health would decrease. Alternative P would decrease road density, which may affect access, community resilience, and quality of life for individuals who rely on the forests for economic and leisure opportunities. Increased forest resilience may support the production of culturally important foods, which may affect Tribal interests and well-being.

Old Forest Management and Timber Production

Alternative P would manage 28 percent of the Forest for focused restoration and 44 percent of the Forest for general restoration. This distribution is similar to the proposed action and the effects would be the same as described for the proposed action.

Restoration may improve resilience to fire, insects, and disease. Increased forest resilience may reduce wildfire risk in adjacent communities. Reduced wildfire risk promotes social values related to health and safety, the protection of private property, and preservation of aesthetic quality. Under alternative P, 26 percent of the Colville National Forest would be within the historical range. This is consistent with the proposed action.

Focused restoration would also provide commercially valuable forest products. Alternative P estimates harvest of approximately 62 million board feet of wood products annually. This is similar to the proposed action. The economics section of this chapter describes the local economic consequences of wood product harvest from the Colville National Forest. In addition to supporting economic activity, the landscape-level approach to old forest management would protect the flow of ecosystem services related to old forests. As discussed above, old forests provide numerous values such as recreation, spiritual fulfillment, and species viability.

Alternative P does not retain the Eastside Screens, which may concern individuals and groups who value the protection of large-diameter trees. However, alternative P would protect late forest structure at a landscape level and includes a guideline related to retention of large individual trees. The desired conditions for late forest structure under alternative P would ameliorate social concerns related to loss of large-diameter trees.

Under alternative P, the quantity of firewood harvested from the Colville National Forest annually would be similar to current conditions. Firewood would continue to be an important source of home

heating in the socioeconomic impact zone. No changes to quality of life or household expenditures related to home heating and firewood are expected as a result of this alternative.

Motorized Recreation Trails

Alternative P would increase backcountry motorized opportunities from approximately 1 percent of the Forest to 5 percent of the Forest. The effects would be the same as described for the proposed action.

Alternative P would keep the largest share of the Forest open to summer and winter motorized recreation among action alternatives. Approximately 687,200 acres would be open to winter motorized recreation and 875,700 acres would be open to summer motorized recreation. Only no action would have the potential for more motorized recreation opportunities. Alternative P would provide a variety of motorized opportunities on the Forest and would support quality of life for motorized recreation users. Alternative P would do less to address concerns of individuals and groups who oppose motorized recreation than alternative R.

However, the increase in recommended wilderness would place limits on future development of motorized activities relative to no action. On balance, alternative P is not expected to change visitation or visitor satisfaction relative to existing conditions. Therefore, the effects would be similar to those described under no action.

Access

The desired road density under alternative P is between 1 and 2 miles per square mile, which is a reduction in density relative to current conditions. Lower road density may affect forest access, which is valuable to many individuals who recreate or engage in economic activities on the Forest. Lower road density may negatively affect quality of life for individuals who value the Forest for motorized recreation and livelihood activities. Individuals who are elderly or have disabilities may be particularly likely to be adversely affected by reduced access, due to mobility limitations. However, reduced road density may positively affect social values related to ecological integrity and ecosystem services. Fewer roads may decrease sedimentation, habitat fragmentation, and disturbance to non-motorized forest visitors.

Recommended Wilderness Areas

Alternative P would recommend an additional 61,700 acres of wilderness, which represents approximately 6 percent of the Colville National Forest. The NVUM survey estimates that less than 1 percent of visits to the Forest are to a designated wilderness area (USDA Forest Service 2012e). None of the survey respondents reported overcrowding in designated wilderness during their visit. These findings suggest that current designated wilderness is adequate to satisfy recreational demand for wilderness.

The social value of designated wilderness is not limited to recreation. Wilderness designation may provide amenity values to nearby residents and landowners, support ecosystem service provision (e.g., clean water and carbon sequestration), and offer opportunities for research and environmental education. Designated wilderness may protect “non-use” values. Non-use values arise not from the consumption of goods or services provided by wilderness areas, but from the value of knowing it exists or preserving the option to visit in the future. Among all the considered alternatives, alternative P would do less to support social values related to designated wilderness than all considered alternatives except alternative O.

Environmental Justice

The largest minority group in all three counties of the socioeconomic impact zone is Native Americans. The Tribal Resources section of this chapter describes potential consequences to Native American populations in the vicinity of the Colville National Forest. Unlike no action, alternative P would be more likely to provide culturally significant foods, due to improved forest resilience to disease and insects. However, alternative P would decrease road density and Forest access relative to current conditions, which may particularly affect the ability of elders to access cultural sites, hunting and fishing grounds, and gathering areas.

Communities near Colville National Forest have higher rates of poverty than the state and the Nation. Therefore, actions that adversely affect employment, income, or the cost of participating in activities on the Forest may disproportionately affect low-income individuals. Alternative P is not expected to change employment or income relative to current conditions. However, the increase in recommended wilderness and reduced road density may increase the cost of accessing the Forest, which may disproportionately affect low-income individuals.

The increased areas open to the harvesting of firewood could benefit low-income individuals, as they may need to spend fewer resources traveling to an area on the Forest where they can harvest firewood for home heating.

Cumulative Effects

Residential development on private lands adjacent to the Colville National Forest may inhibit the use of prescribed fire as a forest restoration tool, due to social concerns about smoke emissions. Therefore, private land development could make it more difficult and costly to increase forest resilience.

Disturbances on adjacent Federal lands, such as disease and insects, may affect the health of the Colville National Forest. For example, invasive vegetation on adjacent lands may spread to the Colville National Forest. However, other Federal actions to improve forest resilience would support the provision of ecosystem services, including culturally significant foods on both the Colville National Forest and adjacent Federal lands. The cumulative effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities changes.

The expansion of resource protections under alternative P—particularly reduced road density—may offset social concerns about the loss of forest lands elsewhere in the socioeconomic impact zone, particularly related to the conversion of private forest land for residential development.

Monitoring Recommendations

The monitoring recommendations are consistent with those identified for no action.

Alternative B

This alternative combines feedback from diverse interest groups and incorporates management strategies supported by the Northeast Washington Forestry Coalition. Alternative B addresses the concerns of multiple constituencies in one alternative by designating restoration and timber management zones, recommending the highest level of wilderness designation and the least amount of area for backcountry management and backcountry motorized use.

Alternative B would not measurably change access and roaded motorized recreation opportunities relative to current conditions, which would support social values related to commodity use and more developed recreation opportunities. However, backcountry motorized opportunities are the lowest among all considered alternatives, which would reduce the quality of life for visitors who value backcountry motorized opportunities. Alternative B would have the highest acreage in recommended wilderness among all considered alternatives. Alternative B would support social values related to wilderness, such as research and education, solitude, and scenic views.

Old Forest Management and Timber Production

Alternative B would manage 31 percent of the Forest as a restoration zone. Management actions in this area would promote social values related to ecological health and the provision of ecosystem services, such as clean water and wildlife habitat. However, increased stand density may contribute to the spread of insects, fire, and tree mortality, which may compromise some of the social values related to old forests. Fire adjacent to communities may adversely affect private property and human health. Under alternative B, 38 percent of the Colville National Forest would be within the historical range. Reduced risk of uncharacteristic wildfire promotes social values related to health and safety, the protection of private property, and preservation of aesthetic quality.

Forty-four percent of the Forest would be managed to provide a stable flow of timber and to improve the Forest's resilience to insects, disease, and uncharacteristic fire. Management actions in this area would promote social values related to human safety and the protection of private property from wildfire and economic stability in the forest products sector. Alternative B estimates harvest of approximately 37 million board feet of wood products annually. This is approximately 60 percent of the volume that is expected to be harvested under the proposed action. The economic contribution of alternative B to employment and income in the forest products sector is described in the economics section above.

Alternative B would maintain the Eastside Screen direction, which prevents the harvest of large-diameter trees. This direction would protect old forest-dependent species habitat and promote both use (e.g., recreation and wildlife viewing) and non-use (e.g., knowing that it exists) values associated with the Forest. However, the Eastside Screens reduce the ability to maintain or enhance late forest structure on the Colville National Forest if it is not present within the reserve. In contrast, the proposed action adopts a landscape approach to protect late forest structure. Some individuals and groups prefer the Eastside Screen direction due to a desire to prevent the harvesting of large-diameter trees. The values of these individuals and groups are reflected in alternative B.

Under alternative B, the quantity of firewood harvested from the Colville National Forest annually would be similar to current conditions. Firewood would continue to be an important source of home heating in the socioeconomic impact zone. No changes to quality of life or household expenditures related to home heating and firewood are expected as a result of this alternative.

Motorized Recreation Trails

Alternative B would provide the fewest summer and winter motorized recreation opportunities in the backcountry. As a result, individuals who value less developed recreation opportunities would be less satisfied with their visit and experience a lower quality of life.

Summer and winter motorized use would be more limited under alternative B compared to no action and the proposed action. Acres open to summer and winter motorized use would be similar to the acres open under alternative R. Approximately 842,000 acres would be open for summer motorized use and 656,300 acres would be open for winter motorized use. Individuals and groups who value

motorized recreation on the Colville National Forest may experience reductions in quality of life under this alternative.

Access

Alternative B would cap existing levels of total miles of National Forest System roads at the current level. Therefore, this alternative would require that existing roads be decommissioned if new roads are added. This action is not expected to reduce forest access relative to existing conditions. Therefore, no measurable effects to quality of life and community resilience would occur due to roads management under alternative B.

Recommended Wilderness Areas

Alternative B would recommend an additional 220,300 acres of wilderness, which represents approximately 20 percent of the Colville National Forest. The NVUM survey estimates that less than 1 percent of visits to the Forest are to a designated wilderness area (USDA Forest Service 2012e). None of the survey respondents reported overcrowding in designated wilderness during their visit. These findings suggest that current designated wilderness is adequate to satisfy recreational demand for wilderness.

The social value of designated wilderness is not limited to recreation. Wilderness designation may provide amenity values to nearby residents and landowners, support ecosystem service provision (e.g., clean water and carbon sequestration), and offer opportunities for research and environmental education. Designated wilderness may protect “non-use” values. Non-use values arise not from the consumption of goods or services provided by wilderness areas, but from the value of knowing it exists or preserving the option to visit in the future. Among all the considered alternatives, alternative B would do the most to support social values related to designated wilderness among all considered alternatives.

Environmental Justice

The largest minority group in all three counties of the socioeconomic impact zone is Native Americans. The Tribal Resources section of this chapter describes potential consequences to Native American populations in the vicinity of the Colville National Forest. Similar to no action, alternative B would be less likely to provide culturally significant foods, due to reduced forest resilience to disease and insects. In addition, alternative B would decrease motorized access relative to current conditions due to increased recommended wilderness, which may particularly affect the ability of elders to access cultural sites, hunting and fishing grounds, and gathering areas.

Communities in proximity to the Colville National Forest have higher rates of poverty than the state and the Nation. Therefore, actions that adversely affect employment, income, or the cost of participating in activities on the Forest may disproportionately affect low-income individuals. Alternative B is not expected to change employment or income relative to current conditions. However, the increase in recommended wilderness may increase the cost of accessing the Forest, which may disproportionately affect low-income individuals.

Cumulative Effects

Vegetation management actions may interact with residential development on private lands adjacent to the Colville National Forest to increase risks to private property and human health from wildfire. Additionally, disturbances on adjacent Federal lands, such as disease and insects, may exacerbate threats to the provision of ecosystem services, including culturally significant foods. The cumulative

effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities diminishes.

The expansion of resource protections under alternative B —particularly reduced backcountry motorized recreation opportunities and increased recommended wilderness acreage—may offset social concerns about the loss of forest lands elsewhere in the socioeconomic impact zone, particularly related to the conversion of private forest land for residential development.

Monitoring Recommendations

The monitoring recommendations are consistent with those identified for no action.

Alternative O

This alternative comes from a series of public, collaborative meetings run by the Forest Service that focused on motorized recreation, wilderness recommendations, and vegetation management and reflects areas of general agreement among participants in those meetings. The Forest Service fully developed this alternative using the proposed action to fill in the gaps not addressed in the collaborative process. Alternative O emphasizes summer and winter motorized and non-motorized opportunities in a backcountry, unroaded setting and minimizes recommended wilderness.

Alternative O would manage for both ecological integrity and a sustainable flow of timber. Access, motorized recreation opportunities, and recommended wilderness would not meaningfully change relative to current conditions. Therefore, social values related to these resources and uses would not be affected.

Old Forest Management and Timber Production

Alternative O would place 34 percent of the Forest in a Restoration Management Area, which would focus on protecting old forest and enhancing ecological integrity. Management actions in this area would promote social values related to ecological health and the provision of ecosystem services, such as clean water and wildlife habitat. However, increased stand density may contribute to the spread of insects, fire, and tree mortality, which may compromise some of the social values related to old forests. Fire adjacent to communities may adversely affect private property and human health. Under alternative O, 35 percent of the Colville National Forest would be within the historical range. This alternative lowers the risk of uncharacteristic wildfire compared to no action, the proposed action, and alternatives P and R. Reduced wildfire risk promotes social values related to health and safety, the protection of private property, and preservation of aesthetic quality.

Thirty-nine percent of the Forest would be in a Responsible Management Area, which would emphasize a stable flow of timber to support community employment in the forest products industry. Alternative O estimates harvest of approximately 38 million board feet of timber annually. This is similar to alternative B. The economic contribution of timber production from the Colville National Forest is described in the economics section above.

Alternative O would maintain the Eastside Screen direction, which prevents the harvest of large-diameter trees. This direction would protect old forest-dependent species habitat and promote both use (e.g., recreation and wildlife viewing) and non-use (e.g., knowing that it exists) values associated with the Forest. However, the Eastside Screens reduce the ability to maintain or enhance late forest structure on the Colville National Forest if it is not present within the reserve. In contrast, the proposed action adopts a landscape approach to protect late forest structure. Some individuals

and groups prefer the Eastside Screen direction due to a desire to prevent the harvesting of large-diameter trees. The values of these individuals and groups are reflected in alternative O.

Under alternative O, the quantity of firewood harvested from the Colville National Forest annually would be similar to current conditions. Firewood would continue to be an important source of home heating in the socioeconomic impact zone. No changes to quality of life or household expenditures related to home heating and firewood are expected as a result of this alternative.

Motorized Recreation Trails

Alternative O would increase backcountry motorized opportunities from approximately 1 percent of the Forest to 5 percent of the Forest. The effects would be the same as described for the proposed action and alternative P.

Across the Forest, alternative O would keep open the most acres to winter motorized recreation among the action alternatives (approximately 687,800 acres). However, fewer acres would be open to winter motorized use compared to no action. Similarly, alternative O would also keep open the most acres to summer motorized recreation among the action alternatives (approximately 876,300 acres). This is a decrease compared to no action.

Alternative O would only slightly increase recommended wilderness, which would maintain the potential for future motorized access. On balance, alternative O would maintain quality of life for motorized recreation users at existing conditions. Among the action alternatives, alternative O is likely to be favored by motorized recreation users.

Access

Alternative O would cap existing levels of total miles of National Forest System roads at the current level. Therefore, this alternative would require that existing roads be decommissioned if new roads are added. This action is not expected to reduce forest access relative to existing conditions. Therefore, no measurable effects to quality of life and community resilience would occur due to roads management under alternative O.

Recommended Wilderness Areas

Alternative O would recommend an additional 15,900 acres of wilderness, which represents approximately 1 percent of the Colville National Forest. The NVUM survey estimates that less than 1 percent of visits to the Forest are to a designated wilderness area (USDA Forest Service 2012e). None of the survey respondents reported overcrowding in designated wilderness during their visit. These findings suggest that current designated wilderness is adequate to satisfy recreational demand for wilderness.

The social value of designated wilderness is not limited to recreation. Wilderness designation may provide amenity values to nearby residents and landowners, support ecosystem service provision (e.g., clean water and carbon sequestration), and offer opportunities for research and environmental education. Designated wilderness may protect “non-use” values. Non-use values arise not from the consumption of goods or services provided by wilderness areas, but from the value of knowing it exists or preserving the option to visit in the future. Among the action alternatives, alternative O would do the least to support social values related to designated wilderness.

Environmental Justice

The largest minority group in all three counties of the socioeconomic impact zone is Native Americans. The Tribal Resources section of this chapter describes potential consequences to Native American populations in the vicinity of the Colville National Forest. Similar to no action, alternative O would be less likely to provide culturally significant foods, due to reduced forest resilience to disease and insects. Alternative O would not meaningfully affect motorized access relative to current conditions, which is important for elders to access cultural sites, hunting and fishing grounds, and gathering areas.

Communities in proximity to the Colville National Forest have higher rates of poverty than the state and the Nation. Therefore, actions that adversely affect employment, income, or the cost of participating in activities on the Forest may disproportionately affect low-income individuals. Alternative O is not expected to change employment, income, or the cost of accessing the Forest relative to current conditions.

Cumulative Effects

Vegetation management actions may interact with residential development on private lands adjacent to the Colville National Forest to increase risks to private property and human health from wildfire. Additionally, disturbances on adjacent Federal lands, such as disease and insects, may exacerbate threats to the provision of ecosystem services, including culturally significant foods. The cumulative effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities diminishes.

Disturbances on adjacent Federal lands, such as disease and insects, may affect the health of the Colville National Forest. For example, invasive vegetation on adjacent lands may spread to the Colville National Forest. However, other Federal actions to improve forest resilience would support the provision of ecosystem services, including culturally significant foods on both the Colville National Forest and adjacent Federal lands. The cumulative effect of disturbances across jurisdictions may affect community resilience and well-being, as the availability of substitute opportunities changes.

Heritage Resources

Cultural resources represent the tangible and intangible evidence of human behavior and past human occupation. Cultural resources may consist of archaeological sites, historic-age buildings and structures, and traditional use areas and cultural places that are important to a group's traditional beliefs, religion or cultural practices. These types of resources are finite and nonrenewable with few exceptions.

Cultural resources may be affected by the issues addressed in the revision topics: Old Forest Management, Motorized Recreation Trails, Road Access, Recommended Wilderness, Livestock Grazing, Wildlife Concerns, and Riparian and Aquatic Resources. The National Historic Preservation Act (NHPA) requires that Federal agencies consider the effects of their actions on cultural resources. The 1982 planning rule states that the "examination shall consider impacts of the management of cultural resources on other uses and activities and impacts of other uses and activities on cultural resource management."

Affected Environment

The lands of the Colville National Forest contain a long and diverse cultural record that began approximately 6,000 years ago. Remnants of past and current human activities and events that reflect continuous use by native peoples and the exploration, settlement, and management by Euro-American cultures can be found throughout the Forest. Based on current inventory surveys, it is estimated that over 2,500 cultural resource sites are located on the Forest. At present, over 1,500 archaeological sites are recorded (Colville National Forest inventory and site files). Many of these sites have not been determined eligible for listing on the National Register of Historic Places. The Heritage Program of the Colville National Forest is responsible for the management of cultural resources for the benefit of the public through preservation, public use, and research.

Cultural Setting

Prehistoric

Archaeological research has uncovered evidence for human activity in the region dating to the middle-Archaic period. The evidence for this activity is found predominantly in the form of lithic artifacts. Archaeological excavations have recovered artifacts, but subsequent research and analysis have not produced a chronology or a generalized local sequence. In general, a three-period chronology system (Thoms 1987) is utilized; this system is an adaptation of a Northwestern Plains sequence proposed by Mulloy (1958).

The Forest is located within a culture known as the Plateau. The Plateau is set apart from its neighboring cultural areas by topography (mountainous barriers) and aboriginal cultural adaptations. The cultural adaptions were strongly influenced by available resources and the inland maritime environment (Chatters and Pokotylo 1998). Most Plateau cultural adaptations have emphasized the mass harvest and long-term storage of three resource groups: fish (salmonids), edible roots (camas), and large ungulates. Settlements within the Plateau area were also similar and characterized by winter settlement in the lowlands and dispersed resource procurement encampments in the summer. Population densities were tied to resource abundance (particularly fish). The Plateau culture area is sub-divided into the Northern (Canadian) Plateau, the Southern (Columbia) Plateau, and the Eastern Plateau. The Forest is influenced predominately by the Northern and Eastern Plateau cultural areas; with Pend Oreille County located entirely within the Eastern Plateau sphere of influence.

The Eastern Plateau region is characterized by great physiographic diversity. This diversity has influenced the aboriginal cultural adaptations that arose in the area. The diverse terrain presented obstacles and opportunities for native peoples. In general, the presence or absence of fish migration (salmon and steelhead) impacted cultural development more than any other factor (Chatters and Pokotylo 1998).

Ethnographic investigation has permitted certain generalities about the region. During the past 6,000 years, the region has been utilized by diverse groups of people for a variety of activities. The project area lies within the traditional use area of the Colville Confederated Tribe. Ethnographic investigation has permitted certain generalities about the region. During the past 6,000 years, the region has been utilized by diverse groups of people for a variety of activities. The project area lies within the traditional use area of the Colville. The Colville is a sub-group of the Salishan speaking groups that include the following cultural traditions: Wenatchee, Columbia, Chelan, Methow, Okanogan, Nespelem, Sanpoil, Spokane, Coeur D'Alene, Lakes, and Kalispel. Ethnographic accounts indicate that the Colville practiced wintertime deer drives and maintained resident fisheries

along the Columbia, Kettle, and San Poil Rivers. In addition to hunting deer and fishing, the Colville harvested camas and other root crops (Camassia species) (Holstine 1987).

A presidential executive order established the Colville Indian Reservation in 1872 (Colville Confederated Tribe 2004). The reservation originally extended across the entirety of Ferry County. Much of the reservation land was distributed in 80-acre allotments to members of the Tribe. In 1896, the northern half of Colville Indian Reservation was opened for mineral entry. A few years later, in 1900, the north half was opened to Euro-American homesteaders (Walter and Fleury 1985).

Since 1855, the Kalispel opposed any attempts at government removal from their traditional lands. The governments tried to move the Kalispel to one of three reservations (Colville, Coeur D'Alene, or Flathead); some eventually moved to the Flathead Reservation, but a small group would not leave the river valley (Lahren 1998). On March 23, 1914, President Wilson, by executive order, formally set aside and reserved the territory described for the use and occupancy of the Kalispel Indians.

Traditionally, the Spokane occupied approximately 3 million acres in northeastern Washington. On January 18, 1881, President Hayes, by executive order, formally set aside and reserved (154,602 acres) the territory described in the Agreement of August 1877, for the use and occupancy of the Spokane Indians (Lahren 1998).

Historic

Fur-trading

Beginning in 1821, the Hudson Bay Trading Company had great influence in the Colville and Pend Oreille Valley regions; this influence lasted through to the late 1800s. The Hudson Bay Trading Company was the largest trade outpost in the region, serving parts of Washington, Idaho, Montana, and Canada. The company also maintained a cadre of trappers as well as purchasing furs from freelance trappers. Under the auspices of the Hudson Bay Trading Company, many trails were created to facilitate trade within the region. The presence of the Hudson Bay Trading Company induced cultural changes in both Euro-American and First Nation Communities alike (Chance 1973). In 1809, David Thompson of the North West Company was the first trader to make contact with the Kalispel (Thoms and Schalk 1984). In 1809, Thompson attempted to descend the Pend Oreille River and made it as far as the present day community of Tiger.

Mining

Hundreds of miners began to filter into the Pend Oreille River Valley primarily looking for gold. Some gold was found, but it was the larger deposits of zinc and lead that continued to fuel the mining industry. The earliest gold discovery was in 1859, on Sullivan Creek (Holstine 1987). The earliest mining efforts were for placer deposits. In its simplest form, all that was required to placer mine was a gold pan and running water, fueled by determination. In its most complex form, several men would work rockers, sluice boxes, pressure hoses, and floating dredges. Most of the placer mines played out by the 1870s. Placer mining eventually gave way to hard rock mining; requiring heavier equipment and capital investment. The most notable hardrock mine in Pend Oreille County was the Oriole mine, which produced silver, copper, and gold ore. George H. Linton located the Oriole mine, situated west of Metaline Falls.

Homesteading

While the miners had gained entry into the Pend Oreille Valley by the 1850s, the majority of the northern part of the county remained isolated and inaccessible. Riverboat traffic stopped at Box Canyon until 1906, when the Federal Government widened the channel. Even so, riverboat landings

were scarce and it was not until the Great Northern Railroad's transcontinental line arrived in 1892 that homesteading expansion grew in earnest (Holstine 1987). Much of the lands adjacent to the river had been claimed, forcing new arrivals to claim parcels on higher ground. These lands were marginal and suited to timber and grazing. Eventually, most settlers abandoned their lands or sold them to timber companies or the Federal Government via the Resettlement Administration. Most of the homesteads date from the 1890s through to the 1920s; homesteading left an indelible mark on the Forest.

Logging

Settlers in the late 1880s introduced the timber industry into the area. With the timber industry and the passage of the Forest Homestead Act in 1906, homesteaders moved into the area (Bamonte and Bamonte 1996). The Forest Homestead Act allowed for 160-acre homesteads on reserved forest lands. Under the Act, the land parcels were supposed to have agricultural potential, but much of the land was rocky and unsuitable for farming. Settlers in the area found that timber harvest was much more profitable than farming (Bamonte and Bamonte 1996).

The timber industry became the primary industry and contributed greatly to the settlement and economic development of Pend Oreille County (Fandrich 2002). In 1902, the Dalton and Kennedy sawmill was built in Dalkena; the mill contributed to much of the local prosperity in that section of the Pend Oreille Valley. The Panhandle Lumber Company, located in Ione, was also a major influence on the area and was considered to be one of the best-equipped sawmills in northeastern Washington. By 1914, the timber industry was paying 55 percent of all wages in the state of Washington.

The mining and timber industries with the coincidental influx of settlers had a negative impact on Native American Tribes living in the region. The industry and the people were at odds with the Native Americans residing in lands withdrawn from public entry in 1872. Newcomers wanted the land and resources and were willing to lobby Congress to acquire lands inhabited by Tribal members and communities. The "North Half" of the Colville Reservation contained resources the mining industry desired and in 1890s, the public petitioned Congress to open the North Half to mineral entry. In 1891, the North Half was ceded to the Federal Government, in return, the Tribes were to receive $1.5 million and 80-acre tracts for those Tribal members who wished to remain in the North Half (Holstine 1987, Lahren 1998). The bill was ratified in 1892, but Congress neglected to provide the promised payment. In 1896, the North Half was open for mineral entry.

"New Deal" Era

During the Great Depression, President Franklin D. Roosevelt proposed a series of economic relief programs to the American public. These programs were designed to put the many unemployed Americans back to work and provide an income with which they could support their families. One such program was the Civilian Conservation Corps (CCC).

Northeastern Washington had fallen into economic depression well before the stock market crash of 1929. Many of the industries that supported northeastern Washington fell on hard times after World War I when farm prices dropped and mining needs diminished (Holstine 1987). The Colville National Forest and other public lands benefitted from the New Deal Era programs; arguably, the greatest contribution to the Forest and the community as a whole was made by the CCC.

Approximately 11,200 men were employed by the CCC in the State of Washington at the time of its inception (Holstine 1987), with approximately 200 men located at each camp. There were 16 CCC camps located within or adjacent to what is now the Colville National Forest; eight of these camps

were located in Pend Oreille County. The camp duties included but were not limited to the following: fighting local fires, building and maintaining roads and trails, improving campgrounds, and planting trees.

Inventory (Identification), Evaluation, and the National Register

One of the steps to comply with Section 106 of the NHPA is identifying historic properties and evaluating the significance of those historic properties for the National Register of Historic Places (NRHP). In addition to Section 106 compliance requirements, Federal land agencies are directed to inventory cultural resources and nominate eligible properties to NRHP per E.O. 11593 *Protection and Enhancement of the Cultural Environment*, Section 110 of the NHPA, and Archeological Resource Protection Act (ARPA) Section 14. Section 110 establishes inventory, nomination, protection and preservation responsibilities for federally owned historic properties. ARPA section 14 directs agencies to develop a schedule for inventory surveys of lands likely to contain the most scientifically valuable archaeological resources. To meet the Forest Service's responsibilities under E.O. 11593, Section 110 of the NHPA and ARPA the Heritage program conducts and/or facilitates non-project-specific inventory surveys for cultural resources within the Forest and nominates federally owned properties that meet the criteria to the NRHP. Most of the inventories and evaluation of cultural resources were conducted to meet Section 106 compliance requirements.

Approximately 297 cultural resource surveys have been conducted for land management activities, primarily for timber and fuel wood sales, hazard fuels reduction projects, and several large data recovery projects for land exchanges, highways, and infrastructure and energy corridors (Colville National Forest inventory records).

Approximately 51,250 acres have been intensively surveyed for cultural resources (Colville National Forest heritage GIS database).

Areas Requiring More Intensive Survey

Most of the lands on the Forest have not been surveyed for cultural resources. Approximately 51,250 acres (current Federal lands) have been intensively surveyed for cultural resources resulting in the identification of over 1,200 sites (Colville National Forest heritage GIS database, INFRA database).

National Register Status of Cultural Resources

The NRHP is the official list of historic properties recognized by the Federal Government as especially worthy of preservation for their national, state, or local significance. At present, over 1,200 archaeological sites are recorded (Colville National Forest inventory and site files). Of those, the majority of these sites have not been evaluated for eligibility for the NRHP. According to the R6 programmatic agreement and Forest Service policy, all sites that are unevaluated are treated as eligible until they are formally determined eligible or not eligible for the NRHP.

Priority Heritage Assets

Currently, there are 16 historic properties considered priority heritage assets that are eligible or potentially eligible for nomination to the NRHP. Historically, the priority heritage assets on the Colville National Forest have been subjects of several Passport in Time volunteer opportunities. The Passport in Time projects are focused preservation efforts. Each priority heritage asset has an associated management plan.

Traditional Cultural Properties

Traditional cultural properties (TCPs) are defined in National Register Bulletin 38 as properties associated "with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." TCPs might include structures, mountains and other landforms, plant-gathering locations, or other types of properties important to communities. These areas are considered properties that may be eligible to list on the NRHP. With regard to the Forest, the identified TCPs on the Colville National Forest are often associated with American Indian cultures.

Fourteen American Indian Tribes represented by three Tribal governments are known to have ancestral ties and/or traditional use areas on the Colville National Forest based on current and past consultation: Okanagan, Methow, Chelan, Entiat, Wenatchee, Moses-Columbia, Nespelem, San Poil, Lakes, Colville, Palus, Chief Joseph Nez Perce, Spokane, and Kalispel. Forest Service consultations with appropriate members of each Tribe can identify the Tribe's historic and present day uses of the Forest.

The lands, resources, and archaeological sites within the Forest are considered traditionally significant to all affiliated Tribes and, in some cases, certain resources or areas are considered sacred to a specific Tribe or Tribes. Each group has its own history, traditions, and relationship to the land and to the other groups. Traditional use of the Forest and its resources by the Tribes dates back several generations, and for some groups, many centuries.

Known traditional use areas and cultural places located within the Forest include, but are not limited to spruce forests, mountains, cinder cones, springs, caves, trails, and shrines. TCPs and sacred sites known to have been used and/or continue to be used for traditional cultural purposes have been identified and locational information is not available for public disclosure. In some cases, there are multiple areas used for collection of resources or religious ceremonies found on or within the vicinity of a prominent topographic feature. Many other areas located on the Forest are used for traditional cultural purposes, but have not been specifically identified. Additional areas may be identified through project or permit specific Tribal consultation. Therefore, the inventory of known TCPs and areas used for traditional cultural purposes is subject to change.

Public Outreach, Interpretation and Education

One of the objectives of the heritage program is to promote and invest in public education and outreach to meet the intent NHPA Section 110, E.O. 13287 Preserve America, and ARPA section 10(c). ARPA states "Each federal land manager shall establish a program to increase public awareness of the significance of the archaeological resources located on public lands and Indian lands and the need to protect those lands." The forest's heritage program has been active in providing opportunities to the public to promote cultural resource stewardship and conservation through volunteer programs, recreation opportunities, and presentations. Examples of public outreach and education that have been conducted in the past or are available on the forest include: School and public presentations (e.g., K-12 class presentations, Washington archaeological month events, Children's Forest GeoCache Activities), and numerous Passports in Time projects involving historic building restoration, surveys, site recording, and excavations. Some of the projects include the Growden Changing House Restoration, Gypsy Copper Powderhouse Restoration, and Lake Thomas Survey and Testing.

Current Condition of Archaeological Sites

Past practices, including Forest Service management activities, public resource procurement, recreation use, and natural processes have impacted cultural resources. Multiple uses and activities on the Forest that have resulted in the most impacts to cultural resources include: infrastructure, livestock grazing, fire, timber and vegetation management, recreation activities, looting and vandalism, and land adjustments.

Infrastructure

During the 20th century, a large network of roads was created to access, harvest and transport timber. Road construction, use, and maintenance have been a major source of human impacts to sites. Roads have partially damaged or completely destroyed site features and cultural materials by the excavation of or grading away of soils, changing the pattern of erosion causing increased flows of water across sites, compaction of soils, and rutting from vehicle use during wet conditions. While the construction and use of roads (both official and unauthorized) in and near sites can directly impact sites, the presence of roads in and near sites can also indirectly affect site condition as well. The most important of these indirect impacts is intentional vandalism (see Looting and Vandalism below). Many of the facilities and infrastructure are eligible for consideration as historic properties on their own merits.

Construction and management of facilities and structures have adversely impacted cultural resources. Facilities that had the most impact on cultural resources include power transmission and distribution lines, fire lookout towers, communication towers, dams, wastewater treatment plants and pipelines, and highways. The impact caused from constructing and maintaining facilities on areas with sites usually involves the destruction of cultural material and features.

Livestock grazing

Grazing activity has occurred on the Forest since the 1880s. Ranchers built homesteads and range improvements such as fences and water catchments. The lands selected for homesteads and construction of water catchments were often located in the same areas used prehistorically. Direct and indirect impacts from livestock have occurred to sites on the Forest. Forest permits dating to the early 1900s reveal that large numbers of sheep, cattle, and horses grazed and crossed NFS lands. Livestock grazing can negatively impact sites directly by trampling, artifact breakage, soil compaction, soil removal, and other types of damage to features as livestock walk through a site. Grazing can indirectly impact sites through loss of ground cover, which, in turn, leads to erosion.

Fire

Most of the lands within the Forest are located in a fire-adapted ecosystem. Evidence that prehistoric sites and TCPs have been repeatedly burned (prior to active fire suppression), is demonstrated by fire-scarred trees and thermally (fire) altered artifacts.

Generally, low-intensity fires have not adversely impacted prehistoric sites that are not fire sensitive or composed of combustible material. Conversely, most historic sites are either combustible or include combustible cultural material. These sites are very vulnerable to adverse impacts from fire.

The aggressive fire suppression management practices prior to 1970, and livestock grazing resulted in changes to the forest structure. Over time, dead and down materials increasingly grew thicker on forest floors and the Forest became dense with stands of regenerated young trees. These unnatural conditions have created more frequent high-intensity wildfires with permanent adverse impacts to archaeological sites. These impacts include, but are not limited to, historic sites completely burned

down, and the accelerated erosion of site features caused by hydrophobic soils, denuding of the ground surface exposing cultural materials.

Timber and Vegetation Management

Logging on the Forest can directly impact sites by temporary road construction, landings, movement of heavy equipment across the ground surface, skidding of trees and indirect impacts from over-harvesting, which can lead to erosion. Commercial timber and fuel wood harvesting has occurred across the Forest since the late 1870s. During the 1920s, an extensive network of logging railroads was constructed on the Colville National Forest.

Recreation Activities

Areas popular with campers are often near water, scenic vistas, or flat areas that were also commonly used prehistorically. Camping has impacted sites and can lead to looting and unintentional vandalism of sites. Sites that are near camping areas can be damaged by campers exploiting rock materials from structures and features for fire pits and for other camping activities, digging holes for latrines or trenches for discharging gray water; illegal collecting surface artifacts and rearrangement of artifacts into piles, using pieces of collapsed wooden historic structures as firewood, and clearing of space for tents and other equipment. Indirect impacts from camping include damage from erosion resulting from changes in soil compaction and denuding of vegetation.

Non-motorized trails, once established, generally do not themselves pose a large threat to sites; but like roads, easy access to sites facilitates vandalism, digging of holes within the site to dispose of waste, illegal collection of surface artifacts, and looting. Established motorized and non-motorized trails through or near sites have caused direct and indirect impacts by increasing visitation resulting in vandalism. Some of the motorized and non-motorized trails were converted from forest system or temporary roads and the sites were impacted by the original construction of the roads.

Looting and Vandalism

Intentional looting and vandalism of sites on public lands is a problem throughout Washington. Some of these activities are conducted for illegal recreation and others for illegal gain. When a site is looted, significant contextual information and parts of our history are stolen and destroyed. As transportation technology has advanced (i.e., 4-wheel drive) a greater number of roads have provided access to remote areas. The increasing number of roads and trails provides access to remote sites and provides looters a convenient method to easily transport heavy, awkward historical artifacts or delicate archaeological items and/or larger quantities of those items that previously would have been difficult to remove from the backcountry. Carved, inked, or painted graffiti on historic structures creates permanent damage, and at archaeological and historical sites, degrades their setting.

Environmental Consequences

The forest plan provides a programmatic framework that guides site-specific actions, but does not authorize, fund, or carry out any project or activity. Because the forest plan does not authorize or mandate any site-specific projects or activities (not limited to ground-disturbing actions (i.e., extensive modification of view-sheds or vegetation adjacent to historic structures, TCPs or sacred may be adverse)) there can be no direct effects. However, there may be implications, or longer-term environmental consequences, of managing the forest under this programmatic framework.

Under the provisions of the National Historic Preservation Act (NHPA 1966, as amended; 16 U.S.C. §470), adverse effects to cultural resources include a variety of criteria affecting the potential eligibility of cultural resources for inclusion on the National Register of Historic Places (36 CFR

§800.9b). Specifically, effects may be deemed adverse according to the following (36 CFR §800.5[1]):

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Cultural resource surveys for specific actions (e.g., timber sales, vegetation treatments) would be conducted prior to approving site-specific projects in compliance with Federal law and Forest Service policy. Prior to the Forest making a decision on a site-specific action that is subject to NHPA, the Forest would complete archeological surveys to locate and evaluate sites for the NRHP, and analyze the effects of the proposed use or activity in compliance with the R6 programmatic agreement. Following the identification and recording of cultural resources, mitigation measures appropriate to the proposed undertaking would be implemented. For example, such measures could include avoidance of cultural resources by redesigning the project boundaries, modifying construction plans, or excluding site areas from treatments. In cases where specific activities would constitute an adverse effect and avoidance could not be accomplished, the adverse effects would be resolved in accordance with 36 CFR 800.

Methodology and Analysis Process

The primary legislation governing cultural resource management is the NHPA of 1966 (amended in 1976, 1980, and 1992). Section 106 of NHPA requires that Federal agencies take into consideration the effects of their undertakings on historic properties, which are defined in 36 CFR 800.16(l) as any district, site, building, structure, or object that is included in or eligible for inclusion in the NRHP. The "Section 106 review process," entails five steps: (1) determining whether the proposed action is an undertaking that has the potential to affect historic properties); (2) identifying historic properties; (3) evaluating the significance of historic properties; (4) assessing effects; and (5) consulting with interested parties (including Native People), the State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP). Section 110 (Federal Agencies' Responsibility to Preserve and Use Historic Properties) of the NHPA provides direction to Federal agencies to establish programs and activities to identify and nominate historic properties to the NRHP and to consult with Tribes. The Pacific Northwest Region has a programmatic agreement with the ACHP and Washington SHPO that stipulates the Forest Service's responsibilities for complying with NHPA.

Under the regulations, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative. Specific examples of adverse effects cited in statute include (36 CFR 800.5):

- Physical destruction of or damage to all or part of the property.
- Removal of the property from its historic location.
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance.
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.

The analysis includes a review of the alternatives and an assessment of the potential impacts each alternative could have to cultural resources on the Forest. The criteria used for establishing the area of potential effect for cultural resources was based on the possible acres treated within each potential natural vegetation type (PNVT) and the boundary of each management area. The existing condition was determined by reviewing the NRHP, a review of forest's archaeological site and inventory files, cultural resource management overviews, heritage Geographic Information System (GIS) database, and other natural resource and fire history databases.

Assumptions

In the analysis for this resource, the following assumptions have been made:

- The land management plan provides a programmatic framework for future site-specific actions.
- The plan decisions (desired conditions, objectives, standards, guidelines, areas with special designations, suitability, monitoring) would be followed when planning or implementing site-specific projects and activities.
- Analysis and impacts to cultural resources from site-specific actions would be addressed at the time site-specific decisions are made.
- Law, policy, and regulations would be followed when planning or implementing site-specific projects and activities.
- The agency has the capacity (e.g., funding, personnel, other resources) to accomplish the minimum planned objectives.
- There is no cross-country motorized use where prohibited.
- Burning could occur across all NFS lands.
- Unplanned ignitions are analyzed at the time of the fire's start and documented in the Wildland Fire Decision Support System (WFDSS). Management response to a wildfire is based on objectives appropriate to conditions of the fire, fuels, weather, and topography to accomplish specific objectives for the area where the fire is burning. Effects to cultural resources are considered when determining the objectives and management response to a wildfire
- The kinds of resource management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives of the forest plan. The specific location, design, and the extent of such activities are generally not known. The effects analysis is intended to be useful for comparing and evaluating alternatives on a forestwide basis. It is not intended to be applied directly to specific locations on the forest.
- Prior to making a project-level decision that is subject to NHPA, the forest would complete cultural resource surveys to locate and evaluate sites for the NRHP and analyze the effects of the proposed use or activity in compliance with the *Programmatic Agreement Among the United States Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), the*

Advisory Council on Historic Preservation, and the Washington State Historic Preservation Officer Regarding Cultural Resources Management on National Forests in the State of Washington (R6 programmatic agreement) (USDA Forest Service 1997). Following the identification and recording of cultural resources, mitigation measures appropriate to the proposed undertaking would be implemented. For example, such measures could include avoidance of cultural resources by redesigning the project boundaries, modifying construction plans, or excluding site areas from treatments. In cases where specific activities would constitute an adverse effect and avoidance could not be accomplished, the adverse effects would be resolved in accordance with 36 CFR 800.

- *Programmatic Agreement among the NF in WA State and WA SHPO, ACHP regarding Recreation Residence, Recreation Residence Tract and Organizational Camp/Club Management* (2006c) provides guidance on best preservation practices for recreational residences located on National Forest System lands.

Unavoidable Adverse Impacts

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Before any proposed actions (not limited to ground-disturbing actions) take place, they must be authorized in a subsequent site-specific environmental analysis. Therefore, none of the alternatives cause unavoidable adverse impacts. Mechanisms are in place to monitor and use adaptive management principles to help alleviate any unanticipated impacts that need to be addressed singularly or cumulatively.

Irreversible and Irretrievable Commitment of Resources

The land management plan provides a programmatic framework that guides site-specific actions, but does not authorize, fund, or carry out any project or activity. Because the land management plan does not authorize or mandate any site-specific project or activity (not limited to ground-disturbing actions), none of the alternatives cause an irreversible or irretrievable commitment of resources.

Adaptive Management

All alternatives assume the use of adaptive management principles. Forest Service decisions are made as part of an ongoing process, including planning, implementing projects, and monitoring and evaluation. The land management plan identifies a monitoring program. Monitoring the results of actions would provide a flow of information that may indicate the need to change a course of action or the land management plan. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

Effects of Alternatives

Cultural resources, depending on their nature and composition, are subject to different types of impacts from vegetation management, fire, livestock grazing, infrastructure, recreation, looting and vandalism, and land adjustments

All alternatives propose treatments that result in restoring ecosystem health. This has the potential to reduce the potential adverse effects to cultural resources from uncharacteristic high-intensity and high-severity fires. These treatments would also lead to the restoration of natural processes and the landscape, which in turn, has the potential to restore the historic setting and cultural landscapes of the Forest.

Ground-disturbing activities (including mechanical activities) are the dominant cause of potential impacts to cultural resources in all alternatives. The potential types of affects to cultural resources from the proposed treatments in the alternatives are the same. Differences, however, may be found among the alternatives regarding the number of cultural resources that would be potentially impacted by the treatments.

Heritage Program Management

National Register Sites and TCPs

The 1988 forest plan (no action alternative) has not been amended to reflect the 1992 requirements and amendments to the NHPA. The 1992 amendments clarified Section 110, language terms, and required each Federal agency to establish a historic preservation program. The program must provide for the identification and protection of the agencys historic properties; ensure that such pr operties are maintained and managed with due consideration for preservation of their historic values; and contain procedures to implement Section 106, which must be consistent with the ACHP regulations. The no action alternative also does not address requirements of the Native American Graves Repatriation Act of 1990, E.O. 13007 Indian Sacred Sites, E.O. 13175 Consultation and Coordination with Indian Tribal Governments, and E.O. 13287 Preserve America. The focus of management and guidelines for forest resources within the 1988 forest plan were developed prior to the passage or issuance of these statutes, which leads to more impacts to historic properties. Emphasis is on use of timber and multiple use activities that incorporate the location of archaeological sites and TCPs that may not be compatible with those uses. The action alternatives have incorporated the passage of these statutes and issuance of executive orders providing for increased consideration and management to preserve historic properties for their historic and cultural values.

Under all alternatives, the Forest would continue to fulfill its responsibilities to conduct non-project-related inventory surveys and nominate sites that are eligible to the NRHP to protect and preserve cultural resources per Section 110 of NHPA, E.O. 11593, and Section 14 of ARPA. Internal and outside funding sources, researchers, partners and volunteers would be sought to assist in research and preservation projects. Public outreach and interpretation would continue to be provided through heritage programs, projects, and interpretive materials. The identification, evaluations, and analysis of the effects from proposed actions to cultural resources that are eligible, nominated, or listed on the NRHP would be completed to meet the requirements of Section 106 of NHPA.

Most of the discussion regarding impacts focuses on effects to archeological sites because they are discreet locations that are more easily identified. Traditional use areas accessed for the collection of traditional materials may also be impacted. The Forest consults with three different Tribal governments that have a cultural affiliation to the area. At present, Tribes have not identified concerns or issues that the alternatives would result in adverse impacts to known and unidentified TCPs. Government-to-government consultation would continue between the Forest and the Tribes. If Tribal consultation results in identification of additional, currently unidentified, traditional uses and traditional cultural properties, impacts to those areas would be considered during site-specific environmental assessments.

Public Outreach and Education

In all alternatives, the Forest would continue to fulfill its responsibilities to promote and invest in public education and outreach to meet the intent of NHPA Section 110, E.O.13287 Preserve America, and ARPA section 10(c). The Forest's heritage program would continue to provide opportunities to the public to promote cultural resource stewardship and conservation through volunteer programs,

recreation opportunities, interpretation, and presentations. These programs are intended to increase public awareness of the significance of the archaeological resources located on public lands and the need to protect those resources. This awareness may result in reducing the number incidents and severity of damage caused by looting, vandalism, and unintentional vandalism from recreational activities.

Relationship of Short-term Uses and Long-term Productivity

Traditional cultural areas used for collecting forest and mineral resources could be affected by the temporary closure of areas from wildland fires and treatments. Many of the traditionally used plants respond to fire by increasing productivity. All alternatives propose to treat a similar number of acres with fire and would potentially increase the long-term productivity of traditionally used forest resources and availability of those resources across the landscape. Access for visits to cultural resources (archaeological sites and TCPs) could be affected in the short term during implementation of prescribed burn treatments.

Conducting prescribed burns has the potential to restore the natural and cultural landscape, and the natural fire regime, reducing the potential for permanent adverse effects from high-intensity, high-severity fires. Mechanized treatments have the similar benefits to cultural resources as fire treatments because they would reduce the potential for permanent adverse effects from fire, but these treatments have the highest potential for long-term indirect effects from erosion caused from intensive ground disturbance near sites. Also, slash from mechanized treatments is often piled and burned, resulting in more locations with hydrophobic soils, increasing erosion to sites if the burn piles were located near sites.

Cumulative Effects

The cumulative effects on cultural resources should take into account all surface-altering actions that have occurred or are likely to occur within the Forest, as well as those actions that modify view-sheds and vegetative material in and adjacent to historic properties to include TCPs and sacred sites. Some of the recorded sites on the Forest are at least statewide significant, and a few are nationally significant. This statewide or national importance of some sites within the Forest reinforces the need for protecting significant local cultural resources that may be affected from cumulative impacts of management activities within the Forest and state. Federal, Tribal, and State lands adjacent to the Forest comprised the analysis area for cumulative effects.

Livestock Grazing

This section evaluates and discloses the potential environmental consequences on the range resource that may result with the adoption of a revised land management plan. It examines, in detail, six different alternatives for revising the 1988 Colville National Forest Land and Resource Management Plan (1988 forest plan).

Affected Environment

The rangelands of the planning area and many of the major perennial grasses (such as bluebunch wheatgrass and Idaho fescue) did not evolve with substantial ungulate grazing (Daubenmire 1970). Year-long open-range grazing in the late 1800s and into the early 1900s was of such magnitude and had such devastating legacy results, that grazing laws were developed for public lands by 1910. In the planning area, season-long sheep and cattle grazing without rotation or rest was prevalent in the first half of the 20th century and caused degraded conditions in many grasslands and meadows (Franklin and Dyrness 1988, Alverson and Arnett 1986). The effects of past management are apparent in the high amount of non-native grasses like Kentucky bluegrass (*Poa pratensis*), reed canarygrass (*Phalaris arundinacea*) and redtop (*Agrostis alba*) in low elevation meadows (Kovalchik and Clausnitzer 2004). Disturbed steppe and shrub-steppe communities that were once characterized by perennial bunchgrasses now have a strong forb component or are dominated by introduced species (Clausnitzer et al. 2006). Overgrazing of green fescue (*Festuca viridula*), an important dominant bunchgrass of montane and subalpine herbaceous vegetation types, has caused soil erosion and increases in unpalatable forb and dwarf-shrub species in some areas that have persisted into present (Clausnitzer et al. 2006, Shiflet ed. 1974). The recovery rates of bunchgrass communities are slow and may never reach their former status after severe overgrazing (Franklin and Dyrness 1988).

Grazing allotments on the Forest cover about 745,000 acres (68 percent) of administered forest lands. At the landscape scale, the potential natural vegetation within grazing allotments consists predominantly of forested communities. Douglas-fir forests are the potential natural vegetation for 50 percent of the landscape within range allotments, 28 percent of the allotments are characterized by western hemlock communities, and 20 percent are occupied by subalpine forest communities. The remaining area within the allotments are mapped as dry ponderosa pine forests (1 percent) and grass- and shrublands (1 percent). At a finer scale, the predominantly forested landscape includes many montane and subalpine meadows, wetlands, and riparian communities as described by Clausnitzer et al. (2006). Many of these non-forest and deciduous forest communities are small-sized or linear features along lake margins and riparian communities, therefore, they are treated as inclusions in the landscape-scale potential natural vegetation model for the Colville National Forest.

Much of the forested landscape consists of dense conifer stands with canopy covers greater than 60 percent. Gradient Nearest Neighbor analysis (Ohmann and Gregory 2002) shows that 57 percent of the allotment area has canopy coverage greater than 60 percent, 25 percent has canopy coverage of 40 to 60 percent, and only 19 percent has canopy coverage less than 40 percent. Sites with canopy coverage greater than 60 percent would likely provide little to no forage, sites with canopy coverage of 40 to 60 percent would provide some forage, and sites with canopy coverage less than 40 percent would provide the most forage. Western hemlock forests do not tend to produce significant livestock forage even at early seral stages and are, therefore, not considered suitable rangelands. Other forest communities should be considered transitory range, but are currently highly stocked with limited forage production. Future desired conditions for dry conifer communities would favor open canopies, compared to current conditions, and potentially improve forage availability in these stands.

During the homestead era from the 1890s to the 1930s, approximately 4,000 acres of "homestead meadows" were created across the Colville National Forest. These areas are primarily upland sites that were historically cleared of timber and cultivated to grow crops. Today, these meadows are considered National Forest System lands managed by the Forest Service. They are dominated by non-native vegetation that provides valuable forage for livestock and wild ungulates. These areas are considered highly departed from their site potential with species such as Kentucky bluegrass (*Poa pratensis*), orchard grass (*Dactylus glomerata*), and common timothy (*Phleum pratense*) as dominant vegetation mixed with native forbs. These sites are susceptible to invasive plant establishment and spread and require treatments to control invasive species.

Limited condition and trend monitoring data are available for the Colville National Forest. Fifteen historic rangeland condition and trend plots, established in the early 1960s and late 1970s, were relocated and inventoried in 2002 and 2005. Vegetation at inventoried sites consists of seeded redtop clearings or meadows (4), Idaho fescue grasslands (2), Sandberg bluegrass grassland (1), subalpine grasslands with green fescue (3), snowberry shrubland (1), forested communities with ponderosa pine (2) or Douglas-fir (1), and a lodgepole pine site with spotted knapweed (1). The 2002/2005 forage condition ratings from the Parker-3-Step inventory was good for 7 sites, fair for 4 sites and poor for the remaining 4 sites. The trend after 30 to 50 years is up for two sites, down for four sites, and static for the remainder.

Livestock grazing on lands of the Colville National Forest has changed dramatically over the past century. Prior to the Forest's establishment, grazing was largely unregulated with mostly cattle and sheep grazing the rangelands. The Colville National Forest was created as a National Forest Reserve in 1907, and records indicate that the first grazing permit was issued in 1911. Relatively large numbers of sheep and cattle grazed the Colville National Forest during the 1920s, '30s, and '40s, with cattle utilizing the lower elevations and sheep grazing the higher elevations, especially in the Kettle Crest mountain range. During the 1950s, the majority of sheep grazing ceased on the Forest, and today almost all permitted grazing is for cattle with only one sheep allotment (currently vacant) remaining.

Livestock grazing on the Colville National Forest is an important use to the local ranching industry and local communities. Permitted livestock grazing on the Colville National Forest helps to maintain the social customs and traditions of ranching and agriculture, and provides social and economic contributions at a local, regional, and national level.

Grazing on public lands contributes directly to livestock forage needs. The total contribution of national forest grazing lands to permittees is understated because Forest Service allotments are valuable grazing areas that not only provide foraging opportunities within permitted seasons, but they also afford permit holders the opportunity to grow forage on other private ranch lands that are needed to sustain livestock during periods when they are not on the national forest.

Ecological conditions and trends in forage areas have been evaluated annually (utilization and actual use) and extensively (long-term monitoring sites) during the allotment NEPA process for each allotment. The majority of long-term monitoring sites show an improvement in condition and trend. The exception to this is where tree density has increased, which has resulted in a reduction in forage production.

Livestock are attracted to areas with high amounts of forage and water. Wetlands, springs, and streams on the Forest can be negatively affected by this use. Recent range NEPA analyses have addressed issues in these areas, and the Forest would continue to evaluate livestock effects in these areas.

Range Allotments and Permitted Livestock

Relatively large numbers of sheep and cattle grazed the Colville National Forest during the 1920s, ’30s and ’40s with cattle utilizing the lower elevations and sheep grazing the higher elevations, especially in the Kettle Crest mountain range. During the 1950s, the majority of sheep grazing ceased on the Forest. Today almost all permitted grazing is for cattle with only one sheep allotment, which is currently vacant, remaining. Over the life of the 1988 forest plan, permitted animal unit months (AUMs) have declined from a 1988 average of approximately 35,000 per year to a current average of approximately 29,500 per year. Today, there are a total of 58 grazing allotments where 42 currently have permitted use and 16 are in a vacant status. The decline in permitted AUMs is mostly due to allotments becoming vacant, and agency direction to have current NEPA documentation prior to authorizing use. Most vacant allotments cannot be permitted at this time due to there being no current NEPA document which assesses and discloses the effects of grazing and no current allotment management plan (AMP). Vacant allotments would be assessed at the project level to determine the appropriateness of future grazing use.

Livestock grazing is authorized through the National Environmental Policy Act of 1969 (NEPA) planning process that allocates forage for grazing, and a permit system administers the authorized grazing within individual allotments. AMPs, also developed from the NEPA planning process, provide site-specific details for management of the resource and identify mitigation measures needed to reduce identified potential grazing impacts in order to meet or move toward management objectives, as well as any required monitoring. A variety of range and livestock management tools such as herding, rotational grazing, off-site water development and fencing can be implemented on grazing allotments to facilitate improved allotment management, livestock management, and natural resource protection.

Thirty-eight of the total 58 active and vacant grazing allotments have been assessed under regional protocols for resource conditions, and environmentally analyzed under NEPA and the Rescission Act of 1995. This process still needs to occur for the remaining allotments. An adaptive management strategy analyzed through the NEPA process is commonly used to provide livestock management flexibility to allow for changing resource conditions. Implementation of an adaptive management framework is dependent upon appropriate NEPA analysis of potential management strategies and/or practices that may be implemented due to changing resource conditions as well as regulatory or policy changes. Monitoring is also a key component in successfully implementing an adaptive management framework.

Riparian Areas

Livestock are attracted to areas with water and available forage. Cattle, if not actively managed, tend to stay in and graze gentle-gradient riparian areas to an extent that can interfere with attaining the desired vegetation and soil resource conditions for these areas. Adaptive management practices commonly utilized on the Colville National Forest to reduce impacts from grazing on riparian areas include:

- Creation of pastures and development of grazing strategies that provide for deferment, rest and/or vegetative recovery
- Off-stream/off-site water development and trough placement
- Salting livestock in upland areas
- Fencing and/or brush barriers
- Armored stream crossings

Current allotment management focuses on strategies to move livestock enough to distribute their use and impacts throughout pastures and prevent concentration in the riparian areas. Monitoring and identifying appropriate thresholds is a key component in successfully implementing an adaptive management practice.

Rangeland Resources

Rangelands provide a wide variety of tangible products including forage for grazing and browsing animals, wildlife habitat, water, minerals, recreation, and wood products. Rangelands also produce intangible products such as natural beauty and scenery. The ability of these lands to support the needs of grazing and browsing animals is a result of their capacity to produce rangeland vegetation and forage.

As a result of development and sub-division of private property, which has reduced the amount of private grazing lands, demand for public land grazing on the Colville National Forest is constant or increasing.

Climate Change

Climate change may have the potential to affect grazing capacity in both the short term and long term. Changes in forage production may result from predicted shifts in precipitation patterns and increased temperatures.

"Uncertainty about climate projections are much greater at the local and regional scales important to land managers because uncertainties amplify as data and model outputs are downscaled. Ecological response to climate-related changes is highly likely to be more difficult than climate to model accurately at local scales. Though there is uncertainty based on modeling, it does not imply a complete lack of understanding regarding climate change and grazing lands. Managing in the face of uncertainty would best involve a suite of approaches, including planning analyses that incorporate modeling with uncertainty, and short-term and long-term strategies that focus on enhancing ecosystem resistance and resilience, as well as actions taken that help ecosystems and resources move in synchrony with the ongoing changes that result as climates and environments vary. Flexibility to address the inherent uncertainty about local effects of climate change could be achieved through enhancing the resiliency of forests. Efforts to address existing stressors would address current management needs, and potentially reduce the future interactions of these stressors with climate change" (U.S. Climate Change Science Program 2008).

Although we know an ecosystem's sensitivity to grazing pressure and threshold for degradation changes with bioclimatic setting, resulting in lower sustainability in very dry and very humid ecosystems (Asner et al. 2004), the future bioclimatic setting within the planning area is highly uncertain. It is very likely that as future average temperatures increase, snowpack would be reduced and snowmelt, run-off, and peak flows would occur earlier in the year (USDA Forest Service 2008b). In addition, with increased atmospheric carbon, primary production is expected to increase particularly on semi-arid rangelands (Derner et al. 2005). It has been hypothesized that grazed areas resulting in a lower soil water-holding capacity and lower temperature sensitivity of soil respiration might release less carbon dioxide (CO_2) to the atmosphere through soil respiration under future precipitation and temperature scenarios.

Need for Change

Desired Conditions for Livestock Grazing for Alternatives

- There are opportunities to engage in ranching activities and graze livestock on NFS lands. These activities contribute to the stability and social, economic, and cultural aspects of rural communities.
- The desired structure and diversity of native herbaceous plant communities (including highly palatable forage species) are maintained or enhanced through proper livestock management principles. Rangelands consisting of native plant communities such as open conifer forests, low-elevation grasslands, shrub-steppe plant communities and meadows have few to no invasive plant species, have stable or improving ecological conditions, and are resilient to disturbance events. Rangelands with significant non-native plant components have stable or improving soil stability.
- Rangelands and forestlands provide forage for use by both livestock and wildlife. Grazing continues to be a viable use of vegetation on the Forest. Availability of lands identified as suited for this use contributes to providing animal products, economic diversity, open space, and promotes cultural values and a traditional local life style. Allotments are generally grazed on an annual basis.
- Consistent with sustaining other resource desired conditions, a viable level of forage is available for use under a grazing permit system where use typically occurs on an annual basis generally between June and October. Riparian and upland areas within allotments reflect ecological conditions supporting the desired conditions, including those described in the Wildlife, Aquatic and Riparian, Soil, and Vegetation Desired Conditions.

Old Forest Management and Timber Production

In the revision of the forest plan, three broad-scale concerns drove the need to consider how we address old forest management, especially the current reserve system approach at the landscape scale. These are:

- The recent history of uncharacteristic levels of disturbances resulting from fire and insect and disease activity that would likely continue into the future.
- The interaction between disturbances and climate change that elevates the importance of restoring landscape resiliency.
- Uncertainty about the recovery and viability of old forest-dependent species given the increased risk of uncharacteristically severe disturbances that is likely to be exacerbated by climate change impacts.

Motorized Recreation Trails

The 1988 forest plan provides direction for summer and winter motorized uses, including identifying areas where such use may not be authorized or is limited, mainly for protection of aquatic, plant, and wildlife habitats.

The goal for recreation settings and experiences would include providing a spectrum of high quality, nature-based outdoor recreational settings where visitors access the Forest, including access to the biological, geological, scenic, cultural, and experiential resources of the Forest. Where the visitor's outdoor recreational experience involves few conflicts with other users, access is available for a broad range of dispersed recreation activities such as dispersed camping, rock climbing, boating,

mushroom and berry picking, hunting, and fishing and these experiences are offered in an environmentally sound manner, are within budget limits, and contribute to the local economy.

Access

Three broad concerns drove the need to address road density:

- The Forest can no longer afford to properly maintain the road system at current operational maintenance levels,
- The current road system is not aligned with current and future resource management objectives, and
- The existing road management direction is confusing and difficult to follow because it is scattered throughout the 1988 forest plan (Colville National Forest Land and Resource Management Plan), Forest Plan amendments (Eastside Screens, Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH, USDA Forest Service 1994 and 1995)), national-level decisions (the Roadless Rule), and interim policy (e.g., Grizzly Bear No-Net-Loss, Lynx Agreement, the Interior Columbia Basin Strategy).

Recommended Wilderness Areas

By law, all National Forest System lands must be evaluated for possible wilderness recommendation during the plan revision process. The result of that evaluation shows whether a need exists for additional wilderness and what trade-offs may exist if the area is eventually designated part of the National Wilderness Preservation System.

Currently, the Salmo-Priest Wilderness covers about 3 percent of the Colville National Forest and evaluation showed a need for additional wilderness opportunities on the Forest. A review of possible areas showed some are available to fill this need.

Wildlife

The 1988 forest plan provides limited protection for habitat connectivity, providing wildlife and aquatic crossing structures, and managing activities adjacent to the structures so they are used by wildlife.

Riparian and Aquatic Resource Management

The 1988 forest plan includes riparian management direction from the Inland Native Fish Strategy (INFISH, USDA Forest Service 1994 and 1995). This approach appears to have either maintained or improved riparian and aquatic habitat conditions at the watershed and larger scales.

Objectives for riparian management areas would give emphasis to maintaining or restoring the riparian and aquatic structure and function of intermittent and perennial streams, confer benefits to riparian-dependent plant and animal species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, contribute to improved water quality and flows, and contribute to a greater connectivity of the watershed for both riparian and upland species.

Desired conditions for riparian management areas within any given watershed are to have compositions of native flora and fauna and a distribution of physical, chemical, and biological conditions commensurate with natural processes

Environmental Consequences

Methodology

Assumptions

- This programmatic analysis does not analyze changes that may occur to livestock management at an allotment level. Instead, project-level analysis would be completed independent of this planning effort at the allotment level to determine the appropriate intensity, timing, and duration of livestock use.
- The revised plan allows for site-specific determinations relating to allotment management, such as the proper grazing systems and range improvements needed to meet desired conditions.
- The revised plan sets objectives for vegetation treatment and manipulation practices that contribute to the amount and condition of rangeland vegetation. (1982 Rule Sec. 219.20 (a)).
- Conflict or beneficial interactions among livestock and wild animal populations are managed at the allotment level through adaptive management and appropriate mitigation measures (1982 Rule Sec. 219.20 (b)).
- The revised plan, through desired conditions and objectives for each management area, provides direction to move rangelands in unsatisfactory condition toward desired conditions. Implementation occurs at the allotment level (1982 Rule Sec. 219.20 (b)).
- Under all alternatives, project-level analysis, including season of use, permitted livestock numbers, and forage use levels occur at the allotment level. Livestock grazing under all alternatives would be managed with adaptive management to match livestock numbers with annual forage production and resource needs based upon assessment and monitoring data.
- Climate change may affect forage conditions on the forests. Under all alternatives, adaptive management used in allotment management planning allows for adjustments in the number of livestock and season of pasture use so that livestock use matches forage production for every grazing season.
- Rangeland capability does not change across alternatives.
- Acres of rangeland suitability are lower in the action alternatives compared to the no action alternative due to the distribution of proposed management areas.

Methods of Analysis

Potential effects to livestock grazing were identified and include availability of forage, impacts to rangeland vegetation, access for administration of grazing allotments, and modification of allotment management resulting from wildlife and riparian management direction. Effects are assessed using the percentage of the Forest allocated to a management area that is associated with the management direction, or by looking at changes in plan components by alternative.

This section describes the capability and suitability of National Forest System (NFS) lands for producing forage for grazing animals and for providing habitat for wildlife. It also describes the potential environmental consequences of vegetation treatments (mechanical and fire) on the rangeland resource.

An AUM is the amount of dry forage consumed by one animal unit over 30 days. An animal unit is one 1,000-pound cow with or without a calf under six months, or five sheep.

The methods for determining acres of land capable and suitable for livestock grazing are described in detail in appendices A and B of the Range Specialist Report and appendix G of this FEIS. The boundary for the suitability analysis contains all NFS lands within the boundaries of the Colville National Forest.

Incomplete and Unavailable Information

- Knowledge and synthesis of current monitoring data for annual livestock use indicators, such as stubble height, bank alteration, herbaceous utilization within the active floodplain and woody species utilization is not complete at the pasture level on a forestwide scale.
- Knowledge of the number of pastures, and amounts of streams within them, that adhere to the descriptions in the 2011 Technical Reference 1737-23, Multiple Indicator Monitoring (MIM) of Stream Channels and Streamside Vegetation.

Spatial and Temporal Context for Effects Analysis

The spatial affected environment for direct and indirect effects is the lands administered by the Colville National Forest. Effects are analyzed over the life of the forest plan, which is 15 to 20 years.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

- Sub-division of private lands and development.
- Grazing on adjacent Federal, State and private lands.
- Wildfire.

Summary of Effects

The revised forest plan provides a programmatic framework that guides site-specific actions, but does not authorize, fund, or carry out any project or activity. Because the forest plan does not authorize or mandate any site-specific projects or activities, there can be no direct effects. However, there may be implications, or longer-term environmental consequences, of managing the Forest under this programmatic framework.

All alternatives provide similar guidance for managing livestock grazing. The management focus is to balance livestock grazing with available forage and other resource needs. This would be accomplished at the allotment level.

Lands Capable and Suitable for Livestock Grazing

A rangeland capability analysis has been completed for this forest plan revision effort, found in appendix G of the FEIS. Capability was assessed for cattle and sheep grazing separately. Total capable rangeland acres on the Colville National Forest are seen in table 228.

Provisions of the 1982 planning rule require that the capability for producing forage for grazing animals on NFS lands be determined. Capability refers to the potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends upon current resource conditions and site conditions, such as climate, slope, landform, soils, and geology, as well as the application of management practices.

Table 228. Colville National Forest capable rangelands

Description	Acreage
Forest Service Administered Lands	1,103,000
Capable for Cattle Grazing	628,740
Capable for Sheep Grazing	777,152

Rangeland capability does not vary by alternative and is therefore only determined once through the land management planning process. Maps depicting the capable areas of the Colville National Forest for cattle and sheep are shown below.

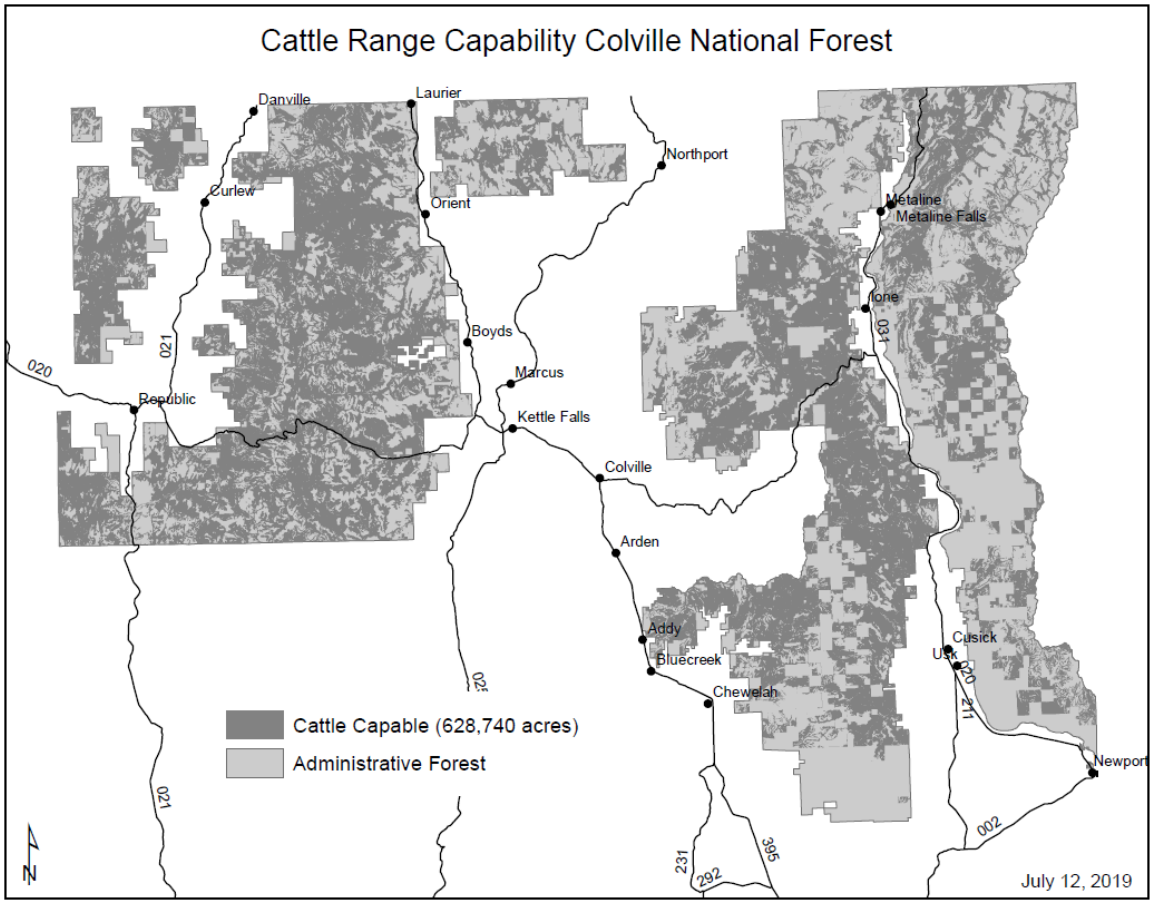


Figure 14. Cattle range capability

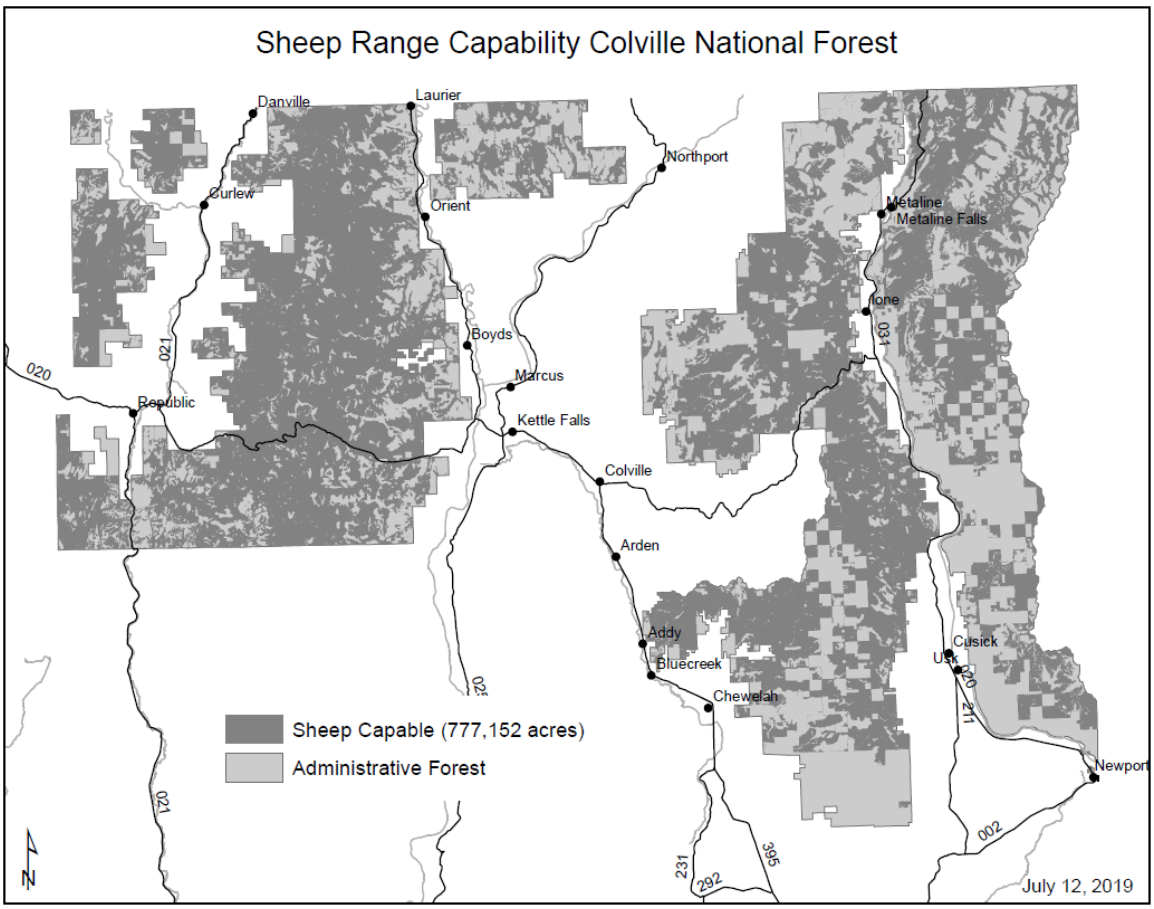


Figure 15. Sheep range capability

This current assessment improves on the prior assessment done during the development of the 1988 forest plan, because it accounts for changes in suitability that have occurred since the original decisions were issued, and also because it employs current GIS mapping technologies that were unavailable during previous planning efforts.

Suitability refers to the appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses forgone. A unit of land may be suitable for a variety of individual or combined management practices.

The criteria for suitability for livestock grazing are the same in the action alternatives. This is very similar to the existing direction under no action.

Table 229. Suitability of livestock grazing on the Colville National Forest

Management Area	Livestock Grazing Suitable	Livestock Grazing Not Suitable
Wood/Forage	X	
Scenic Timber	X	
Old Growth Dependent Species Habitat/Late Forest Structure	X	
Caribou Habitat		X
Winter Range	X	
Scenic/Winter Range	X	
Focused Restoration	X	
General Restoration	X	
Active Management/Responsible Management Areas	X	
Restoration Zone	X	
Backcountry	X	
Backcountry Motorized	X	
Wilderness – Designated	X	X for Salmo-Priest
Wilderness – Recommended	X	
Research Natural Areas	X proposed RNAs	X established RNAs
Scenic Byway Corridor	X	
Kettle Crest Recreation Area	X	

Range Suitability Determination

Table 230. Colville National Forest suitable rangelands by alternative

Alternative	Acres of Suitable Rangeland
No Action	Cattle – 284,084 Sheep – 350,115
Proposed Action	Cattle – 281,999 Sheep – 348,030
Alternative R	Cattle – 281,999 Sheep – 348,030
Alternative P	Cattle – 281,999 Sheep – 348,030
Alternative B	Cattle – 281,999 Sheep – 348,030
Alternative O	Cattle – 281,999 Sheep – 348,030

Even though the amount of land suitable for livestock grazing varies slightly by alternative, there would be no anticipated impact on permitted AUMs in all alternatives based on their suitability alone. The alternatives would continue to provide some level of forage for domestic livestock and opportunities for ranching lifestyles consistent with the other desired conditions.

Consistent with the "Methodology and Analysis Process to Determine Rangeland Suitability and the Capability for Colville National Forest Plan Revision" found in appendix A of the Range Specialist Report and the "Processes Used for Determinations of Rangeland Capability and Suitability" found in appendix B of the Range Specialist Report, there are different rangeland suitability determinations for cattle compared to sheep. Maps depicting the suitable areas of the Colville National Forest for cattle and sheep are shown below.

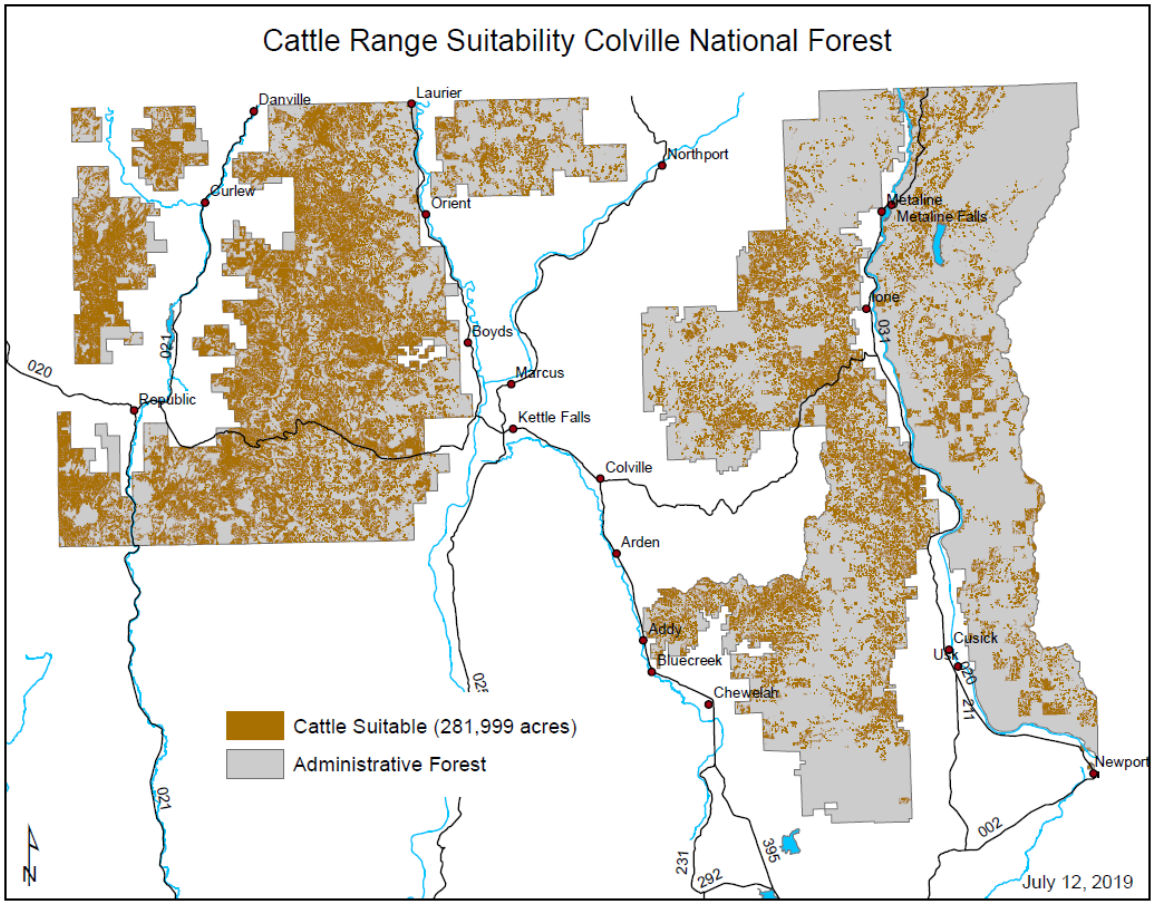


Figure 16. Cattle range suitability

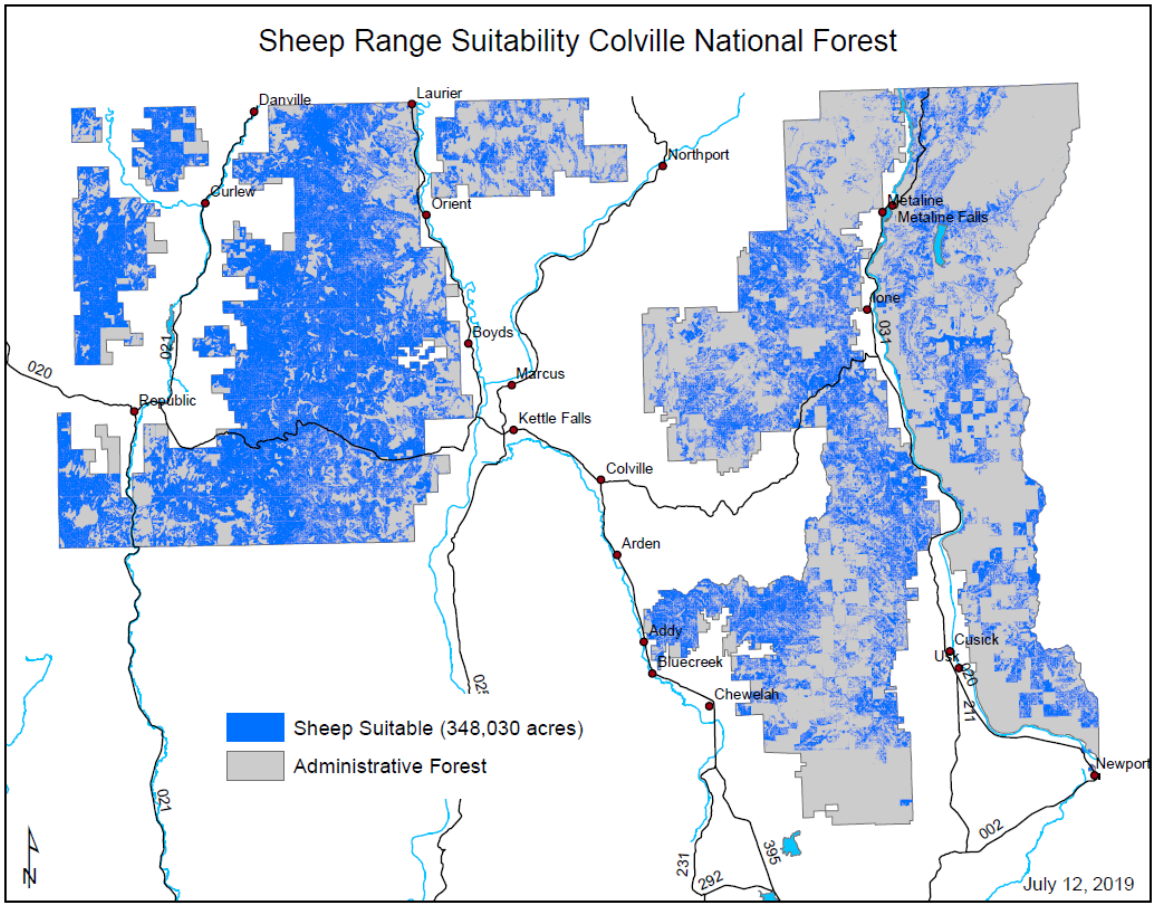


Figure 17. Sheep range suitability

Old Forest Management and Timber Production

Addressing forest health issues through vegetation management and fuels reduction would likely produce positive outcomes in the amount and abundance of understory vegetation, which permitted livestock and wildlife use as forage. Griffis et al. (2001) found that the abundance of native grass production increased significantly with treatment intensity through thinned timber stands that also had prescribed fire to reduce surface fuels. Additional research has revealed that as stand density index decreases, forage production increases (Moore and Deiter 1992).

Permitted grazing would benefit from timber production through increased forage abundance. This increased forage production may not result in changes to permitted stocking levels because it would need to be determined at the project level if there would be a net increase in forage production and how other resources may be affected by potential changes.

Access

Access is assessed for the various alternatives in this section by looking at the combined total of the percentages found for Backcountry and Recommended Wilderness management areas combined with proposed road density limits. The greater the total number for these two management areas equates to more acres where future access, relative to roads or motorized trails, would be reduced.

Table 231. Colville National Forest restricted access management areas, percentage by alternative

Management Area	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Backcountry	8	8	2	12	0	16
Recommended Wilderness	0	9	19	6	20	1
Total	**8**	**17**	**21**	**18**	**20**	**17**

An effect to livestock grazing from all motorized access is mainly limited to the grazing permit holder's ability to access the allotment. Motorized access (including off-highway vehicles) into non-motorized management areas within allotments can be authorized by line officers on a case-by-case basis for allotment administration. Motorized access needs could include transportation of fence and/or water development materials, control of invasive plants, maintaining range improvement projects, checking livestock, locating livestock and distributing salt. Permit holders for allotments with less motorized access may take more time and labor to observe stock, check fences and water developments, and distribute salt than allotments with motorized off-highway vehicle access.

To assess the total effects of changes in access, proposed road density limits also need to be considered. Table 232 displays the road density limits for each of the alternatives analyzed in the revised forest plan.

Table 232. Upper limit of desired road density by alternative

No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
80% of the Forest is suitable for roads. About 4,000 miles of roads on the Forest. Upper limits vary from 0.4 to no limit.	2 miles per square mile in Focused Restoration MAs and 3 miles per square mile in General Restoration MAs.	1 mile per square mile in Focused Restoration MAs and 2 miles per square mile in General Restoration MAs.	1 mile per square mile in Focused Restoration MAs and 2 miles per square mile in General Restoration MAs.	Cap NFS road miles at current level. Applicable forestwide.	Cap NFS road miles at current level. Applicable forestwide.

Climate Change

Climate change scenarios predict more, larger uncharacteristic wildfires. Wildfires can burn fences and water developments within allotments. Pastures may have to rest from grazing until recovery objectives are met following a wildfire. These short-term effects of wildfire are minor compared to the long-term effects of increased forage from large wildfires (over 100 acres burned), which can last for decades. Over the last 25 years, total acres burned by wildfire on the Forest has exceeded 1,000 acres in four years 1994, 2001, 2003 and 2015. The trend in size and number of larger wildfires is expected to increase over the life of the plan, resulting in an increase in forage.

"Grazing lands are estimated to contain 10 to 30 percent of the world's soil organic carbon" (Schuman et al. 2002). While some studies have found limited to large reductions in soil carbon and increases in CO_2 flux associated with grazing (Haferkamp and MacNeil 2004, Welker et al. 2004), studies involving modeling and remotely sensed data indicate that proper grazing can improve ecosystem production as measured by soil carbon storage (Li et al. 2007, Steinfeld and Wassenaar 2007, Reeder et al. 2004, Schuman et al. 2002). Additional studies similarly conclude that certain levels of grazing may even increase carbon sequestration (Hellquist et al. 2007, Derner et al. 2006,

Derner et al. 2005, LeCain et al. 2001, Ganjegunte et al. 2005, Manley et al. 1995, Reeder et al. 2004, Schuman et al. 2002). Complementing these findings, several studies indicate that light to moderate levels of grazing have no overall effect on total carbon sequestration (Hellquist et al. 2007, Ingram et al. 2008, Derner et al. 2006, Stavi et al. 2008, Owensby et al. 2006, Shrestha and Stahl 2008, Ingram et al. 2008). In fact, intensive rotational grazing appears to be a viable option for greenhouse gas reduction and carbon sequestration credits (Bosch et al. 2008, de Steiguer et al. 2008, USDA Natural Resources Conservation Service 2006, Li et al. 2007, Ingram et al. 2008, Conant and Paustian 2000, Streater 2009, Sharrow 2008).

It can safely be asserted that there is tremendous variability in carbon storage and its response to grazing across different land types (Derner et al. 2006, Henderson et al. 2004). The Northern Great Plains appears to have small potential as a carbon sink (Haferkamp and MacNeil 2004). Alternately, local research indicates that ungrazed sagebrush steppe sites were CO_2 sinks during the period they were measured (Svejcar et al. 2008). Management practices that maintain or move plant associations to "good" condition appear to be consistent with maintaining the soil organic pool (Henderson et al. 2004, Brown and Thorpe 2008, Sharrow 2008).

Grazing results in redistribution of carbon on the landscape (Stavi et al. 2008). It has been noted that livestock waste management represents a potential long-term soil carbon gain (Fellman et al. 2008). Free-ranging livestock deposit manure across the landscape, resulting in aerobic decomposition. Aerobic decomposition of manure generates considerably less methane than does decomposition associated with stockpiling strategies used in more concentrated livestock production strategies (Alberta Agriculture and Food Ag-Info Center) (EPA 2005b). This "in-effect" land application of manure also results in a buildup of soil carbon that decomposes much more slowly than occurs when composting (USDA Natural Resources Conservation Service 2007).

Svejcar et al. (2014) found that grazing is a complex ecological process and that synthesis of the scientific literature can be a challenge. They found that legacy effects of uncontrolled grazing during the homestead era further complicate analysis of current grazing impacts. Interactions of climate change and grazing would depend on the specific situation (Svejcar et al. 2014). They further state that Beschta et al. (2013) argue that grazing by large ungulates (both native and domestic) should be eliminated or greatly reduced on western public lands to reduce potential climate change impacts. Svejcar et al. (2014) found that the authors in Beschta et al. (2013) did not present a balanced synthesis of the scientific literature, and that their publication is more of an opinion article with their conclusions not being reflective of the complexities associated with herbivore grazing (Svejcar et al. 2014). Beschta et al. (2013) devote a significant portion of their climate change discussion to warmer spring temperatures, reduced snowpack, earlier peak flows, and reduced summer stream flows. Svejcar et al. (2014) found it to be unclear how removing grazing would overcome the effects of large-scale climatic changes (such as reduced snowpack) that are triggered by larger and more complex resource issues than grazing (Svejcar et al. 2014).

All alternatives would use adaptive management to address climate change. Climate change is expected to affect forage conditions on the Forest. The adaptive management used in allotment management planning, which is outside of this planning effort related to the forest plan revision, allows for adjustments in the number of livestock and season of pasture use so that livestock use matches forage production for every grazing season.

Wilderness and Recommended Wilderness

Wilderness designation by congressional action does not affect allotment boundaries or suitability for grazing. The existing wilderness area, Salmo-Priest, does not have any grazing allotments or portions

of grazing allotments within its boundary, therefore, permitted livestock grazing would not occur in the future. There should be no effects to livestock grazing from designated wilderness management; though new requirements concerning the types of materials that could be utilized for range improvement projects may be a future consideration should any recommended wilderness be designated as wilderness in the future. Additionally, mechanized tools such as chainsaws are generally not allowed in designated wilderness. Therefore, the ability for permittees to use mechanized tools for trail clearing or range improvement project work in designated wilderness would be limited.

The amount of recommended wilderness existing within grazing allotments has the potential to constrain a grazing permittee's motorized access into the various recommended wilderness areas where motorized trails exist. This would vary by alternative based on which areas would be recommended wilderness.

Should recommended wilderness become designated wilderness, the potential for livestock grazing would likely cease on the portions of long-term vacant allotments within wilderness area boundaries. Grazing of allotments with active permits could continue with the designation of wilderness.

No Action Alternative

Access for allotment management by motorized trail or roads is likely to remain unchanged from that experienced under the 1988 forest plan.

Any new sheep grazing permits would be managed to reduce risks of disease transmission to bighorn sheep herds. Effects from domestic sheep grazing on bighorn sheep would be analyzed at the allotment level and a "Risk of Contact" analysis would be completed.

Impacts to permittee's time, labor, and costs would continue to be affected by riparian area direction.

Old Forest Management and Timber Production

Timber harvest can have a favorable effect on forage production by creating areas of forage through removing overstory. The quality of the forage created depends on the vegetation type and individual site characteristics. The expected timber harvest acreage would continue, so there is no change in forage from changed acres of timber harvest.

Prescribed fire can also create areas of forage depending on the vegetation types burned. Under this alternative, the amount of prescribed fire is unlikely to markedly increase in the short term. Forage created by prescribed fire would not increase.

Motorized Recreation Trails

Total miles of motorized trails on the Forest are expected to remain the same in the short term. Motorized trail access for permittees would remain the same in the short term.

Access

Today, there are about 4,000 miles of National Forest System roads, and about 80 percent of the Forest is suitable for road construction. The 1988 forest plan includes standards and guidelines that limit road densities to between 0.4 to 2 miles per square mile in deer and elk winter range, grizzly bear habitat areas, and lynx habitat. Outside of these habitats, the forest plan does not set an upper limit on road density. Today, the average National Forest System road densities in 12th field watersheds range from a low of 0.33 to a high of 4.45 miles per square mile on National Forest

System lands. The total miles of National Forest System roads are expected to remain the same or decrease slightly over the next 10 years.

The 1988 forest plan constraints on access may result in increased time, labor, and capital investments for the permit holder. Permit holders of allotments with less road access may take more time and labor to observe stock, check fences and water developments, and distribute salt than allotments with higher road densities.

Low maintenance native surface roads serve as routes for easily moving livestock on, off of and around pastures, and some routes may be lost as roads are decommissioned. Cut and fill slopes along with the native surface of low maintenance roads is a location providing foraging areas for livestock, therefore, lower road densities may have a small effect on availability of forage.

A positive effect of lower road density and miles is that cattle and range improvements would generally receive less disturbance and vandalism. Public use of roads in allotments with intensive grazing systems disturbs livestock, increases the risk of gates being left open, and tends to disrupt the proper use of forage by moving livestock along roadways.

Road densities and total miles of road on the Forest are expected to remain the same in the short term and likely to decrease in the long term due to budget trends. Motorized vehicle access for permittees would remain the same in the short term and may decline slightly in the long term.

Recommended Wilderness Areas

Currently there are no recommended wilderness areas on the Forest.

Wildlife

Sheep

The Forest currently supports two bighorn sheep herds and has no active sheep allotments. It is unknown if or when a sheep allotment may become active. Risk of contact concerning disease transmission from domestic sheep to bighorn sheep exists, which can be fatal for bighorn sheep. The 1988 forest plan is silent on disease transmission risks. It is assumed that any permit for sheep grazing would take steps to reduce or eliminate the risk of contact. The Forest Service would continue to address risks through allotment management planning, which may reduce future permitting of domestic sheep in allotments near bighorn sheep herds. A risk of contact analysis would be conducted at the allotment level before domestic sheep are authorized back on the Forest.

Wildlife management

The eastern portion of the Forest is within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zone that extends east into Idaho and Montana. The 1988 forest plan is silent on grizzly bear depredation, other than to state that grizzly bear habitat is managed in accordance with the Interagency Bear Guidelines, Colville National Forest Guidelines for Management in Occupied Grizzly Bear Habitat (appendix H, FEIS), national policy, and the Grizzly Bear Recovery Plan. Following direction to avoid depredation may result in changes in timing or location of livestock movement within an allotment. If this occurs, the permittee may need to spend more time and labor to implement these changes.

Riparian and Aquatic Resource Management

Forest plan direction that protects riparian areas has an effect on grazing operations through the need for the permit holder to spend time, labor, and make capital investments to limit potential livestock

grazing effects to riparian areas. Currently, there are riparian management areas that are called riparian habitat conservation areas (RHCAs) established by the INFISH and Eastside Screens amendments, and management direction from the INFISH amendment that address livestock grazing in riparian management areas. This direction would continue and permittee's time, labor, and capital investments would continue at the same levels, assuming allotment management is in compliance with the allotment management plan.

Proposed Action

Old Forest Management and Timber Production

Timber harvest can have a favorable effect on forage production by creating transitory rangelands that exist for a period following treatment. The proposed action and alternative P have similar projected wood sale quantities (PWSQ), which is the highest of the various alternatives considered at approximately 62 MMBF, and include desired conditions for creating gaps and patches of vegetation ranging up to 40 acres. More and larger gaps in vegetation would create more foraging areas, so the proposed action and alternative P are likely to increase forage for livestock and wildlife. Timber harvest and follow-up fuels treatments result in increased forage standing crop due to the relationship between forage production and overstory being curvilinear with forage production being negatively related to density of overstory vegetation (Masters et al. 1993). More forage would reduce forage competition between livestock and big game and may improve livestock distribution over the allotments.

Prescribed fire can also create desirable foraging areas, depending on the vegetation types burned.

The proposed action and alternative P are expected to result in forests that are more resilient and have fewer large and uncharacteristic wildfires in the long term. The trend in size and number of larger wildfires is expected to increase over the life of the plan as a result of anticipated climate change, resulting in a short-term increase in forage and a long-term decrease in wildfire-created forage.

Motorized Recreation Trails

The combined total for management areas that would restrict motorized access would total 17 percent of the Forest under the proposed action. This means that there would be 9 percent fewer acres under the proposed action where motorized access would be allowed compared to the 1988 forest plan. Limited access could equate to an increase in time and labor costs for permittees.

The analysis assumes that permit holders may not have the same level of motorized off-highway vehicle access to parts of their allotment within a backcountry non-motorized management area as existing roads and routes grow closed with vegetation or become undrivable.

Access

The total effect to access comes from looking at the percentage of Forest acres in Backcountry and Recommended Wilderness management areas and proposed road density limits. Compared to the no action alternative, access opportunities could be slightly reduced through an increase in the Backcountry and Recommended Wilderness acres. The proposed action's recommended road density limits of 2 miles per square mile for Focused Restoration management areas and 3 miles per square mile for General Restoration management areas are unlikely to result in a noticeable change in grazing permittees' ability to access their allotments. Some watersheds would see reductions in the

amount of roads present, but this is unlikely to have an impact on allotment management because of a lack in infrastructure, grazable areas, and/or allotments within the affected watersheds.

Recommended Wilderness Areas

Concerning recommended wilderness, the proposed action and alternatives P and O would allow existing uses that are inconsistent with wilderness designation to continue until Congress makes a decision on the Forest Service's recommendation. None of the recommended wilderness areas currently have National Forest System roads or motorized trails. Alternatives with a higher percentage of allotment acres in recommended wilderness would have the highest effect to permit holders' use of mechanized equipment in these areas, should Congress act upon the Forest Service recommendation and designate wilderness in the future.

Wildlife

There is nothing specifically in the proposed action for wildlife or wildlife habitat management that would affect livestock or allotment management.

Riparian and Aquatic Resource Management

The guidelines directing management for grazing practices in the Aquatic Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008a) are unlikely to have a substantial effect on allotment management. The ARCS (2008a) standard requiring new livestock handling, management, or watering facilities to be located outside of riparian management areas would continue direction contained in INFISH standard GM-2, except ARCS (2008a) provides additional flexibility that would allow these facilities in riparian management areas if they must inherently be located there.

Riparian management area widths vary by alternative. Riparian management area widths for the proposed action would increase compared to the no action alternative and that experienced under the 1988 forest plan. This alternative increases riparian management area widths for lakes and natural ponds from 150 feet to 300 feet, which could potentially further constrain a permittee's ability to fully utilize management options within these areas.

Alternative R

Old Forest Management and Timber Production

Timber harvest can have a favorable effect on forage production by creating transitory rangelands that exist for a period of time following treatment. The estimated PWSQ for alternative R is 14 MMBF, which is less than the 41 MMBF average experienced under the 1988 forest plan, therefore, it is anticipated that alternative R would produce fewer acres of transitory rangelands and less available forage than no action.

Prescribed fire can also create desirable foraging areas, depending on the vegetation types burned.

Motorized Recreation Trails

The combined total for management areas that would restrict motorized access would be 21 percent of the Forest under alternative R. This means that there would be 13 percent fewer acres under alternative R where motorized access would be allowed compared to the 1988 forest plan. Limited access would increase time and labor costs for permittees.

The analysis assumes that permit holders may not have motorized off-highway vehicle access to parts of their allotment within a Backcountry Non-motorized management area.

Access

The total effect to access comes from looking at the percentage of Forest acres in Backcountry and Recommended Wilderness combined and proposed road density limits. Compared to the no action alternative, access opportunities would be reduced through an increase in the recommended wilderness acres and the identified road densities for Focused and General Restoration management areas.

Alternative R's recommended road density limits of 1 mile per square mile for Focused Restoration management areas and 2 miles per square mile for General Restoration management areas, combined with this alternative having the largest percentage of Forest acres being in a Focused Restoration management area are likely to result in a noticeable change in a grazing permittee's ability to access their allotments. Many watersheds would likely see reductions in the amount of roads present, and this reduction in access could result in grazing permit holders having to spend more time and labor to manage the allotment.

Low maintenance native surface roads serve as routes for easily moving livestock on, off of, and around pastures, and some routes may be lost as roads are decommissioned. Cut and fill slopes and the native surface of low maintenance roads is another source of forage, so lower road densities may have an effect on availability of forage for livestock grazing.

Alternative R is the most restrictive of the alternatives in regards to restricting access through the amount of land contained within Focused Restoration, Backcountry and Recommended Wilderness management areas. Limited access would equate to an increase in time and labor costs for permittees. A positive effect of lower road density and miles is that cattle and range improvements would generally receive less disturbance and vandalism. Public use of roads in allotments with intensive grazing systems disturbs livestock, increases the risk of gates being left open, and tends to disrupt the proper utilization of forage by moving livestock along roadways. Alternative R would have the most allotment acreage in the Focused Restoration management area with the lowest road density.

Recommended Wilderness Areas

In the short term, the effect of recommended wilderness to livestock grazing is to limit motorized trail access for the permit holder in alternatives R and B, where a standard does not allow motorized uses within recommended wilderness.

Alternatives R and B would recommend the largest amount of recommended wilderness to Congress for potential designation, and these alternatives would have the most substantial effect on range management through limiting access, restricting tools, and increasing the time required to complete management activities. None of the recommended wilderness areas currently have National Forest System roads, but Owl Mountain, Jackknife, Twin Sisters and South Huckleberry all have motorized trails that are used for livestock and allotment management. Since all of these areas become recommended wilderness in alternative R, a permittee's ability to complete allotment and livestock management activities would be further constrained. In the long term, if Congress decides to designate the recommended wilderness areas as wilderness, motorized and mechanized activities may not be authorized. This would result in the permit holder having to spend more time and labor to manage the allotment.

Wildlife

There is nothing specifically in alternative R for wildlife or wildlife habitat management that would affect livestock or allotment management.

Riparian and Aquatic Resource Management

Forest plan direction contained within alternative R to protect riparian areas could constrain grazing and would likely require the permit holder to spend additional time, labor, and make capital investments to limit potential livestock grazing effects on riparian areas. Alternative R has the most restrictive plan components for riparian areas in regards to permitted livestock grazing. Additional standards, or changing a guideline to a standard, may put the permittee at a higher risk of being in non-compliance with the AMP.

Riparian management area (RMA) widths for alternative R would increase, compared to direction in the 1988 forest plan and INFISH. Alternatives with wider riparian management area widths are the proposed action and alternatives R, P, and O. These alternatives increase riparian management area widths, and therefore, protections for lakes and natural ponds from 150 feet to 300 feet.

Alternative R has additional standards, and standards that in other alternatives are guidelines, addressing livestock grazing and rangeland infrastructure in riparian management areas. These plan standards, and increased riparian management area widths may increase time, labor, and capital expenditures by the permittee to manage allotments.

Standard 9 of ARCS-modified, which pertains to livestock handling, management and water facilities, could limit the implementation of future management options to improve riparian areas and water quality. Specifically, given the increased RMA widths, the terrain and the types of stream channels experienced on the Forest, it could be difficult to locate new water troughs outside the RMA and have them function with consistent available water.

Guideline 9 of ARCS-modified pertaining to green-line vegetation areas is more restrictive in regard to minimum stubble height amounts and could potentially double the amount of required residual stubble height remaining in areas along the greenline, compared to the existing condition as documented in Allotment Management Plans. It is recognized that riparian and stream conditions are improving on the Forest with current management, which requires a minimum of 4 inches of herbaceous stubble in riparian zones. This ARCS-modified guideline, which would require a minimum of 6 to 8 inches of herbaceous stubble in riparian zones, could constrain permitted grazing and could result in a shortened grazing seasons for permittees. Clary and Leininger (2000) suggest that 4 inches (10 centimeters) of residual stubble height is recommended as a starting point for improved riparian management as this amount is near optimal when considering riparian issues such as maintaining forage vigor, entrapping and stabilizing sediment under inundated flow, trampling of streambanks and diversion of willow browsing (Clary and Leininger 2000). They also found that in some situations, 2.75 inches (7 centimeters) may provide for adequate riparian ecosystem function while others may require 6 to 8 inches (15 to 20 centimeters) (Clary and Leininger 2000). Clary and Webster (1990) found that special situations such as critical fisheries habitats or easily eroded streambanks may require stubble heights of greater than 6 inches. Critical habitat for threated fish species (bull trout) is limited on the Forest, with only three allotments having critical habitat. No listed fish have been observed on these allotments. This equates to approximately 5 percent of the Forest's grazing allotments having critical habitat within their boundaries. Easily eroded banks are also rare on the Forest, as most stream reaches within grazing allotments are greater than 4 percent gradient with rock, boulder, and embedded wood, which anchor the streambanks.

Having conservative/restrictive guidelines identified in ARCS-modified, such as a minimum stubble height requirement of 6 to 8 inches, is likely to ensure riparian health, but presents additional constraints for livestock operators who could experience shorter grazing seasons to comply with a 6- to 8-inch minimum stubble height requirement.

Implementation of ARCS-modified guidelines and standards does not account for the variability that occurs over the 1.1 million acres of the Colville National Forest. The riparian management area guidelines and standards of alternative R provide limited flexibility concerning the placement of rangeland infrastructure and limited knowledge of the protocols and processes to be used in evaluating conditions, though there is the ability to modify numeric thresholds listed for stubble height, bank alteration, and woody vegetation utilization. Therefore, these constraints applied across the entire Forest could dampen economic contributions to local economies if standards or guidelines are at risk of being exceeded and livestock have to be removed sooner than authorized.

Alternative P

Old Forest Management and Timber Production

Timber harvest can have a favorable effect on forage production by creating transitory rangelands that exist for a period of time following treatment. The proposed action and alternative P have similar PWSQs, which is the highest of the various alternatives considered at approximately 62 MMBF, and include desired conditions for creating gaps and patches of vegetation ranging up to 40 acres. More and larger gaps in vegetation would create more foraging areas, so the proposed action and alternative P are likely to increase forage for livestock and wildlife. Timber harvest and follow-up fuels treatments result in increased forage due to the relationship between forage production and overstory being curvilinear with forage production being negatively related to density of overstory vegetation (Masters et al. 1993). Additional forage would reduce forage competition between livestock and big game and may improve livestock distribution over the allotments.

Prescribed fire can also create desirable foraging areas, depending on the vegetation types burned.

The proposed action and alternative P are expected to result in forests that are more resilient and have fewer large and uncharacteristic wildfires in the long term. The trend in size and number of larger wildfires is expected to increase over the life of the plan due to anticipated climate change, resulting in a short-term increase in forage and a long-term decrease in wildfire-created forage. However, the proposed action and alternative P would continue to provide increased forage because of the desired condition for large size gaps and patches.

Motorized Recreation Trails

The combined total for management areas that would restrict motorized access would total 18 percent of the Forest under alternative P. This means that there would be 9 percent fewer acres under alternative P where motorized access would be allowed, compared to the 1988 forest plan. Limited access could equate to an increase in time and labor costs for permittees.

The analysis assumes that permit holders may not have the same level of motorized off-highway vehicle access to parts of their allotment within a backcountry non-motorized management area as existing roads and routes grow closed with vegetation or become undrivable.

Access

The total effect to access comes from looking at percentage of Forest acres in Backcountry and Recommended Wilderness combined with proposed road density limits. Compared to the no action alternative, and over the life of the plan, access opportunities would be reduced through an increase in the Backcountry and Recommended Wilderness acres.

Alternative P's recommended road density limits of 1 mile per square mile for Focused Restoration management areas and 2 miles per square mile for General Restoration management areas is likely to

result in changes in a grazing permittee's ability to access their allotments. Over the life of the plan, many watersheds would likely see reductions in the amount of roads present, and this reduction in access may result in grazing permit holders having to spend more time and labor to manage the allotment. While access by highway legal vehicles may be reduced due to the road density limits, depending on closure methods, access by off-highway vehicles may remain in the same locations.

Low maintenance native surface roads serve as routes for easily moving livestock on, off of, and around pastures, and some routes may be lost as roads are decommissioned. Cut and fill slopes and the native surface of low maintenance roads provide forage producing areas, so lower road densities may have an effect on availability of forage for livestock grazing as overstory vegetation increases and limits herbaceous production in the understory of former road locations. Limited access could equate to an increase in time and labor costs for permittees.

A positive effect of lower road density and miles is that cattle and range improvements would generally receive less disturbance and vandalism. Public use of roads in allotments with intensive grazing systems disturbs livestock, increases the risk of gates being left open, and tends to disrupt the proper utilization of forage by moving livestock along roadways.

Recommended Wilderness Areas

Concerning recommended wilderness, the proposed action and alternatives P and O would allow existing uses that are inconsistent with wilderness designation to continue until Congress makes a decision on the Forest Service's recommendation. None of the recommended wilderness areas currently have National Forest System roads, or motorized trails. Alternatives with a high percentage of allotment acres in recommended wilderness would have the highest effect to a permit holder's use of mechanized equipment in these areas. This would result in the permit holder having to spend more time and labor to manage the allotment.

Alternative P identifies the Abercrombie-Hooknose, Bald Snow and Salmo-Priest Adjacent inventoried roadless areas as recommended wilderness. This results in approximately 6 percent of the Colville National Forest being recommended wilderness. Of the total Colville National Forest grazing allotment acres, alternative P would result in approximately 4 percent being in recommended wilderness. The grazing allotments with recommended wilderness would be Quartz, Graves Mountain, Lake Ellen, Z Canyon, Lost Lake, Silver Creek, and Smackout.

Only the Bald Snow recommended wilderness has known existing range infrastructure within its boundaries. This infrastructure consists of two water developments. They are the White Mountain Water Development on the Lake Ellen Allotment and the Cabin Water Development on the Graves Mountain Allotment. Should recommended wilderness become designated wilderness in the future, there could be restrictions that would prevent the use of mechanized equipment at these improvements.

There is currently a portion of one vacant allotment within one area of recommended wilderness. Approximately 5,000 acres of the existing and vacant Graves Mountain allotment is within the Bald Snow recommended wilderness. Should recommended wilderness become designated wilderness and the Graves Mountain allotment still be vacant, the potential for livestock grazing would likely cease on the portion of this vacant allotment that would be within the wilderness area boundary. Grazing of allotments with active permits could continue with the designation of wilderness.

Wildlife

There is nothing specifically in alternative P for wildlife that would affect livestock or allotment management.

Riparian and Aquatic Resource Management

Forest plan direction contained within alternative P to protect riparian areas could constrain grazing and may require the permit holder to spend additional time, labor, and make capital investments to limit potential livestock grazing effects on riparian areas. Some standards and guidelines have the potential to place the permittee at a higher risk of being in non-compliance with the AMP.

Riparian Management Area widths for alternative P would increase compared to direction in the 1988 forest plan and INFISH. Alternatives with wider riparian management area widths are the proposed action and alternatives R, P, and O. These alternatives increase RMA widths, and therefore, protections, for lakes and natural ponds would increase from 150 feet to 300 feet.

Language in standard MA-STD-RMA-09 of alternative P addressing recreational and permitted grazing management, livestock handling facilities and watering facilities in riparian management areas prohibits new and replaced livestock handling facilities and/or management facilities and trailing, salting, and bedding of animals in RMAs unless they do not prevent or retard the attainment of aquatic and riparian desired conditions, inherently must be located in an RMA, or are needed for resource protection. While the language from MA-STD-RMA-09 in alternative P is similar to language in the no action alternative's GM-3 (see comparison in appendix H), the increased distance of the RMAs means that the mentioned actions and activities may be restricted farther from actual water than in the 1988 forest plan. Given the increased RMA widths, the terrain and the types of stream channels experienced on the Forest, it could be difficult to locate new or re-locate existing water troughs outside the RMA and have them function with consistent available water. More constraining plan standards and increased RMA widths may increase time, labor, and capital expenditures by the permittee to manage allotments.

Forest plan guideline MA-GDL-RMA-12 pertaining to annual grazing use indicators is more restrictive than direction contained in AMPs developed under the 1988 forest plan in regard to herbaceous and woody species utilization and residual greenline stubble height for some allotments. It is currently difficult to quantify all of the effects to permitted grazing for the listed indicator values of this guideline because of incomplete forestwide information at the allotment and pasture level. There is flexibility within this guideline which specifies that: (1) the values listed are starting points for management, (2) that only those indicators and numeric values that are appropriate to the site and necessary for maintaining or moving toward desired conditions should be applied, (3) that specific indicators and indicator values should be prescribed and adjusted, if needed, in a manner that reflects existing and natural conditions for the specific geo-climatic, hydrologic and vegetative setting in which they are being applied, (4) that indicators and indicator values should be adapted over time based on long-term monitoring and evaluation of conditions and trends, and (5) that alternative use and disturbance indicators and values, including those in current ESA consultation documents, may be used if they are based on best available science and monitoring data and meet the purpose of this guideline. Some potential effects to permitted grazing from this guideline could include changes to allotment management through increased livestock management, modification of salting locations, fencing, shorter grazing seasons, or reduced livestock numbers. Where allotment management changes are needed to comply with this forest plan guideline, grazing permittees could experience increased time requirements, increased labor requirements, and increased costs. This guideline, which is derived from the Colville ARCS, is more restrictive than direction contained in no action,

alternative B, the proposed action, and alternative O, but is less restrictive than direction for alternative R.

Forest plan guideline MA-GDL-RMA-14, derived from the Colville ARCS pertaining to fish redds, states to avoid livestock trampling of federally listed threatened or endangered fish redds. This is similar to requirements obtained through ESA consultation, and therefore, should not represent a change. Compliance with this guideline could be accomplished through riparian exclosure fencing or temporal separation so that livestock are not grazing near known fish redds during the time that they are active.

Kettle Crest Recreation Area

Alternative P proposes the creation of a recreation area in the Kettle Crest range to account for the special characteristics seen in and unique values recognized for this area. The proposed Kettle Crest Recreation Area is suitable for livestock grazing and no effects are anticipated from its existence.

Alternative B

Old Forest Management and Timber Production

Timber harvest can have a favorable effect on forage production by creating forage areas by removing overstory. The projected PWSQ for alternative B is 37 MMBF, which is less than the average level experienced under the 1988 forest plan. This would result in a decreased amount of timber harvest, and therefore, forage production from transitory rangelands. Alternatives B and O limit gap size to 3 acres. More and larger gaps in vegetation would create more forage areas, so alternative B is not likely to sustain forage levels for livestock and wildlife.

Prescribed fire can also create desirable foraging areas, depending on the vegetation types treated.

Motorized Recreation Trails

The combined total for management areas that would restrict motorized access would total 20 percent of the Forest under alternative B. This means that there would be 12 percent fewer acres under alternative B where motorized access would be allowed, compared to the 1988 forest plan. Limited access could equate to an increase in time and labor costs for permittees.

The analysis assumes that permit holders may not have motorized off-highway vehicle access to parts of their allotment within a backcountry non-motorized management area.

Access

The total effect to motorized trail access comes from looking at the percentage of allotment acres in Backcountry and Recommended Wilderness. The highest percentage of allotment acres in Recommended Wilderness and Backcountry are in alternatives R and B, which would limit motorized trail access and increase time and labor for permittees the most among the alternatives.

Today, there are about 4,000 miles of National Forest System roads, and about 80 percent of the Forest is suitable for road construction. Alternative B would cap the number of road miles at the current level, so that should any new road be proposed, an equal amount of road would have to be decommissioned.

Road densities and total miles of road on the Forest are expected to remain the same in the short term, and likely to decrease in the long term due to budget trends. Motorized vehicle access for permittees would remain the same in the short term and may decline slightly in the long term.

Low maintenance native surface roads serve as routes for easily moving livestock on, off of and around pastures, and some routes may be lost as roads are decommissioned. Cut and fill slopes along with the native surface of low maintenance roads are locations providing foraging areas for livestock, therefore, lower road densities may have a small effect on availability of forage for livestock grazing.

Recommended Wilderness Areas

In the short term, the effects of recommended wilderness to livestock grazing is to limit motorized trail access for the permit holder in alternatives R and B, where a standard allows no motorized uses within recommended wilderness.

Alternatives R and B would recommend the largest amount of recommended wilderness to Congress for potential designation, and these alternatives would have the most substantial effect on range management through limiting access, restricting tools, and increasing the time required to complete management activities. None of the recommended wilderness areas currently have National Forest System roads, but Owl Mountain, Jackknife, Twin Sisters, and South Huckleberry have motorized trails that are used for livestock and allotment management. Since all of these areas become recommended wilderness in alternative B, a permittee's ability to complete allotment and livestock management activities would be constrained. Alternative R would identify mechanized and motorized uses as not suitable in recommended wilderness. This could result in the permit holder having to spend more time and labor to manage the allotment.

Wildlife

There is nothing specifically in alternative B for wildlife that would affect livestock or allotment management.

Riparian and Aquatic Resource Management

Of the action alternatives, riparian management area widths are the smallest in alternative B, which would have the least effect on the permittee's management of the allotment. The 1988 forest plan direction concerning riparian and aquatic resource management would be continued in alternative B. Forest plan direction that protects riparian areas has an effect on grazing operations through the need for the permit holder to spend time, labor, and make capital investments to limit livestock grazing effects to riparian areas. Currently, there are RMAs that are called RHCAs established by the INFISH and Eastside Screens amendments, and management direction from the INFISH amendment that address livestock grazing in RMAs. This direction would continue and permittees' time, labor, and capital investments would continue at the same levels, assuming allotment management is in compliance with the AMP.

Alternative O

Old Forest Management and Timber Production

Timber harvest can have a favorable effect on forage production by creating forage areas through removing overstory. The projected PWSQ for alternative O is 38 MMBF, which is less than the average level experienced under the 1988 forest plan. This would result in a decreased amount of timber harvest, and therefore, forage production from transitory rangelands. Alternatives B and O limit gap size to 3 acres. More and larger gaps in vegetation would create more forage areas, so alternative O is not likely to sustain forage levels for livestock and wildlife very well.

Prescribed fire can also create desirable foraging areas depending on the vegetation types treated.

Motorized Recreation Trails

The combined total for management areas that would restrict motorized access would total 17 percent of the Forest under alternative O. This means that there would be 10 percent fewer acres under alternative O where motorized access would be allowed compared to the 1988 forest plan. Limited access could equate to an increase in time and labor costs for permittees.

The analysis assumes that permit holders may not have motorized the same level of off-highway vehicle access to parts of their allotment within a backcountry non-motorized management area as existing roads and routes grow closed with vegetation or become undrivable.

Access

The total effect to access comes from looking at percentage of Forest acres in Backcountry and Recommended Wilderness combined with proposed road density limits. Compared to no action, access opportunities could be slightly reduced through an increase in the Backcountry acres, but a reduction in access is not likely to be related to road density limits.

Today, there are about 4,000 miles of National Forest System roads, and about 80 percent of the Forest is suitable for road construction. Alternative O would cap the number of road miles at the current level so that should any new road be proposed, an equal amount of road would have to be decommissioned. Limited access could equate to an increase in time and labor costs for permittees.

Road densities and total miles of road on the Forest are expected to remain the same in the short term and likely to decrease in the long term due to budget trends. Motorized vehicle access for permittees would remain the same in the short term and may decline slightly in the long term.

Low-maintenance native surface roads serve as routes for easily moving livestock on, off of, and around pastures, and some routes may be lost as roads are decommissioned. Cut and fill slopes along with the native surface of low maintenance roads are locations providing foraging areas for livestock, therefore, lower road densities may have a small effect on availability of forage for livestock grazing.

Recommended Wilderness Areas

Concerning recommended wilderness, the proposed action and alternatives P and O would allow existing motorized uses to continue until Congress makes a decision on the Forest Service's recommendation. None of the recommended wilderness areas recommended in alternative O currently have National Forest System roads, or motorized trails.

The only recommended wilderness in alternative O is Salmo-Priest Adjacent, which is not contained within a grazing allotment. No permitted grazing exists in this area, and therefore, there would be no effect to permitted grazing.

Wildlife

There is nothing specifically in alternative O for wildlife that would affect livestock or allotment management.

Riparian and Aquatic Resource Management

The guidelines directing management for grazing practices in the Aquatic Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008a) are unlikely to have a substantial effect on allotment management. The ARCS (2008a) standard requiring new livestock handling, management or watering facilities to be located outside of RMAs would continue direction contained in INFISH

standard GM-2, except ARCS (2008a) provides additional flexibility that would allow these facilities in RMAs if they must inherently be located there.

RMA widths vary by alternative. RMA widths for alternative O would increase compared to no action, and that experienced under the 1988 forest plan. This alternative increases RMA widths for lakes and natural ponds from 150 feet to 300 feet, which could potentially further constrain a permittee's ability to fully utilize management options within these areas.

Kettle Crest Recreation Area

Alternative O proposes the creation of a recreation area in the Kettle Crest range to account for the special characteristics seen in and unique values recognized for this area. The proposed Kettle Crest Recreation Area is suitable for livestock grazing and no effects are anticipated from its existence.

Cumulative Effects (Common to all Alternatives)

The cumulative environmental consequences for a programmatic Forest Plan also consider lands managed by other entities in the area, and describe the relative contribution of the forest plan decision when considering surrounding landscape with other similarly scaled planning efforts and opportunities.

The area for this cumulative effects analysis includes adjacent national forests, Bureau of Land Management, State, Tribal, and private land.

Vegetative treatments are expected to occur on these adjacent lands at a similar level and intensity. These types of treatments would increase forage for livestock and improve rangeland condition.

Cattle grazing effects on Forest allotments and other allotments and/or pastures within these watershed areas affect vegetation by reducing plant height, canopy cover, and ground cover. The timeframe for these combined effects is 30 years, 15 years in the past, and 15 years in the future because changes in condition and trend in the vegetation depend on the presence of favorable growing conditions after cattle leave the pasture. If growing conditions were favorable, plant height and canopy cover would completely recover within 1 year. If growing conditions were not favorable, plant recovery would occur more slowly (up to 2 to 3 years). Vegetation recovery from the other activities and natural events may take this long, depending on climate.

The cumulative effect of adjacent Federal lands management would not change any of the direct and indirect effects. Grazing, where allowed on adjacent Federal lands, is intensively managed to accommodate other public land uses and to protect resource values. The effects to permit holders on other Federal lands are much the same as Forest Service permit holders on the Colville National Forest. There have been no significant changes in the management plans for adjacent Federal lands relative to grazing that would be considered a cumulative effect.

Livestock production costs would likely increase due to increased input costs and the availability of grazing lands would likely decrease due to residential and agricultural development of private lands.

An effect associated with mechanical treatments and livestock grazing is the potential to spread invasive species from adjacent lands. New weed populations could occur from vehicle-transported seeds, disturbed soils and increased light availability following mechanical treatments, or creation of seedbeds by livestock use. Livestock and wildlife can spread weed seeds, but livestock and wildlife use results in fewer new weed populations than those established along roads and trails by seeds spread from vehicle tires, equipment tracks, and/or attached soil (Tyser and Worley 1992, Tyser and

Key 1988, Gelbard and Harrison 2003). This circumstance is attributed to the higher amount of biotic and below-ground biotic resistance experienced in areas other than roads and trails (Gelbard and Harrison 2003). All alternatives would contribute similarly to the control, treatment, and eradication of invasive plant species introduced from outside the forests.

Fires from adjacent lands can escape and spread onto the Colville National Forest. If they do, it could lead to temporary grazing exclusions and impact ranching operations by requiring the permittee to find new forage or sell all or part of the livestock.

Minerals and Geologic Resources

This section summarizes effects related to minerals and geologic resources from the specialist report, with special emphasis on the publicly identified issues of motorized recreation trails access, and recommended wilderness (Graham and Nooney 2017).

The indicators shown in table 233 are used to evaluate effects on mineral resources of each alternative. They are appropriate because they address risks to mineral resources from motorized recreation trails, road access, and recommended wilderness. Geologic resources are protected as described in the assumptions and were not a part of the significant issues, so are not addressed in the effects analysis. The other significant issues are also addressed; however, they have little impact to mineral resources, so effects indicators are not identified (Nooney 2017).

Table 233. Evaluation criteria and key indicators for mineral resources

Issue	Evaluation Criteria	Key Indicator
Motorized Recreation Trails	Evaluate the access for possible mineral operations	Percent of total forest acreage allocated to Backcountry Non-motorized management area by alternative
Road Access	Evaluate the access for possible mineral operations	Desired road density or cap on road miles for each alternative
Recommended Wilderness	Evaluate the access for possible mineral operations	Percent of total forest acreage in recommended wilderness management areas Qualitative description of low, moderate, and high mineral potential that intersects with recommended wilderness

Affected Environment

United States mining laws classify mineral commodities into three distinct groups: locatable, leasable, and salable. Forest Service control or discretion over the disposal of various mineral commodities ranges from a minimum with locatable minerals to a maximum with salable minerals.

Locatable minerals include most metals and many non-metals (e.g., barite, fluorite, and gypsum). Most Federal lands not withdrawn from mineral entry are available for the exploration and development of locatable minerals by any U.S. citizen under provisions of the Mining Law of 1872, as amended. Mineral operators are entitled to reasonable access to these lands including, where reasonable and necessary, roaded entry. Forest Service control of such activities is limited to minimizing surface impacts and is accomplished via an environmental analysis of individual proposals (36 CFR 228 Subpart A).

Leasable minerals are specific mineral resources identified by the Mineral Leasing Act of 1920, as amended, the Mineral Leasing Act for Acquired Lands of August 7, 1947, the Geothermal Steam Act

of December 24, 1970, as amended, and the Federal Coal Leasing Amendments Act of August 4, 1976. Leasable minerals include oil and gas, coal, oil shale, and geothermal resources, as well as sodium, potassium, phosphate, and a few others. On lands with acquired status, these minerals, as well as those that are normally locatable, are leased under the Leasing Act for Acquired Lands, August 7, 1947. Forest Service regulations for oil and gas resources are found at 36 CFR 228 Subpart E.

Salable minerals, also known as common variety minerals or mineral materials, include sand, gravel, stone, and some other widely available mineral materials, as described in the Materials Act of July 31, 1947. Forest Service regulations for these minerals are found at 36 CFR 228 Subpart C.

It is Forest Service policy for minerals resource management to foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs.

The Colville National Forest has a geological environment favorable to the occurrence of mineral deposits. Minerals occurring in most National Forest System lands administered by the Colville National Forest are federally owned; however, there are many outstanding or reserved mineral rights. Private parties acting on their rights to outstanding mineral interests can potentially limit or impair the Forest Service from managing the surface of the land for the purposes for which they were acquired. Three percent of the total forest is withdrawn from mineral entry because it is wilderness. Other areas of the Forest such as administrative sites, research natural areas, seed orchards, and recreation areas are also withdrawn from mineral entry.

Significant locatable mining operations occur on private and other Federal lands adjoining the Forest. These mining operations supply important minerals for industry. In addition, these mining operations provide economic benefits to rural communities and counties through direct employment, purchase of goods and services, and create increased tax bases. The mining industry has been a major contributor to the tri-county economy, and would continue to do so in the future.

Locatable Minerals

Locatable minerals are those valuable deposits subject to exploration and development under the Mining Law of 1872 and its amendments. Commonly, these minerals are referred to as hardrock minerals. The Forest Service and BLM (Bureau of Land Management) cooperate in managing this resource; the Forest Service manages the surface resources that may be impacted by mining activities, and the BLM manages the minerals. Potential for lead and zinc, limestone, and silica predominates in the Metaline and Northport mining districts. In 2014, Teck American Inc. resumed operations developing zinc deposits at the Pend Oreille Mine north of Metaline Falls, Washington. The mine operation has a 5-year operating life, with the potential to extend operations (Kramer 2014). Copper, silver, dolomite, and silica are more common in the Chewelah, Loon Lake, and Newport areas. Limestone, dolomite, and silica may be subject to disposal as locatable or salable minerals depending on the nature, chemical composition, and use of the material. Precious metals are most important in mining districts near Republic and Orient, especially gold. Gold exploration and mining in the Republic area increased in the 1990s to 2000s. The western Okanogan Highlands region has produced more than 3 million ounces of gold and almost 15 million ounces of silver from predominately the Republic Mining District (USDI Bureau of Land Management 2011). Because mining operations at the Buckhorn Mine on the Okanogan National Forest are shutting down, at this time Kinross Gold is ramping down their milling operations outside of Republic, Washington. Uranium potential is greatest in the Kettle Range and in the Selkirk Mountains east of Colville and

Chewelah. Small-scale minerals activities (panning, sluicing, dredging, and rock/mineral collecting) are usually for non-commercial purposes.

The Forest has approximately 750 mining claims covering 14,980 acres. The vast majority of those claims are lode claims with only a few placer claims. In general, mineral activity on the Forest is relatively minor in scope, given the size and scale of the national forest. Current locatable mineral activities on the Forest primarily include prospecting, exploration, claim staking, and limited mining for select commodities. This level of activity is expected to continue. Locatable mineral activities have included both metallic and nonmetallic minerals. The development of important energy minerals is unlikely, with the potential exception of uranium.

There would be continued interest in commercial and small-scale minerals activities, especially if the prices of gold, silver, and other precious metals or base metals increase. Projecting long-term demand for any specific mineral commodity is difficult because domestic demand is influenced by many factors, such as economic and geopolitical trends, some of which are national and international in scale.

Leasable Minerals

Leasable minerals include oil and gas, coal, oil shale, and geothermal resources, as well as sodium, potassium, phosphate, and a few others. On lands with acquired status, these minerals, as well as those that are normally locatable, are leased under the Leasing Act for Acquired Lands, August 7, 1947. These minerals are subject to exploration and development under leases, permits, or licenses granted by the Secretary of Interior with Forest Service consent. Currently, there are no active mineral leases or pending lease applications on the Forest. The greatest potential for leasable mineral development on the Forest is on the Sullivan Lake and Newport Ranger Districts, which are where the majority of NFS lands with Acquired land status occur. Only one portion of the Forest, running north and south of the town of Republic along the Sanpoil, Curlew, and Kettle River valleys is identified as having a moderate potential for oil and gas (USDI Bureau of Land Management 2011). There is no or very low potential on the Forest for the occurrence of geothermal and coal resources (USDI Bureau of Land Management 2011).

Demand for most leasable minerals, like locatable minerals, is influenced by economic and geopolitical factors. While the United States has increased domestic production, most of the leasable development has been in other parts of the country, where there is greater mineral potential and permitting, development and production costs are lower or there is less risk on investment return. This is likely to continue. As there is no or very low potential for geothermal and coal resources on the Forest, demand would be filled elsewhere.

Salable Minerals

Salable mineral materials, or common variety minerals, are generally deposits of sand, clay, gravel, and stone that are used for road surfacing and building materials. Disposal of these materials is by mineral material contract, and is discretionary by the Forest Service. Historically, salable minerals production and use has primarily been used for public works projects and for Forest Service roads maintenance and construction. Free-use mineral material disposals are available to the general public on an annual basis. Salable mineral materials, particularly sand, gravel and stone, are widely available throughout the Forest. Demand for salable minerals is expected to grow with increased land development. Private parties may purchase salable minerals from the Forest, but those disposals are infrequent based on the availability of those materials from private sources, and the discretion of the Forest Service.

Geologic Resources

Paleontological Resources

Paleontological or fossil resources on the Forest are managed in accordance with the Paleontological Resources Preservation Act of 2009, and implementing regulations found at 36 CFR 291. Bedrock or sediments ranging in age from late Precambrian age to Pleistocene have the potential to contain paleontological resources, and surface-disturbing activities in these areas may negatively impact paleontological resources. The areas of the Forest containing Precambrian and Pleistocene deposits were mapped during a Pacific Northwest Region – Forest Service effort several years ago.

Groundwater

Groundwater is the Nation's principal reserve of fresh water. Groundwater on NFS lands is a major contributor to flow in many streams and rivers, provides clean drinking water to local communities, and supports groundwater-dependent ecosystems. The Forest recognizes the importance of managing groundwater resources in a wise and sustainable manner in accordance with the Forest Service national groundwater policy outlined in Forest Service Manual 2880. See the hydrology section in chapter 3 of the FEIS for additional information on the Forest's management of groundwater.

Geologic Hazards

Geologic hazards include events such as flooding, mass wasting, seismicity, ground subsidence, reactive soils, volcanic eruptions, toxicity associated with mineralization, acid mine drainage, and naturally occurring hazardous minerals and gases (e.g., asbestos, uranium, radon). Geologic hazards on NFS lands are managed to ensure protection of public safety, health, property, and the environment. Qualified Forest Service geologists are consulted for the recognition, inventory, analysis, and interpretation of geologic hazards, and that information is integrated into Forest and project planning, design, construction, maintenance, and monitoring activities, reviews of proposals, permits, approvals, concurrences, and recommendations for uses of NFS lands.

Caves and Cave Ecosystems

Caves and cave ecosystems are protected and maintained in accordance with Federal law. Caves of importance can be nominated for Significant Cave eligibility in accordance with the Federal Cave Resource Protection Act of 1988 and 36 CFR 290 due to things like unique geologic/hydrologic conditions or important sensitive biota that inhabits the cave. There is one known cave on the Colville National Forest (Pocahontas Cave), and a few suspected but unverified caves. No caves on the Colville National Forest have been nominated for Significant Cave status.

Environmental Consequences—Minerals

The major influence of resource management direction on minerals is their effect on access. This varies from limited access in wilderness and backcountry areas, to high accessibility in general forest areas. Generally, prospecting and early exploration activities have little effect on other resources because of greater flexibility of access and equipment use at that stage. Actual mineral extraction may have minimal to great interaction with other resources, depending upon the location, the mineral being removed, and the process and type of equipment used. For example, a small underground mine, shipping ore directly to an existing offsite mill or smelter without processing and located in a general forest area, would have few effects. On the other hand, a large open pit mine and milling operation, located in wildlife habitat could potentially have a much greater effect on other resources.

Assumptions

- Regardless of the alternative, mineral operations have to comply with Federal and State laws and regulations. These include but are not limited to laws such as the Clean Water Act, National Environmental Policy Act, or Endangered Species Act.
- Locatable minerals can be developed per the direction in the Mining Law of 1872, Forest Service regulations at 36 CFR 228A, and other pertinent laws and regulation on all areas of the Colville National Forest not withdrawn from locatable mineral entry.
- Salable minerals can be disposed under Forest Service regulations at 36 CFR 228 Subpart C.
- Leasable minerals are managed in accordance with Forest Service policy found at Forest Service Manual 2820.
- Geologic resources would be managed in accordance with the Paleontological Resources Protection Act of 2009 and Forest Service implementing regulations found at 36 CFR 291. Groundwater is managed in accordance with the Forest Service national groundwater policy outlined in Forest Service Manual 2880. Caves and cave ecosystems are protected and maintained in accordance with Federal law (Federal Cave Resource Protection Act of 1988 and 36 CFR 290.) The Forest's geologic resources are inventoried, evaluated, and managed on both a landscape level and as part of projects to protect geologic resources regardless of the alternatives.

Methods of Analysis

Risks to mineral resource operations are identified. The level of risk is assessed by alternative using percent of the Forest allocated to a management area that is associated with the risk, either increasing or decreasing effects.

Spatial and Temporal Context for Effects Analysis

The spatial affected environment for direct and indirect effects is the lands administered by the Colville National Forest. Effects are analyzed over the life of the forest plan, which is expected to be 15 to 20 years.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The affected environment for cumulative effects includes the Confederated Tribes of the Colville Reservation lands, Kalispel Tribe Reservation lands, National Forest System lands administered by the Idaho Panhandle National Forests; other Federal and State lands; and lands of other ownership adjacent to the Colville National Forest boundaries.

No Action Alternative

Access is the main factor affecting minerals operations. The 1988 forest plan limits minerals operations in old forest management areas and riparian habitat conservation areas. It also excludes salable mineral operations from non-motorized management areas, research natural areas (RNA), ski areas, the recreation/wildlife management area 3B, and old growth management areas (MA-1). In addition, the 1988 forest plan recommends mineral withdrawal for RNAs. The Salmo-Priest wilderness area is withdrawn from mineral entry, which accounts for 3 percent of the total Forest area. Wildlife, riparian, and old forest management requirements may add time and costs to mineral operations.

Effects on Minerals from Old Forest Management

The 1988 forest plan includes management areas that emphasize managing for old forest habitats. Salable mineral activities are not allowed in these areas. Mineral resource exploration and development would include reasonable requirements to protect old forest wildlife habitat. Old forest management emphasis can increase the time and costs of mineral operations, by imposing limits on mineral operation to protect and maintain old forests. The effect of these management restrictions on mineral activities is minimal as they apply to 3 percent of the total Forest area.

Effects on Minerals from Motorized Recreation

The major influence of other resource management direction on minerals is their effect on access. About 12 percent of the Forest is in a backcountry non-motorized type of management area. Due to budget trends, the motorized trail system is likely to see small additions in the future, so current access would continue, but not meaningfully increase. For salable minerals, a non-motorized designation essentially eliminates the opportunity to exploit mineral materials as the 1988 forest plan excludes these areas from salable minerals disposal. For locatable and leasable minerals, motorized access on existing, open forest system roads/trails, road/trail reconstruction, or new road/trail construction can still be permitted in designated non-motorized areas through the applicable regulatory processes.

Effects on Minerals from Road Density

The major influence of other resource management direction on minerals is their effect on access. Current road density direction would continue. Today, there are about 4,000 miles of NFS roads, and about 80 percent of the Forest is suitable for road construction. The 1988 forest plan includes standards and guidelines that limit road densities to between 0.4 to 2 miles per square mile in deer and elk winter range; grizzly bear habitat areas; and lynx habitat. Outside of these habitats, the forest plan doesn’t set an upper limit on road density. Today the average NFS road densities in 12th field watersheds range from a low of 0.33 to a high of 4.45 miles per square mile on NFS lands. Due to budget trends, the total miles of NFS roads are expected to remain the same or decrease slightly over the next 10 years.

Access for salable mineral materials would continue at current levels or be slightly less. For locatable and leasable minerals, road decommissioning to achieve road density standards may limit motorized access on existing, open forest system roads during initial prospecting and exploration activities in places. However, alternative means of access are possible and road reconstruction or new construction can always be proposed and approved in accordance with applicable regulations. Proposed road reconstruction or new road construction in management areas with road densities at or above standards would require amendments to the forest plan which can increase permitting timelines and costs.

Effects on Minerals from Recommended Wilderness

Under the 1988 forest plan, there is no recommended wilderness on the Forest. Approximately 3 percent of the Forest is allocated to wilderness and withdrawn from mineral entry. Research natural areas, also to be withdrawn, account for less than 1 percent of the total Forest area. The 1988 forest plan has a minerals standard that directs the Forest to minimize the acres withdrawn for mineral entry to that necessary for protecting dedicated areas such as developed recreation sites, wilderness, research natural areas, and administrative sites (USDA Forest Service 1988).

Effects on Minerals from Wildlife

Wildlife direction can result in timing restrictions and avoidance of specific sites for wildlife protection, for minerals activities. Measures can vary by the type of mineral operation and location. The effect can be to increase time to permit and approve plans of operation and cost of mineral operations, but would not be known until projects are developed. Protection of wildlife and compliance with the ESA is required of all mineral operations. This would continue.

Effects on Minerals from Riparian and Aquatic Resource Management

Direction limiting location of facilities or types of operations can increase time to permit, approve plan of operations, and cost of mineral operations. The extent of effects can vary by the type of mineral operation and location, which is unknowable until site-specific projects are developed. Protection of water quality and compliance with the Clean Water Act is required of mineral operations. The 1988 forest plan does address mineral operations in relation to riparian and aquatic resources. Minerals operations in RHCAs direct operators to take all practicable measures to maintain, protect, and rehabilitate fish and wildlife habitat that may be affected by the operations. Surface occupancy for leasable minerals and salable mineral operations is limited to those operations that meet riparian objectives and alternative locations are not available. This would continue.

Effects Common to All Action Alternatives

Old Forest Management and Timber Production

The effects of vegetation management on minerals are the same for all alternatives. It is not expected that any of the vegetation direction would adversely or positively affect minerals to a large degree. There are a few owners of mining claims that have pre-1955 rights to timber resources on their claims. Vegetation management on these claims would require discussions with claim owners, and potentially include replacement of an equal volume of timber removed from those claims.

Wildlife

Wildlife direction in all alternatives could result in timing restrictions for minerals activities and avoidance of specific sites for wildlife protection. Wildlife habitat protection measures can vary by the type of mineral operation, location, and season. The effect can be to increase the time involved to authorize the mining operation, and the cost of mineral operations, but would not be known until projects are developed. Protection of wildlife and compliance with the ESA are required of mineral operations under any alternative.

Riparian and Aquatic Resource Management

Plan direction limiting location of facilities or types of operations can increase the time to authorize mining operations and/or approve a plan of operation, and the cost of mineral operations. Effects can vary by the type of mineral operation, its location, and season of operation. The extent and duration of effects is unknown until site-specific projects are developed. All of the action alternatives have plan direction for RMAs (RHCAs in no action and alternative B) that address mineral operations. For the proposed action and alternatives R and O, plan direction primarily includes guidelines minimizing adverse effects of mining on aquatic and other riparian dependent resources. No action and alternative B include standards and guidelines (from INFISH) that provide similar direction for minerals management as the proposed action and alternatives R and O. The guidelines encourage siting locations of structures, facilities, mining support roads, and mine waste defined as hazardous material (as defined by the Comprehensive Environmental Response, Compensation, and Liability

Act of 1980) outside of RMAs to the extent possible. Where they remain inside RMAs, the objective is to minimize damage and risk to aquatic and riparian resources.

Rather than guidelines, alternative P incorporates management standards for mining activities in RMAs that are consistent with the 2016-version of the Forest Service Region 6 Aquatic and Riparian Conservation Strategy. Alternative P includes additional standards regarding leasable oil, gas, and geothermal exploration; salable minerals; inspections of mineral plans, leases, and permits; and suction dredge and placer mining. These standards don't exclude mining operations in RMAs. The intent of implementing these standards is to protect aquatic resources in RMAs and meet desired conditions to the extent possible during and after mining operations. The Forest will continue to work with mining operators to locate operations, facilities, roads outside of RMAs, wherever possible. When operations, facilities, roads remain inside RMAs, the Forest would work with operators to minimize their effect on aquatic and riparian resources. Unlike other alternatives that would allow mine waste that meets the Comprehensive Environmental Response, Compensation, and Liability Act definition to be located in an RMA, under alternative P, mine waste that meets the Comprehensive Environmental Response, Compensation, and Liability Act definition could not be located inside RMA, with the exception of temporary staging of waste during abandoned mine cleanup.

Implementation of RMA plan direction would have a minimal effect on most mineral operations, since few approved mining operations occur in RMAs on the Forest. The greatest effect could be to recreational miners operating under a state Gold and Fish Pamphlet. Holders of a state Gold and Fish Pamphlet should contact the Forest prior to operating on NFS lands to determine whether their recreational mining may have an effect on NFS resources, and whether a Plan of Operations would be required. Since protection of water quality and compliance with the Clean Water Act is required of mineral operations in all alternatives, the difference in effects from riparian and aquatic resource management across alternatives is minimal.

Access

Access by motorized recreation trails and roads are a factor for mineral exploration and development.

For salable minerals, a non-motorized designation essentially eliminates the opportunity to exploit mineral materials. Areas allocated to Backcountry (BC) management areas vary across the alternatives as shown in table 234. Alternative O allocates the highest amount of land to a BC allocation. However, when considered along with the amount of land allocated to recommended wilderness, alternatives B and R put the largest total amount of the Forest into allocations (BC and recommended wilderness) that do not allow roads or motorized trails. Alternatives B and R would have the highest effect on access for salable minerals.

For locatable and leasable minerals, an increase in non-motorized management area acreage can limit motorized access on existing, open NFS roads and trails for initial prospecting and exploration activities that may not otherwise require Forest Service regulatory approvals. Motorized access on existing roads and trails or proposed road/trail reconstruction/construction could still be approved in non-motorized areas for all locatable operations on Public Domain lands open to mineral entry, and for leasable operations, so long as the management area does not have a No Surface Occupancy or Controlled Surface Use suitability determination.

Table 234. Backcountry Non-motorized Management Area – percentage of total forest acres

Proposed Action	Alt. O	Alt. B	Alt. R	Alt. P
8	16	Less than 1%	2	12

Effects on Minerals from Road Density

The major influence of other resource management direction on minerals is their effect on access. For salable minerals, a lower road density can adversely affects opportunity to exploit mineral materials due to less open roads on the landscape. Alternatives R and P have the lowest road density desired conditions and would limit access the most.

For locatable and leasable minerals, lower road densities or road decommissioning to achieve lower road density standards can decrease existing motorized access on open NFS roads during initial prospecting and exploration activities that may not otherwise require Forest Service regulatory approvals. However, alternative means of reasonable access are possible and use of existing but closed roads and road reconstruction/construction can be proposed and approved for mineral operations in accordance with applicable regulations. Proposed road reconstruction or new road construction in management areas with road densities at or above standards would require amendments to the forest plan, which can increase permitting timelines and costs for mineral operations.

Table 235. Upper limit of desired road density or road miles

Proposed Action	Alt. O	Alt. B	Alt. R	Alt. P
2-3 miles per square mile. Applicable in Focused Restoration (Active Restoration B) and General Restoration (Active Restoration C)	Cap USFS road miles at current level. Applicable forest wide.	Cap USFS road miles at current level. Applicable forest-wide.	1-2 miles per square mile. Applicable in Focused and General Restoration	1-2 miles per square mile. Applicable in Focused and General Restoration

Recommended Wilderness

Currently, 3 percent of the Forest is in designated wilderness. Table 236 shows the recommended wilderness per alternative as a percentage of total forest acres. All of the action alternatives have recommended wilderness, although alternatives B and R allocate the highest amount of the Forest to recommended wilderness. Alternative P recommends wilderness areas in Pend Oreille County with the Salmo-Priest Adjacent, and Abercrombie-Hooknose recommended wilderness, and the Bald-Snow area in Ferry County. There are mining claims located in and/or adjacent to the recommended wilderness areas in Pend Oreille County. No mining operations, approved under a Notice of Intent or Plan of Operations, are occurring on those claims inside recommended wilderness areas at this time.

Table 236. Recommended wilderness – percentage of total forest acres

Proposed Action	Alt. O	Alt. B	Alt. R	Alt. P
9	1	20	19	6

Effects on minerals from Recommended Wilderness

Until Congress designates the recommended wilderness areas as wilderness, they remain open to mineral entry under the U.S. Mining Laws. Persons prospecting, locating, and developing mineral resources in NFS lands under the Mining Law of 1872, as amended, have a right of access for those purposes. Requests for access to mining claims located in recommended wilderness would be processed according to existing authorities, regulations, and policy. The claimant's access (road or trail, motorized or non-motorized) would be specified in a Plan of Operations submitted to the responsible official (generally a district ranger). The Forest Service is not obligated to approve motorized access if the proposed means or modes of transport are not reasonably necessary for the work to be performed for prospecting, location, or mineral development. Access is not authorized until the responsible official signs the Operating Plan. Temporary roads could be authorized in recommended wilderness areas under an approved Plan of Operations only if that mode of access is determined reasonably necessary.

Wilderness recommendation alone removes lands from consideration for leasing and salable mineral materials use.

Mineral Withdrawal: On the Forest, there are a number areas and places that are withdrawn from mineral entry including administrative sites and seed orchards; recreation areas, Federal Power Act (hydropower), one research natural area, and the Salmo Priest Wilderness. These withdrawals were made to protect capital investments and special or sensitive resources. See the discussion in the Lands section in this chapter. If the recommended wilderness areas become congressionally designated wilderness, those areas would be withdrawn and closed to mineral entry under the U.S. Mining Laws, subject to valid existing rights. Any known or currently undiscovered mineral deposits in congressionally designated wilderness areas would be foregone and not available for exploitation to support domestic or global demand unless another act of Congress makes them available. Mining claims with valid existing rights in designated wilderness could continue to operate in a logical, sequential development scenario, including mining. Costs associated with mining would likely increase inside a designated wilderness area.

After formal wilderness designation, the Forest Service would coordinate valid existing rights determinations with the BLM before approving most proposed locatable activities in wilderness. Holders of mining claims and sites located within the wilderness must prove their right to continue to occupy and use the land for mining purposes. The owner must demonstrate they contain a discovery of a valuable mineral deposit and/or are used and occupied properly under the General Mining Law, as of the date of withdrawal and as of the date of the mineral examination. Mining claims or sites whose discovery or use or occupation cannot be demonstrated on the date of withdrawal or the date of mineral examination have no valid existing rights and would be contested by the Forest Service. Alternatives B and R allocate the highest amount of the Forest to recommended wilderness which, if selected and later designated by Congress, would withdraw the most land from mineral entry.

Research natural areas and the wild segment of wild and scenic rivers are to be withdrawn from mineral entry also. The proposed action and alternative P include a recommendation for a segment of a wild river, so the effects of additional mineral withdrawals come from possible wilderness and wild river designations by Congress. See appendix J for a map and table showing areas on the Forest withdrawn from locatable mineral entry.

Environmental Consequences – Geologic Resources

Effects Common to All Alternatives

The geologic resources and hazards are inventoried, evaluated, and managed on both a landscape level and as part of project-specific design and analysis. Project design includes avoidance, mitigation, or monitoring procedures necessary to protect geologic resources or address geologic hazards.

It is not expected that any of the alternatives would adversely or positively affect geologic resources to any degree. Management of these resources would continue in accordance with applicable law, policy, and direction.

The adoption of any action alternative would not change the management of geologic resources and hazards. The geologic resources and hazards would continue to be inventoried, evaluated, and managed on both a landscape level and as part of project-specific design and analysis. Project design includes avoidance, mitigation, or monitoring procedures necessary to protect geologic resources, address geologic hazards, and provide for public safety.

Cumulative Effects

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The area for considering cumulative effects includes the lands within the Colville National Forest administrative boundary. In consideration of all past, present, and foreseeable actions, no cumulative effects to minerals or geologic resources are anticipated.

Mineral development on privately owned lands is discretionary by the landowners. Lands managed by Washington state agencies and the BLM have minerals generally available by lease or location. National parks are withdrawn from mineral entry, so have no mineral activities. Adjacent national forests follow the same regulations and policy as the Colville National Forest for minerals activities. Leasable, locatable, and salable activities would continue on adjacent Federal and State lands. The level of mineral activities would depend on market prices and mineral potential, same as the national forest. Leasable mineral exploration for oil and gas on lands outside the Forest and within the Columbia Basin was active in the early 2000s, and has since tapered off. There are no current geothermal leases on adjacent national forests, Confederated Tribes of the Colville reservation lands, or BLM high potential lands. Locatable mineral claims are filed in Ferry, Pend Oreille, and Stevens Counties. There has been some increase in activity over the last 5 years with the reopening of the Pend Oreille Mine in Pend Oreille County, although the Kinross Gold mill outside of Republic is ramping down due to exhaustion of ore from the Buckhorn Mine located on the Okanogan National Forest.

Adjacent State and Federal lands have not recently made or intend to make major changes in management of motorized recreation, road density, and recommended wilderness. There are no past, present, or reasonably foreseeable actions that would add to the direct and indirect effects described.

Recreation

The 1982 planning rule, Sec. 219.21 Recreation Resource, requires that a broad spectrum of forest- and rangeland-related outdoor recreation opportunities are provided for in each alternative developed during the forest plan revision process. It further states that the planning process identify: (1) the physical and biological characteristics that make land suitable for recreation opportunities, (2) the recreation preferences of user groups and the settings needed to provide quality recreation opportunities, and (3) recreation opportunities on NFS lands.

Recreation opportunities on the Forest are identified and managed through the Recreation Opportunity System (ROS). A recreation opportunity is defined as "the availability of a real choice for a user to participate in a preferred activity in a preferred setting, in order to realize desired experiences" (USDA Forest Service 1982b). The ROS is a method used to categorize, evaluate, and monitor settings and opportunities based on the natural, managerial, and social environments. Six ROS classes currently apply to NFS lands: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban (USDA Forest Service 1982b). In addition, the Colville National Forest used a sub-class of Roaded Natural, called Roaded Modified, during the development of its 1988 forest plan. ROS current condition inventory information is not available for the Colville National Forest. Instead, the 1988 forest plan ROS Classifications would be used as the baseline for comparing impacts to ROS settings by alternative throughout this section. In addition, the ROS classifications under the 1988 forest plan apply year-round. Under the revised forest plan, the updated ROS classifications would continue to apply year-round. The Colville National Forest would not have a separate ROS Classification map for winter use under the revised forest plan.

In addition to the requirement to identify lands suitable for recreation use, three issues were identified through public comments where the recreation preferences of user groups varied: recommended wilderness, motorized recreation trails, and road access. Indicators related to these issues are described in table 237.

Table 237. Evaluation criteria and key indicators for recreation resources

Issue	Evaluation Criteria	Key Indicator(s)
Identification of Lands Suitable for Recreation Use	Evaluate the distribution of areas open to motorized and non-motorized recreation opportunities and the corresponding recreation management setting	Recreation – acres of allocations for motorized/non-motorized use ROS – acres in each of the ROS Classes
Motorized Recreation Trails	The distribution of motorized and non-motorized recreation trails and areas to assess contribution to motorized / non-motorized recreation opportunities. The contribution of motorized recreation on the national forest to the local county economy.	Recreation – location, trail miles and acres of allocation for motorized and non-motorized use Evaluation of access to motorized and non-motorized trails
Access	Evaluate the effects of road density limits on roaded access for recreation use, wildfire suppression, and vegetation management activities, specifically commercial timber harvest	Location and amount of allocations suitable for roads Social impact related to recreation opportunities
Recommended Wilderness	Whether recommended wilderness areas contribute to the need for wilderness. The availability tradeoffs, especially summer and winter motorized uses. The market and non-market costs and benefits associated with wilderness.	Location and amount of recommended wilderness Miles of trail available for mechanized or motorized use

Introduction

The Colville National Forest offers a variety of recreation opportunities that are consistent with the rolling to steep mountainous terrain typical of the Okanogan Highlands landform province and the Selkirk Mountains. Winter or summer, the Forest offers easy road and trail access to a full suite of motorized and non-motorized recreational pursuits—from resort-based downhill and cross-country skiing to snowmobiling and backcountry skiing; from developed campgrounds to quaint dispersed campsites tucked along one of the Forest's many creeks; from a variety of OHV trail systems to remarkable backcountry and wilderness settings rich with stock, mountain bike, and hiking trails that highlight many of the tallest peaks in northeastern Washington. As a Forest with a limited amount of designated wilderness, but rich in undeveloped backcountry, the Colville experiences pressure from non-motorized and motorized recreation interest groups whose use of those backcountry areas overlaps. As a result, the distribution of motorized and non-motorized recreation opportunities on the Forest is of great interest to many of the visitors to the Colville National Forest, 89 percent of which travel 100 miles or less to visit the Forest (NVUM USDA Forest Service 2012e). Backcountry and motorized recreation opportunities, as well as the many other recreation opportunities provided for on the Colville National Forest, contribute significantly to the local, county, and State economies and are a key component of the lifestyle and family customs of many northeastern Washington residents.

Affected Environment

In 2005, the Colville National Forest completed a Recreation Site Facility Master Plan (RSFMP) process to identify the Forest's recreation niche and identify actions that would move the Forest toward providing a quality, sustainable developed recreation site program. The RSFMP served as a framework from which the Forest prioritized investments and pursued changes in the operation and maintenance of developed recreation sites. Under the RSFMP, the Colville National Forests Recreation Niche was: *Rustic Recreation – A Dispersed Recreation Playground for Our Communities supported by rustic facilities scattered throughout the forest and connected by a network of scenic routes.* (USDA Forest Service 2006a)

By 2012, the Forest identified that the RSFMP Niche was becoming dated in its focus on developed recreation site infrastructure and that stakeholders through collaborative meetings associated with Proof of Concept (a unique budget model the Forest piloted from 2008 to 2012) and NEWSTART (a local recreation collaborative started in 2009 that focuses on sustainable recreation strategies) were asking the Forest to provide more through its recreation program than the RSFMP Niche could support.

In response, the Colville National Forest developed a sustainable recreation strategy to help guide its efforts and investments. The strategy addresses increasing recreation demands through integrating the recreation program with other resource areas to balance social, ecological and financial needs. The overarching goal is to focus on mission-driven priorities, connect recreation benefits to communities, provide for changing urban populations, and most importantly, provide balanced quality recreation opportunities while maintaining a functioning environment. The vision statement for the Forest's sustainable recreation strategy is: *The Colville National Forest is known for its pathways to discovery through a series of linked byways and trails which lead to high quality recreation opportunities, destinations and beyond.*

Goals were developed to describe the specific focus areas that would be implemented under the sustainable recreation strategy. These goals include:

- Focused high quality: We strive to maintain and strategically enhance recreation opportunities and settings that are associated with key pathways instead of attempting to provide every opportunity everywhere.
- Youth and conservation through recreation: Conservation education emphasizing youth is focused on fun, creativity, and a sense of wonder and excitement through discovery.
- Innovative options: Recreation program capacity is enhanced by our culture of innovation and non-traditional approaches. (USDA Forest Service 2012a)

The Forest's sustainable recreation strategy brings forward the RSFMPs idea of connecting to recreation through a network of scenic routes and takes it a step further to include all recreation opportunities. Since the sustainable recreation strategy is designed to balance social, ecological and financial needs and conditions, as any of these change (such as available funding) the strategy would evolve.

Analysis Area

The analysis area includes all lands administered by the Colville National Forest.

Survey, Trend, and Use Information[1]

Demand for access to the Colville National Forest for recreation purposes has increased steadily over the past 26 years since the last forest plan was developed. During that same time, the growth in recreation in the Nation has been extraordinary. For example, participation in camping increased from about 47 million people in 1982 to 1983 to almost 89 million people in 2005 to 2009 (Cordell et al. 2009). Between 2000 and 2007, the total number of recreation activity days increased approximately 25 percent (Cordell et al. 2008). The activities of viewing and photographing birds, day hiking, backpacking, off-highway motor vehicle (OHV) driving, walking outdoors, and canoeing/kayaking have seen the greatest growth in the last two decades (Cordell et al. 2009).

Trend analysis in the 2013 Washington State Comprehensive Outdoor Recreation Plan (SCORP) indicates similar findings to the studies by Cordell and points to a dramatic increase in participation in many nature-based activities. The 2013 SCORP report indicates the most intensive users of public facilities and lands participate in hiking, beachcombing, picnicking/barbecuing/cooking out, wildlife viewing, and swimming in pools or natural waters. The report goes on to state that a third of Washington state residents participate in the following activities at a level lower than they would like: hiking, camping, fishing, walking, bicycling, off-road driving, and hunting. In addition, some activities have had a marked increase in ranking since the previous SCORP, including visiting a

[1] Trend data for this section was considered from the following sources: Hall, *Likely Trends in National Forest Recreation in Region Six (Draft)*, University of Idaho, 2005; Hall et al, *Understanding Recreation Trends in the Pacific Northwest: State of Knowledge and Manager's Needs,* Draft 2004; USDI Fish and Wildlife Service, 2001 *National Survey of Fishing, Hunting, and Wildlife Associated Recreation, Washington,* Revised March 2003 http://www.census.gov/prod/2003pubs/01fhw/fhw01-wa.pdf; Office of the Interagency Committee (IAC), 2002. Interagency Committee for Outdoor Recreation: *An assessment of outdoor recreation on Washington state—a State Comprehensive Outdoor Recreation Planning Document (SCORP) 2002-2007*. The Office of Interagency Committee, PO Box 40917, Olympia, WA. 98504-0917; Outdoor Industry Foundation, *Outdoor Recreation Participation Study, Seventh Edition, for year 2004*, 2005; Cordell, USDA Forest Service, Southern Research Station, Recreation Statistics Update Report Numbers 1-3, 2004; Cordell et al, USDA Forest Service, Southern Research Station, *Off-Highway Vehicle Recreation in the United States, Regions and States: A National report from the National Survey on Recreation and the Environment (NSRE),* 2005; Cordell, H. Ken; Betz, Carter, J.; Butler, Brett J.; Bergstrom, John C. 2008. Trends in Forest-Based Recreation: Reports for the 2010 Montreal Process Indicators for the U.S.; Cordell, H. Ken; Green, Gary T.; Betz, Carter J. 2009. Long-term National Trends in Outdoor Recreation Activity Participation---1980 to Now; Washington State Recreation and Conservation Office. 2013. Outdoor Recreation in Washington, The 2013 State Comprehensive Outdoor Recreation Plan. Olympia, Washington.

nature interpretive center, climbing or mountaineering, firearms use (hunting or shooting), inner tubing or floating, and camping in a primitive location. Finally, the SCORP's assessment of the supply of outdoor recreation facilities and opportunities in Washington suggests that the supply of recreation is not completely meeting public demand, and meeting that demand is further challenged by the pressure of population growth and urbanization in Washington and that a major focus of recreation planning over the next 5 years should be in providing those nature-based activities for Washington residents, while maintaining the integrity of the ecosystems upon which those recreational activities depend (Washington State Recreation and Conservation Office 2013).

Because of the rising demand for recreation opportunities on public land and the increasing economic dependency of communities on that use, several studies have been conducted in the past decade to assess use and trends. Although studies vary in their results, there are several trends that are common in every study:

- The national population is growing and the amount of people recreating in the outdoors is increasing along with the growing population.
- Users are more diverse and more women are participating in outdoor recreation.
- The average age of people recreating is increasing.
- Interest in new recreation activities has grown significantly, although the most popular historical recreation activities (camping and hiking) have held steady and are still the most popular activities today.
- People are using national forests for shorter durations. They prefer more weekend experiences rather than multi-week ventures.

According to Roper surveys in 2000, activities that are more strenuous start dropping off after age 65. However, more Americans are remaining active into their older years, and those who reach age 65 in the next 10 to 15 years would likely seek out more vigorous activities (Hall 2005). This prediction implies that with a generation of health-minded, active baby boomers retiring and having more leisure time, the demand for challenging experiences may remain steady.

Statewide, the population is expected to grow 16.5 percent between 2012 and 2027 (State of Washington Office of Financial Management 2011). The Hispanic population is expected to increase substantially in Washington state and the Asian/Pacific Islander population is expected to increase almost as much, from about 425,000 in 2005 to 700,000 in 2025 (Hall 2005). Surveys have shown that many Hispanic people prefer camping in a group atmosphere and enjoy activities that involve the whole family. There is very little known at this time about preferred outdoor activities for the Asian/Pacific Islander population. However, monitoring for satisfaction would continue, and future surveys may start to show trends in Asian/Pacific Islander activities.

To gain a better understanding of the recreation use, importance of, and satisfaction associated with national forest recreation opportunities, the Forest Service embarked on the national visitor use monitoring project (NVUM) in the late 1990s. The Colville National Forest has conducted three rounds of surveys in fiscal years 2004, 2009, and 2014. Each survey is conducted over the course of one year (October 1 to September 30) and includes questions regarding visitor use (activities), expenditures on recreation activities, and user satisfaction associated with the activities, settings, and infrastructure used while visiting the Forest.

Without several years of survey data to consider, it is difficult to predict use trends from the Forest's NVUM data. However, the Forest can use the data most recently collected to help determine existing

use. Table 238 shows the most popular visitor activities according to the 2009 Colville National Forest NVUM report (the 2014 report has not been completed). This table shows both the main activity visitors engaged in and the participation percentage for all activities. For example, 18.5 percent of the visitors interviewed in 2009 were camping in developed campgrounds, but only 8.5 percent of them listed it as their main activity.

Table 238. Percentage participation in activities and primary activities of Colville National Forest recreation visitors

Activity	Percentage Participation*	Percentage Main Activity	Average Hours doing Main Activity
Viewing Natural Features	30.7	12.0	3.9
Hiking / Walking	29.0	7.8	4.5
Relaxing	28.3	5.7	30.3
Downhill Skiing	24.0	23.3	4.8
Driving for Pleasure	21.9	2.0	2.9
Viewing Wildlife	20.9	0.4	2.4
Developed Camping	18.5	8.5	52.2
Gathering Forest Products	13.8	8.6	5.0
Fishing	13.6	5.5	6.5
Picnicking	13.3	0.4	13.2
Other Non-motorized	9.1	2.5	1.7
Motorized Trail Activity	8.3	4.3	3.5
Snowmobiling	7.7	7.2	4.4
OHV Use	6.6	1.4	3.1
Primitive Camping	6.0	1.7	64.7
Motorized Water Activities	6.0	2.2	4.3
Bicycling	5.1	1.0	7.6
Nature Study	4.9	0.7	1.1
Non-motorized Water	4.2	1.1	6.5
Hunting	3.6	1.6	12.2
Visiting Historic Sites	3.2	0.0	0.0
Nature Center Activities	3.1	0.0	1.0
Cross-country Skiing	2.6	1.6	3.7
Backpacking	2.5	0.4	15.9
Resort Use	2.0	0.0	12.8
Some Other Activity	1.3	0.4	3.3
Other Motorized Activity	0.8	0.7	1.0
Horseback Riding	0.7	0.1	10.3

*Based on 2009 NVUM Reports (U.S. Forest Service. 2012. 2009 Visitor Use Report, Colville National Forest, National Visitor Use Monitoring Data Collected FY 2009).

In general, results from the 2009 NVUM survey indicate that most visitors to the Colville National Forest are satisfied, if not very satisfied, with the recreation experience they had while visiting the Forest (there were very few somewhat dissatisfied or very dissatisfied experiences noted). In

addition, most visitors did not feel overcrowded during their visit. There are, however, a few site-specific contradictions to this information connected with specific recreation areas and days (i.e., Memorial Day and July 4th weekends, opening day of hunting season, etc.). Overall, recreation managers on the Forest are still able to provide satisfying recreation experiences to the majority of Forest visitors in a relatively uncrowded setting.

Historically, people have enjoyed relatively easy access to a variety of recreation opportunities on Federal public lands. Recreation management on NFS lands consists of providing a wide range of environmentally sustainable recreation opportunities in natural settings that meet the current and future needs and desires of Forest visitors at a level consistent with national budget trends. Forest recreation managers are charged with providing this wide range of outdoor recreation opportunities within the parameters of national direction, local resource conditions, and available budgets. Since the end of World War II, demand for outdoor recreation on public lands has grown immensely and is the fastest growing use on NFS lands.

The Colville National Forest provides the majority of the nature-based mountain recreation opportunities in northeastern Washington. Key attractions include viewing natural features, hiking/walking, relaxing, downhill skiing, driving for pleasure, viewing wildlife, and developed camping (NVUM USDA Forest Service 2012e). While some level of recreation activity occurs almost everywhere on the Forest, the majority of summer use is concentrated near water (lakes, streams, and rivers), around campgrounds and day-use developed sites or along NFS trails and roads. In the winter, many roads are managed as snowmobile trails and some roads are managed as cross-country ski trails. Ski areas, both downhill and cross-country, provide key winter destinations, where large seasonal concentrations of recreation use occur. While recreation visits are fewer in spring, there is no off-season here. Use is year-round, with visitor numbers peaking on holidays, weekends and during the first weeks of hunting and fishing seasons.

National forests provide a variety of opportunities for recreating, working, and practicing cultural and spiritual traditions. In turn, communities provide infrastructure and skills to support forest management. Sustainable social and economic opportunities are dependent on well-functioning and resilient ecological systems. Over the past 20 years, demographic and economic changes have altered how people use and access the national forests. There is a need for the Forests to contribute to predictable and sustained flows of economic and social benefits (e.g., ecosystem services) within the capability of the ecosystem. Social changes include an increasing demand, largely due to population growth, for a variety of recreation opportunities on public lands. New activities and modes of travel continue to appear; for example, mountain bicycles with over-snow tires and snowmobiles that resemble motorcycles. In addition, demand for recreation opportunities in ‘front country’ areas is greater than for backcountry areas.

Recreation in northeastern Washington is rooted in local traditions, yet is constantly changing and posing new and increased challenges for agency managers. Forest Service identity is strong in the local communities. People who live in the area are concerned about forest management, have place attachments to the landscape, and are interested in management changes that could affect their lifestyle or livelihoods. Local lifestyles and economics are firmly linked to public land, with the majority of people who visit, influence, or are directly influenced by the Colville National Forest living within two-hours driving time of these lands (NVUM USDA Forest Service 2012e). Recreation facilities, areas, and programs on Colville National Forest lands influence local economies by prompting business in the tourism and retail sectors. Regional and national tourism, along with local Forest recreation use, are factors in the viability of many small businesses in the area.

Need for Change

Identification of Lands Suitable for Recreation Use

NFS lands are generally suitable for a variety of uses, including recreation. The responsible official, as appropriate, shall utilize existing laws, regulation, and policy, as well as social, economic, and ecological considerations to identify the suitability of areas for specific types of recreation within an NFS unit. Land use specifically excluded by law, regulation, or policy; or use that would result in substantial and permanent impairment of the productivity of the land; or use that is incompatible with the desired conditions for the relevant portion of the analysis area would not be authorized.

The identification of an area as suitable for various uses is *guidance* for project and activity decision making, and is *not a resource commitment or final decision* approving projects and activities. Final decisions on resource commitments are made at the project level.

Areas suitable for a particular use – the particular use on these lands is compatible with the desired condition in the forest plan. This does not mean that the use would occur over the entire area.

Areas not suitable for a particular use – the particular use on these areas is not compatible with the desired conditions of the forest plan. This does not mean that the use would not occur in specific areas.

Lands suitable for recreation use are those lands not restricted from recreation use by presidential, congressional, or administrative constraints. The compatibility of these lands with forest plan desired conditions, objectives, and ROS classes provide the basis for determining whether a use is suitable for a particular area. The starting point for the identification of lands as suitable is the existing suitability determination carried forward from the 1988 forest plan. Recreation suitability in the 1982 planning rule is based on the idea that uses are generally suitable unless determined otherwise. This is consistent with the basic philosophy that these are the people's lands, and therefore, it is appropriate to have a presumption that lands are suitable for a variety of uses.

The following table reflects whether the management areas associated with each action alternative is suitable for summer or winter motorized and non-motorized recreation opportunities.

Table 239. Management areas suitable for summer and winter motorized and non-motorized recreation opportunities by action alternative

Management Area – Revised Land Management Plan	Summer Motorized	Summer Non-Motorized	Winter Motorized	Winter Non-Motorized
Active Management – Alternative B	Suitable	Suitable	Suitable	Suitable
Responsible Management – Alternative O	Suitable	Suitable	Suitable	Suitable
Restoration – Alternatives B and O	Suitable	Suitable	Suitable	Suitable
Backcountry – Alternatives R,P,B,O, Proposed Action and No Action[2]	Not Suitable	Suitable	Not Suitable	Suitable
Backcountry Motorized – Alternatives R,P,B,O, Proposed Action and No Action[3]	Suitable	Suitable	Suitable – Limited by wildlife habitat restrictions	Suitable

[2] The Backcountry MA aligns with the no action alternative's Semi-Primitive Non-Motorized Recreation MA.
[3] The Backcountry Motorized MA aligns with the no action alternative's Semi-Primitive Motorized Recreation MA.

Management Area – Revised Land Management Plan	Summer Motorized	Summer Non-Motorized	Winter Motorized	Winter Non-Motorized
Focused Restoration – Alternatives P and Proposed Action	Suitable	Suitable	Suitable	Suitable
General Restoration – Alternatives R, P and Proposed Action	Suitable	Suitable	Suitable	Suitable
Late Forest Structure – Alternative R	Suitable	Suitable	Suitable	Suitable
Administrative and Recreation Sites – Alternatives R,P,B,O, Proposed Action and No Action	Suitable – site-specific decision	Suitable	Suitable – site-specific decision	Suitable
Riparian – Alternatives R,P,B,O, Proposed Action and No Action	Suitable	Suitable	Suitable	Suitable
National Scenic Trails – Alternatives R,P,B,O, Proposed Action and No Action	Not Suitable	Suitable	Not suitable	Suitable
National Recreation Trails – Alternatives R,P,B,O, Proposed Action and No Action	Suitable – if consistent with the purpose of the trail	Suitable	Suitable – if consistent with the purpose of the trail	Suitable
Research Natural Areas – Alternatives R,P,B,O, Proposed Action and No Action	Not Suitable	Suitable	Not Suitable	Suitable
Scenic Byways – Alternatives R,P,B,O and Proposed Action	Suitable	Suitable	Suitable	Suitable
Recreation Area – Alternative P and O	Suitable – except in semi-primitive non-motorized ROS class	Suitable	Suitable – except in semi-primitive non-motorized ROS class	Suitable
Wild & Scenic Rivers – Alternatives R,P,B,O, Proposed Action and No Action	Not Suitable - Wild Segment	Suitable	Not Suitable - wild segment	Suitable
Wilderness – Alternatives R,P,B,O, Proposed Action and No Action	Not Suitable	Suitable	Not suitable	Suitable
Recommended Wilderness – Alternatives R,P,B,O and Proposed Action	Not Suitable	Suitable	Not Suitable	Suitable
Old Growth Dependent Species Habitat – no action alternative	Suitable – if habitat integrity is maintained	Suitable	Suitable – if habitat integrity is maintained	Suitable
Caribou Habitat – no action alternative	Suitable – if habitat integrity is maintained	Suitable	Suitable – if habitat integrity is maintained	Suitable
Recreation – no action alternative	Suitable in MA 3A and 3C; Not suitable in MA 3B	Suitable	Suitable in MA 3A and 3C; Not suitable in MA 3B	Suitable
Scenic/Timber – no action alternative	Suitable	Suitable	Suitable	Suitable

Management Area – Revised Land Management Plan	Summer Motorized	Summer Non-Motorized	Winter Motorized	Winter Non-Motorized
Scenic/Winter Range – no action alternative	Suitable – seasonal closures may be implemented	Suitable	Suitable – seasonal closures may be implemented	Suitable
Wood/Forage – no action alternative	Suitable	Suitable	Suitable	Suitable
Winter Range – no action alternative	Suitable – seasonal closures may be implemented	Suitable	Suitable – seasonal closures may be implemented	Suitable

Motorized Recreation Trails

The Colville National Forest offers a mixture of summer and winter motorized trail opportunities in a variety of recreation settings. Motorized uses associated with both seasons are bound by direction in the 1988 forest plan, the 2005 Travel Management Rule, and wilderness regulations that prohibit all motorized use in designated wilderness areas. The 1988 forest plan language identifies where motorized recreation use may not be authorized or may be limited for the protection of aquatic, plant and wildlife habitats. In addition, summer motorized recreation use is also restricted to those routes (roads and trails) identified on the Forest's current-year motor vehicle use map, which was developed in response to Subpart B of the 2005 Travel Management Rule. An over-snow vehicle use map, pursuant to Subpart C of the 2005 Travel Management Rule has not been developed on the Forest. At this time, no motorized cross-country travel is allowed on the Colville National Forest except for over-snow vehicle travel, which is open to all areas not closed for resource protection or for the protection of wilderness settings.

Existing routes on the Colville's motor vehicle use map were identified through numerous collaborative public meetings that included pro-motorized, neutral, and non-motorized interests. Many routes identified by motorized users during the public meeting process were not opened to motorized use with the publishing of the first motor vehicle use map in 2008, since many non-motorized users felt the routes would lead to additional noise and resource damage and were opposed to their inclusion on the map. As a result, the system of roads identified in 2008 for use by OHVs on the Forest was disjointed, provided few loop riding opportunities, very few connections between the Forest and tourism-dependent communities, and included numerous short out-and-back rides that have been seldom used. To date, the system of OHV routes identified in 2008 remains unchanged across much of the Forest except in the South End planning area (includes NFS lands between U.S. Highway 395 and State Highway 20, generally south of the Little Pend Oreille Wildlife Refuge and north of the Forest's southern border) where a recent decision has improved opportunities for OHV loop rides and connecting OHV users with communities and camping opportunities. Many community members and county commissioners believe that a more cohesive OHV route system on the Forest would bolster local economies through tourism income associated with motorized recreation. The split between motorized and non-motorized interest groups is present not only in discussions involving the Colville National Forest, but also in discussions surrounding community trail systems.

The Forest currently offers 181 miles of summer motorized trails. Approximately 97 percent (177 miles) of those motorized trail miles are located on the Newport and Three Rivers Ranger Districts; 1.4 miles are located on the Republic District; and approximately 3 miles are located on the Sullivan

Lake District. Summer motorized trails make up 36 percent of the total summer trail miles on the Forest, with motorcycle trails accounting for 66 percent of all motorized trail miles.

Off-highway vehicle use is allowed on designated routes (mixed-use roads and trails) across approximately 82 percent of the Forest. Mixed-use roads open to OHV use includes 684 miles (31 percent) out of the 2,206 miles of road that are open to highway-legal vehicles across the Forest. OHV use on trails located in a motorized backcountry setting is allowed on approximately 5 percent of the Forest, which equals 22 percent of the Forest's total (including motorized and non-motorized) backcountry acres. No cross-country OHV use is allowed on the Forest. Three motorized mixed-use roads connect with the Little Pend Oreille OHV trail system, which provides some additional loop riding opportunities. No motorized mixed-use roads connect with the Owl Mountain, Thompson Ridge, Mack King, Twin Sisters, US Mountain, Batey-Bould, Middle Fork Calispell, or South Huckleberry OHV trail systems.

Trails designed specifically for motorcycle use are centered on the Little Pend Oreille and Batey-Bould ORV areas. Both of these systems are popular with intermediate to advanced riders and offer limited terrain for beginners. The Forest supports two small ATV trail systems that do not meet the desired riding distance and loop requirements of most ATV users. These trails are typically used by nearby campers and local residents looking for short beginner rides. In addition, the Forest has seven jeep trails located in the eastern foothills of the Kettle Crest that are open to all vehicles. These trails are popular with intermediate to advanced drivers. However, their use is limited because they are not part of a legal loop riding opportunity for non-highway legal vehicles. These trails do not connect with motorized mixed-use roads, so trail users are required to go out and back or return to their starting points illegally on roads open to highway legal vehicles only. Unlike the majority of the motorcycle and ATV trails which meander through the working front-country terrain of the Forest, these jeep trails traverse through the higher elevation ridgelines of four of the Forest's potential wilderness areas. As a result, these jeep trails provide motorized access into some of the best unaltered and roadless landscapes the Colville National Forest has to offer, and their presence in these potential wilderness areas has resulted in conflict between motorized users and wilderness proponents.

The Forest offers a groomed winter over-snow vehicle trail system that can be used by riders of all skill levels. This system of groomed trails has been scaled back over the past 10 to 15 years as a result of decreased funding at both the Forest and State levels. Snowmobile trails can be found on every district of the Forest and are located almost exclusively on existing NFS roads. These trails are maintained and groomed through partnerships with local grooming councils, which include representatives from the local counties, snowmobile clubs, and contracted groomer operators. Funding for grooming is provided through State grants. Winter trails are also limited to those routes and areas that are not closed for the protection of aquatic, plant, and wildlife habitats or for the protection of wilderness settings. Cross-country over-snow vehicle use is currently allowed across the Forest except in wilderness, semi-primitive non-motorized management areas, research natural areas, and designated winter range. In a few key areas, such as the powerline corridor over Sherman Pass, increased use by backcountry skiers and snowmobilers has resulted in some conflict between the two groups of users.

Non-motorized Trails

According to the Forest's 2009 NVUM survey data, non-motorized trail use is still one of the most popular recreational activities on the Forest with survey respondents indicating that just over 37 percent participated in hiking/walking, bicycling, backpacking, horseback riding or a combination of these activities. These activities are listed in order of popularity on the Forest. In addition, data

reflected in the 2002 Washington State Comprehensive Outdoor Recreation Planning report shows that walking and hiking are the most popular recreation activities in the state and that over 50 percent of the people who responded prefer mountain-forest trails over city sidewalks.

Non-motorized trails (approximately 319 miles) make up 64 percent of summer trail miles on the Forest and accommodate uses such as hiking, mountain biking, and stock use. Most of the Forest's non-motorized trail miles can be found along the Kettle Crest and within the Salmo-Priest Wilderness Area. The remaining trails are scattered around various recreational lakes and in backcountry settings located across the Forest. Most of these trails are located in mid- to high-elevation terrain, which generally limits their use to the summer and fall months. However, there are a couple of lower-elevation trail systems located just outside of Newport and Republic that are popular in the spring and late fall due to their easy access and limited snow cover.

Trail use on the Forest is dominated by day-hikers. Those overnight hikers the Forest does receive tend to use the trail systems along the Kettle Crest and those within the Salmo-Priest Wilderness. There are few non-motorized loop trails on the Forest. As a result, those trails that do create a loop tend to receive much higher use than those trails that are simple out-and-backs or require a shuttle vehicle. This can lead to the perception of crowding on some trails during summer weekends.

Most non-motorized trails on the Forest (81 percent) were designed for pack and saddle stock use and continue to be maintained for that use. Only 3 percent of the trail system is designed and managed for mountain bikes with the remaining 16 percent designed and managed for hikers. Most of the Forest's summer non-motorized trails are open to all types of users, which has led to some conflict between mountain bikers and equestrian users, but generally, the two groups tend to get along and have partnered in trail maintenance projects in the past. However, for safety reasons, interpretive trails, trails entering or leaving developed campgrounds, and some lakeshore trails are only open to hikers.

Winter non-motorized trail use is concentrated around the five cross-country ski trail systems that are located across every district on the Forest except for Sullivan Lake. The five trail systems receive regular grooming through either a private contractor or Forest Service personnel. Funding for grooming is provided primarily through State grants. The permit holder for the 49 Degrees North Mountain Resort is responsible for grooming their Nordic ski trail system. Winter trails are limited on the Colville National Forest due to lynx habitat in the higher elevations (no additional groomed routes are allowed in designated lynx habitat) and inconsistent snow conditions in the lower foothills and valleys. The Forest's five cross-country ski areas are located in a variety of settings including high-elevation ridgelines, lake basins, and rolling forested foothills. These areas experience moderate use when snow conditions are good. Due to the availability of cross-country ski areas closer to Spokane, the Forest's trail system is primarily used by local residents, which keeps crowding to a minimum, given the limited amount of trail miles (40) the Forest has to offer.

Access

Three broad concerns drove the need to address road density: (1) the Forest is no longer able to afford to properly maintain its road system at current operational maintenance levels, (2) the current road system is not aligned with current and future resource management objectives, and (3) the existing road management direction is confusing and difficult to follow because it is scattered throughout the 1988 forest plan, forest plan amendments (Regional Forester's Forest Plan Amendment #2 (Eastside Screens), Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH, USDA Forest Service 1994c and 1995), national

level decisions (the Roadless Rule), and interim policy (e.g., Grizzly Bear No-Net-Loss, Lynx Conservation Assessment and Strategy, The Interior Columbia Basin Strategy).

The Forest's open road network is critical to the recreational use of NFS lands. Regardless of the type of recreation activity being sought, nearly all forest users access that activity with a vehicle. Therefore, each time a road is closed or decommissioned due to a lack of funding or for the benefit of other resource areas (i.e., fisheries or water quality); there is a potential loss of motorized access to a variety of recreation opportunities and settings. Likewise, most roads heavily used for recreation on the Forest are also located along some of the more sensitive riparian areas within the Forest which can lead to complicated decisions with tradeoffs between social needs and resource needs.

In order to provide the public with a spectrum of high quality, nature-based recreational settings and opportunities that access the various biological, geological, scenic, cultural, and experiential resources of the Forest, the Forest must first provide a safe and appropriate level of motorized access to those opportunities and settings. As part of the process in determining what an appropriate road system might look like on the Colville National Forest, the Forest developed a Travel Analysis Report pursuant to Subpart A of the 2005 Travel Management Rule. This process required Forest recreation managers to rank each authorized road on the Forest according to its value to the recreation program. Likewise, other resource specialists (such as wildfire suppression, range management, fisheries, wildlife, soil, plant, and hydrology) also provided a ranking on each road. The Forest's Travel Analysis would be utilized to help inform decision makers of potential trade-offs associated with all future road planning decisions on the Forest. The Travel Analysis Report does not consider unauthorized roads or user-created routes. These routes are currently closed to use through the motor vehicle use map and can be decommissioned as funding allows.

The Colville National Forest's existing road system currently provides adequate access to the Forest's numerous recreational opportunities. With the revised forest plan, there is a need to ensure that the Forest continues to have an access system of authorized roads that is safe, affordable, and environmentally sound, that meets obligations to private cooperators, is efficient to manage, and provides adequate access to recreation settings and opportunities.

Dispersed Recreation

Dispersed recreation includes a variety of activities that occur in almost every type of setting available on the Forest. Primary activities include camping at undeveloped campsites, berry and mushroom picking, hunting, fishing, boating, wildlife viewing and sightseeing. Generally, these activities require little in the form of management other than quality signing, physical barriers where needed to limit motorized use, and a system of roads (see previous discussion) that provides adequate access into and through the Forest. One exception is the need for fishing and boat docks where lake terrain makes access to a quality opportunity difficult. In recent years, the Forest has invested in new boat and fishing docks to improve the access to and use of several lakes.

Most dispersed camping on the Forest occurs in riparian areas along lakeshores, streams, and rivers. Many of the most popular dispersed campsites have been used for generations and are important to the families that have camped there for years; the campsite, activities, and setting are part of their custom and history. However, many of these sites are showing signs of resource degradation due to overuse. The Forest needs to continue to provide dispersed camping opportunities in their traditional settings while correcting existing resource damage and protecting these sites into the future.

Recommended Wilderness

When a forest plan is revised, the 1984 Washington State Wilderness Act requires the Forest Service to review, evaluate, and determine whether inventoried roadless areas should be submitted to Congress for consideration as recommended wilderness.

In the summer of 2005, the forest plan revision team for the Colville and Okanogan-Wenatchee National Forests began the process of evaluating inventoried roadless areas with the help of interested members of the public. Although inventoried roadless areas are evaluated for potential wilderness, it does not necessarily mean that the inventoried roadless area would automatically become (or not become) a new wilderness area. It is an evaluation process, not a final decision on designation. Only Congress can designate additional wilderness.

The forest plan revision team used inventory criteria from the Forest Service Handbook (FSH 1909.12 Chapter 70 – January 31, 2007 version) to evaluate roadless areas for potential wilderness. To qualify for placement on the potential wilderness inventory, an inventoried roadless area has to meet either criteria 1 and 3, or criteria 2 and 3 below:

1. Areas contain 5,000 acres or more.
2. Areas contain less than 5,000 acres, but can meet one or more of the following criteria:
    a. Areas can be preserved due to physical terrain and natural conditions.
    b. Areas are self-contained ecosystems, such as an island, that can be effectively managed as a separate unit of the National Wilderness Preservation System.
    c. Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size.
3. Areas do not contain forest roads (36 CFR 212.1) or other permanently authorized roads.

The first step the forest plan revision team took in the evaluation process was to use the inventory criteria to validate the boundaries of the 2001 Roadless Rule inventory of roadless areas. Beginning in the summer of 2005, the forest plan revision team asked the public to participate in the review of inventoried roadless area boundaries through a series of public meetings, website postings, and electronic and hard copy mailings/newsletters. The public provided input, which the Forest Service validated. Then the forest plan team made adjustments to the inventoried roadless area boundaries based on a given area's current condition.

After the 2001 Roadless Rule inventory was validated, the forest plan revision team worked to identify if any additional roadless areas existed on the Forest that were not part of the 2001 Roadless Rule inventory. In 2008, the forest plan revision team asked the public to participate in a series of public meetings to help identify additional roadless areas. The public once again provided input that resulted in seven areas being identified that met the criteria in FSH 1909.12 Chapter 70 (January 31, 2007 version) for placement on the potential wilderness inventory. The forest plan revision team continues to collect input from the public on potential boundary additions and deletions to the Forest's areas that may be suitable for inclusion in the National Wilderness Preservation System. Prior to the release of the Final Environmental Impact Statement for the revised forest plan, the boundaries for the areas that would be taken forward as recommended wilderness in the preferred alternative would be ground verified and adjusted in the Forest's Geographic Information System.

The second step the forest plan revision team took in the evaluation process was to carefully evaluate each validated roadless area as an addition to the National Wilderness Preservation System. An area

recommended as suitable for *wilderness must meet the tests of capability, availability, and need*. In addition to the inherent wilderness quality it possesses, an area must provide opportunities and experiences that are dependent upon or enhanced by a wilderness environment and the Forest Service should have the ability to manage the area as wilderness.

The result of this two-step process was an individual wilderness evaluation report for all 21 areas that may be suitable for inclusion in the National Wilderness Preservation System located on the Forest, detailing each area's contribution to the evaluation factors of capability, availability, and need. All of the areas were determined capable of meeting the handbook definition of wilderness, though on a sliding scale. Wilderness capability was impacted by existing developments, vague boundaries, geographic shape, and impacts from sights and sounds of human activities. Availability as wilderness was influenced by existing recreational activities that would be displaced, existing mineral interests, the wildland urban interface, and the need for ecosystem maintenance. Analysis determined the greater Spokane metropolitan area is under-served for wilderness recreation due to not having any wilderness within a 1- to 2-hour drive, and that several areas on the Forest that may be suitable for inclusion in the National Wilderness Preservation System offer high contributions to the wilderness system based on the Need factors (recreation, refugia, and preserving landform and underrepresented ecosystems) given in the handbook. (USDA Forest Service 2010b)

The project file for the Colville National Forest plan revision contains the wilderness evaluation reports for each potential wilderness area identified on the Forest.

Any potential wilderness area recommended to Congress is managed to preserve those wilderness characteristics that made it a candidate for wilderness until Congress chooses to take action.

Currently, there is no existing recommended wilderness on the Forest. The evaluation for possible wilderness recommendation identified 21 potential areas that cover an additional 21 percent of the Forest's land base, which may be suitable for inclusion in the National Wilderness Preservation System . Several of these areas contain low-standard roads and signs of past timber harvest. In addition, the Profanity area contains an historic fire lookout, while the Bald-Snow area contains a recreation rental cabin (Wilderness Evaluations USDA Forest Service 2009).

The evaluation process for identifying areas that may be suitable for inclusion in the National Wilderness Preservation System indicated that designated wilderness was under-represented in the Okanogan Highlands ecoregion on National Forest System lands in Region 6. The Okanogan Highlands ecoregion is a landform province characterized by moderate slopes with broad rounded summits resulting from repeated continental glaciation and the broader valley bottoms are characterized by outwashed terraces (Wilderness Evaluations USDA Forest Service 2009). All of the areas that may be suitable for inclusion in the National Wilderness Preservation System on the Forest are located in the Okanogan Highlands ecoregion. The wilderness evaluation process also identified that trade-offs exist between the recreation need for additional wilderness and the public's desire to maintain existing backcountry motorized and mechanized recreation opportunities and the use of an existing backcountry rental cabin and an historic fire lookout.

In 2015, an update to "FSH 1909.12 – Land Management Planning Handbook Chapter 70 – Wilderness" of the Forest Service Manual System changed the terminology used to describe areas evaluated for recommended wilderness from "Potential Wilderness Areas" (PWAs) to "areas that may be suitable for inclusion in the National Wilderness Preservation System." An effort has been made to update the language in the effects section to correspond with current terminology. However, the terms are interchangeable and the lands they describe all went through the same evaluation process.

Developed Recreation

Developed recreation areas on the Colville National Forest include a suite of opportunities and locations such as: interpretive and historic sites, scenic overlooks, information centers, trailheads, improved dispersed camping areas, rental cabins and lookouts, sno-parks, boat launches, picnic areas, campgrounds, and designated swim areas. In general, a developed recreation site is any place on the forest where funds have been spent to improve the site for the visitor's convenience and to protect the natural resources associated with the site. The Colville National Forest offers all of the above types of recreation sites, with many of them located along primary Scenic Byways or recreation lakes.

Many of the Forest's developed recreation sites have been upgraded (new toilets, tables, grills, and signs) over the past 10 to 15 years. However, the majority of sites are not fully accessible for those visitors with mobility impairments and only about half can easily accommodate modern recreational vehicles due to limited road widths and turning radii or restricted parking area widths and lengths. Some existing sites are past their predicted life expectancy and are in need of rehabilitation and in some cases, reconstruction. In addition, the only developed group camping opportunities on the Forest are located the farthest (Sullivan Lake and Republic) from northeastern Washington's primary population center of Spokane. Regardless of these shortcomings, most visitors to the Forest use one or multiple developed recreation sites during their stay. While some sites (campgrounds and day-use areas) can be full on certain summer weekends, typically, use is adequately being met across the Forest with the current number of existing developed recreation sites. Based on changing demographics, there may be a need to develop additional group use sites, day-use areas, and trailheads closer to Spokane over the next 10 to 20 years.

Recreation Special Use Permits

The Colville National Forest administers a variety of permits for recreation special uses including recreation residences, ski areas, recreation events, outfitter/guides and campground concessionaires. Permit activities are located across the Forest and occur throughout the year.

The Forest's recreation residence program is centered around four tracts of homes located on Sullivan Lake. An isolated single cabin is also located on Bead Lake. These cabins are privately owned and are situated on leased lots located on NFS lands. Appraisals and consistency reviews were completed on these permits in the mid to late 2000 era, along with the requirements contained in the Cabin User Fee Fairness Act of 2000. As a result, new 20-year permits have been recently issued to the owners of these cabins, which should extend well into the next forest plan implementation cycle.

The Forest administers one ski resort permit. This permit includes groomed downhill as well as cross-country skiing and a limited amount of summer uses such as mountain biking, huckleberry picking and other special events. The resort recently opened a new lift and summit and is in the process of implementing its current master development plan. A new master development plan may need to be developed for the resort during the next 5 to 10 years to keep up with changing trends in summer and winter use.

Recreation event permits are issued to private organizations that choose to utilize the national forest for one-time or recurring activities. On the Colville National Forest, these activities frequently include trail rides, both motorized and non-motorized as well as summer and winter, but have also been associated with foot races and triathlons. These types of special uses are expected to continue into the future with slight fluctuations in the number and type of events from year to year.

The Colville National Forest has only recently begun to administer outfitter/guide special use permits. The first temporary special use permit for outfitting and guiding was signed in 2009. The Forest currently has six outfitter/guide permits that provide services including archery and rifle hunting, kayaking, snowshoeing/cross-country skiing, and horse riding on backcountry trails. The Forest has recently completed the environmental analysis to add motorized and overnight uses to the list of services provided by our outfitter/guides. It is anticipated, based on requests by our current outfitters, that snowmobiling, OHV riding, and overnight stock camps would all become authorized uses in the near future. Additional requests for unknown and unique outfitter or guide opportunities may also be received in response to changing public recreational interests in the future. In general, the Forest expects to see growth in the number of authorized outfitter/guide permits as well as the number and complexity of activities authorized by those permits over the next 10 to 20 years.

One campground concessionaire permit is administered on the Forest that includes fee campgrounds on the Newport and Sullivan Lake Ranger Districts as well as the four campgrounds located on the Little Pend Oreille Chain of Lakes on the Three Rivers Ranger District. This permit allows a private company to operate and maintain fee-based recreation sites on the Forest in exchange for retaining all fees collected at those sites. The current 5-year permit was issued in 2013, and is renewable for an additional 5-year term in 2018, if the operation and maintenance standards required by the permit are met and fees to the government are paid in a timely manner by the management company. Administration of campground concessionaire permits is unlikely to change over the next 5 to 10 years and the Forest does not expect to add sites to the existing concessionaire permit.

Wilderness

Wilderness areas are managed according to the Wilderness Act of 1964, which protects their wilderness values. Wilderness areas provide outstanding opportunities for solitude or a primitive and unconfined type of recreation. They also provide wildlife habitat and a variety of natural resource and social values. Motorized and mechanical equipment use is prohibited in wilderness. Livestock grazing is allowed in wilderness areas, unless specifically excluded by the law designating the area.

The 43,348-acre **Salmo-Priest Wilderness** (31,400 acres of which is located on the Colville National Forest) was designated by Congress in 1984, as part of Public Law 98-339, the Washington State Wilderness Act of 1984. The Salmo-Priest is the only designated wilderness area located in the state of Washington east of the Cascade Mountains and is located entirely in Washington state. However, only 72 percent of the wilderness is managed by the Colville National Forest; the remaining 28 percent (the far eastern side—part of the Kaniksu National Forest) is administered by the Idaho Panhandle National Forests. The Salmo-Priest Wilderness also contains the Salmo and Roundtop Research Natural Areas. Grazing is not allowed in the Salmo-Priest Wilderness because no authorized grazing was permitted in the area at the time it was designated.

The Salmo-Priest Wilderness is a narrow (generally 2 to 3 miles wide), U-shaped body of land that borders Idaho and British Columbia, Canada. The area receives considerable precipitation (approximately 50 inches annually) which helps support the largest growth of virgin forest left in eastern Washington including western red cedar, western hemlock, Douglas-fir, grand fir, and larch. In addition, the Salmo-Priest Wilderness supports a variety of wildlife, including the threatened and endangered woodland caribou, grizzly bear, and gray wolves.

The Salmo-Priest is easily accessed by roads that lead to eight trailheads located on land administered by the Colville National Forest. Feeder trails access the two predominant ridge trails that traverse through the wilderness along both the west and east ridgelines. Visitor use in the Salmo-

Priest is generally light, with peak use occurring on weekends between mid-July and Labor Day weekend.

Nationally Designated Roads and Trails

The Colville National Forest is accessed by three scenic byways including the Sherman Pass Scenic Byway, the North Pend Oreille Scenic Byway, and the International Selkirk Loop. Access deeper into the Forest can be accomplished through the congressionally designated Pacific Northwest National Scenic Trail and four national recreation trails including the Kettle Crest, Lakeshore, Pass Creek-Grassy Top, and Shedroof Divide National Recreation Trails. These designations help draw a national and international audience to the Forest. In many cases, these designated roads and trails receive some of the heaviest recreation use on the Forest.

The Sherman Pass Scenic Byway was designated as a Washington State Scenic Byway in 1967, and as a National Forest Scenic Byway in 1990. Between 2002 and 2009, over $2 million was invested in new and existing recreation facilities along the byway, including a regional information center located in Kettle Falls. All of the byway amenities are managed by the Forest Service except for the West (City of Republic) and East (Sherman Creek Wildlife Recreation Area) Gateways and the Kettle Falls Regional Information Center.

The North Pend Oreille Scenic Byway was designated as a Washington State Scenic Byway in 1993. The byway corridor is managed by the Washington State Department of Transportation and provides excellent access to Colville National Forest recreation opportunities located along the Pend Oreille River, Sullivan Lake, and within the Selkirk Mountains including numerous backcountry trail and wildlife viewing opportunities.

The International Selkirk Loop was designated as an All-American Road in 2005, making it one of only 31 national scenic byways in the United States (as of 2010) to receive that designation. This 280-mile loop (including state highways in Idaho and Washington and provincial highways in British Columbia, Canada) around the Selkirk Mountains provides easy access to the numerous national forest recreation opportunities on the Newport and Sullivan Lake Ranger Districts. Several side loops off the main Selkirk Loop provides additional opportunities to explore less traveled portions of the Forest. This byway provides visitors with excellent opportunities for year-round recreation access to the Forest.

The Pacific Northwest National Scenic Trail (PNT) was designated by Congress in the 2009 Omnibus Public Land Management Act and extends 1,200 miles from Glacier National Park in Montana to the Pacific Ocean. Approximately 197 miles of the PNT runs through the Colville National Forest and private lands from the Washington/Idaho border west to the Forest's boundary with the Okanogan/Wenatchee National Forest. Several sections of the PNT use existing trails on the Forest, such as the Kettle Crest National Recreation Trail, the Abercrombie Mountain Trail, and the Shedroof Divide National Recreation Trail. In some areas, the congressionally designated location for this non-motorized trail overlays State, County and NFS roads, undeveloped areas where no current trail exists, as well as areas where minor route refinements may be necessary due to other considerations (such as the crossing of the Pend Oreille River at Boundary Dam).

The Forest Service is the lead agency for administration of the PNT and is currently in the process of assembling a planning team comprised of agency personnel and an advisory council made up of interested members of the public that would work together collaboratively to develop the Comprehensive Plan for the PNT. The final location of the PNT would be determined when its legislatively mandated Comprehensive Plan is finalized (estimated completion date of 2018).

Therefore, sections of the PNT (as shown on the alternative maps) are likely to change upon completion of the PNT's Comprehensive Plan. Land and resource management plan direction for the National Scenic Trail Corridor management area would apply to the most current location of the trail as determined by the Comprehensive Plan and published in the Federal Register.

Once the Comprehensive Plan for the trail is complete, work would start to identify trail routes where none exist and to move the trail off its existing road alignments. The trail is open to non-motorized uses. However, mountain bikes are not allowed on sections of the trail where their use is otherwise prohibited, such as in designated wilderness. In addition, motorized uses are allowed on the sections of trail currently located on open NFS roads

The Kettle Crest National Recreation Trail is a 44-mile trail located along the top of the Kettle River Range Mountains and traverses through the Bald-Snow and Profanity Potential Wilderness Areas. This non-motorized trail was designated in 1979, and provides access to outstanding regional views, an historic fire lookout, a backcountry cabin, and excellent winter cross-country touring opportunities. Primary users include hikers, stock, mountain bikers, and skiers.

The Lakeshore National Recreation Trail extends 4.3 miles along the shoreline of Sullivan Lake between two popular campgrounds. The trail was designated in 1978, and provides excellent views of the lake and opportunities for wildlife observation, including resident bighorn sheep from April through mid-June. The trail is open to all non-motorized uses.

The Pass Creek-Grassy Top National Recreation Trail extends just under 8 miles along the hydrologic divide between the Colville National Forest and the Kaniksu National Forest, which is administered by the Idaho Panhandle National Forests. The trail was designated in 1981, and passes through numerous alpine meadows on the way up to the top of Grassy Top Mountain, which provides excellent views into northern Idaho and eastern Washington. The trail is open to all non-motorized uses.

The Shedroof Divide National Recreation Trail extends over 29 miles (22 miles on the Forest) through the heart of the Salmo-Priest Wilderness. The trail was designated in 1981, and offers spectacular views of the wilderness and Selkirk Crest. The trail is well-suited to overnight trips and is open to non-motorized and non-mechanized modes of travel.

Eligible Wild and Scenic Rivers

Eligible rivers were identified during the planning effort associated with the 1988 forest plan. The plan initially identified one eligible river—the Kettle River. An appeal of the 1988 forest plan by American Rivers, Inc., was filed based on the Forest's failure to document the process that was used to evaluate rivers for Wild and Scenic River eligibility during the development of the 1988 forest plan. To meet the legal requirements and terms of the Forest's agreement with American Rivers, the Colville National Forest assembled an interdisciplinary team in 1990 to reexamine all rivers on the Forest and clearly document the process it used for screening and evaluating wild and scenic river eligibility. Direction for the assessment process came from the Forest Service Land and Resource Management Planning Handbook Section 8.2 (dated July 1987) and a draft Preliminary River Value Identification Process Paper dated November 22, 1989. All documentation on the process can be found in the project file located in the Colville National Forest's Supervisor's Office located in Colville, Washington.

The following process was used to identify rivers that would be assessed for wild and scenic river eligibility:

- It was first determined that the entire forest was located within the "Columbia River and Tributaries" region, which includes all of eastern Washington and a southern portion of western Washington. The watersheds within the Forest were then divided according to their water resource council hydrologic unit codes.
- In each watershed, all class 1 and 2 streams and a few of the larger class 3 streams were selected for further evaluation. Most class 3 and all class 4 streams were not included due to factors such as low flows, intermittent flow, and short length that would have made it difficult to sustain or complement identified outstandingly remarkable values. In addition, most of these class 3 and 4 streams are tributaries to the class 1 and 2 streams and were included in those evaluations depending on the assessment of outstandingly remarkable resource values associated with each stream segment.
- All stream segments left the forest boundary as named streams. For instance, if a north and south fork of a stream joined within the Forest, they could be evaluated together. If two forks entered the Forest separately, they were evaluated separately.

After the initial screening process was completed, the remaining rivers were assessed by a core team of resource specialists that included a wildlife biologist, silviculturist, hydrologist, archaeologist, landscape architect, soil scientist, recreation planner, ecologist, planning team leader, resource forester, district ranger, resource assistant, and forestry technician. The team was comprised of Forest specialists and at least one representative from each ranger district. The recreation planner met with each resource specialist individually to gather information on the value of each river resource specifically identified for assessment in the Wild and Scenic Rivers Act including: scenic, recreational, geologic, fish and wildlife, historic, pre-historic and other similar values (botanic, ecological and hydrologic). Once the river resource values were identified, the team met several times over a 4-month period to assess the ratings, reach consensus on the ratings, and document the basis for which each specific river was dropped from consideration. Additional input was solicited from the Kalispel, Colville, Spokane, and Kootenai Tribes, the State Historic Preservation Office, Bureau of Land Management, National Park Service, and Washington Department of Wildlife.

The result of this secondary assessment was that a 5-mile stretch of the South Fork Salmo River was determined to be eligible for classification as a wild river under the Wild and Scenic Rivers Act. No changes have occurred to the free-flowing nature or outstandingly remarkable values associated with the Kettle and South Fork Salmo Rivers since being identified as eligible wild and scenic rivers in 1988 and 1990, respectively.

Suitability studies have not been undertaken on either of the two rivers eligible for possible inclusion in the National Wild and Scenic River System.

Table 240. Eligible wild and scenic rivers on the Colville National Forest

River Name	Outstandingly Remarkable Values	Recommended Classification	Length in Miles	Eligible or Suitable Status
South Fork Salmo River	Fishery Ecological	Wild	5	Eligible
Kettle River	Recreation Scenery	Recreational	3	Eligible

Environmental Consequences

Methodology

Assumptions

- Recreation budget levels would continue along current trend lines, excluding fiscal years (FY) 2008 to 2013 when the Forest's recreation budget was increased under the Proof of Concept budget model (FY13 was increased by the RO as part of a 3-year phase-in of the Strategic Budget Objectives budget model) by 21 percent over the average of fiscal years 2005 to 2006, and by 44 percent over the average of fiscal years 2007 and 2014. Future budget levels may vary by 20 percent plus or minus in addition to the 21 to 44 percent reduction, which has already occurred as a result of switching from the Proof of Concept budget model to the Region's Strategic Budget Objectives budget model.
- The effects for recommended wilderness are based on the assumption that the recommended wilderness areas would be designated as wilderness by Congress.
- Trails within recommended wilderness and those leading directly into recommended wilderness would not be open to motorized or mechanized uses if the recommended wilderness areas were designated as wilderness by Congress.
- Motorized trails located in recommended wilderness areas would be converted to non-motorized/non-mechanized trails.
- Based on predicted budget levels, trail and recreation site construction and reconstruction could be limited over the life of the revised forest plan.
- Roads open to various forms of motorized recreation (motorized mixed-use) under the current year motor vehicle use map would continue to be open to those uses. For purposes of analysis, these routes were not considered to be part of the Forest's motorized trail system. Only the trails listed in the INFRA database were considered when completing the analysis for effect to motorized trails.
- Motorized trail use would not be allowed in Backcountry, Research Natural Area, Recommended Wilderness or Wilderness Management Areas. Motorized trail use would be allowed in Backcountry Motorized Management Areas.
- Most dispersed camping occurs within close proximity of forest system roads, lakes, and streams.
- In spite of the large expanse of undeveloped area available for dispersed recreation use (both motorized and non-motorized), not every acre is suitable for every use.
- All acreage figures are approximate. They were calculated using the most current data available in the Colville National Forest's Geographic Information System (GIS) database.
- The acres shown as suitable for future consideration of motorized use areas and motorized trail development do not reflect site-specific resource concerns such as slope, soils, heritage resources, etc., that would be addressed in project-level analyses.
- The acres shown as suitable for future consideration of mechanized and non-motorized travel do not reflect site-specific resource concerns such as slope, soils, heritage resources, etc., that would be addressed in project-level analyses.

Visitors to the Forest have different preferences for their recreation setting and the activities in which they want to participate. These differences and preferences range from highly intensive

uses that have lasting effects on resources to uses that are barely discernible on the ground. Recognizing the differences in user preferences, the primary goal of managing outdoor recreation is to provide an environment or opportunity in which visitors can have a satisfying experience, while protecting the natural and cultural resources integral to that experience. Because user preferences are so diverse, it is assumed that not all user preferences can be accommodated on every acre of the Colville National Forest.

- Recreation demand on the Colville National Forest is tied to population changes in the communities and larger metropolitan areas of northeastern Washington, northern Idaho, and southern British Columbia, Canada.
- Wilderness, backcountry (semi-primitive non-motorized), research natural areas, big-game winter range, recommended wilderness, and National Scenic Trail management areas were used to identify those acres under each alternative that were closed or could be closed to over-snow vehicle use. For winter range, the entire management area was considered to be closed to over-snow vehicle use regardless of the percentage of the area that was closed to use by gates or Forest closure orders.

Methods of Analysis

Analysis was completed utilizing information contained in the Forest's GIS and INFRA databases, current field data and literature.

Incomplete and Unavailable Information

Trail use figures are not available for the Colville National Forest for total use or by type of recreation use (hike, bike, horse, ski, ATV, etc.). No other incomplete or unavailable information was identified relating to recreation resources.

Spatial and Temporal Context for Effects Analysis

The affected environment for effects includes the lands administered by the Colville National Forest. This analysis covers the life of the forest plan, which is 10 to 15 years.

Summary of Effects

The effects of a warming climate system would have the same potential effects on all alternatives. While scientific research and historical data have allowed for the development of long-term general prediction models at a regional scale, the existing research and data are not sufficient to complete the level of analysis necessary to predict potential changes for specific areas on the Colville National Forest. However, regional climate change models for northeastern Washington indicate an increase in temperature is likely and precipitation is likely to increase during the winter months and decrease during the summer months. Combined, these temperature and precipitation changes for eastern Washington would likely increase the frequency of winter flooding, reduce snowpack, increase winter streamflows, result in earlier peak flows, and decrease late spring and summer flows (Jimenez 2017). The result of the predicted temperature and precipitation changes would likely be: (1) fewer opportunities for over-snow recreation as the average snow line continues to shift toward higher elevations and the average number of days with a sufficient snowpack declines over time, (2) a reduction in the miles of stream supporting sufficient water flow during the late spring and summer for water play and possibly fishing, and (3) an increase in the average length of the traditional "summer" recreation season.

Each of these potential effects may lead to increased competition for recreation resources and opportunities that could lead to crowding and potential conflicts between recreationists pursuing

competing types of recreational activities. While potential conflict is intuitive when opportunities are reduced (i.e., fewer snow-covered acres, fewer stream miles supporting water play) it may also occur when seasons (camping, trail use, boating) are extended as the Colville National Forest is not funded at a level to keep additional recreation facilities open for longer seasons. As a result, increased "shoulder" season participation could lead to potential crowding and conflicts at those sites that remain open to public use.

Winter over-snow vehicle recreation opportunities on groomed and non-groomed designated routes would remain the same across all alternatives. Designated groomed and non-groomed over-snow vehicle trail opportunities would not change as a result of the number of acres associated with recommended wilderness, backcountry, or backcountry motorized management areas since the Forest's existing over-snow vehicle designated groomed and non-groomed trail system is located almost entirely on NFS roads, outside of these management area boundaries. Where management activities, specifically vegetation treatments, must occur during the winter months, short to intermediate closures of designated trails may occur to allow for winter haul. This would result in localized displacement of over-snow vehicle users to other trails located on the Forest or to trails located on neighboring forests. However, thinned areas may attract additional over-snow vehicle users when treatments are complete because the stand openness could result in better off-trail riding opportunities.

Although the proposed riparian and aquatic resource management direction differs between the six alternatives, the effect to the recreation resource would be very similar across all alternatives. Whether the alternative implements INFISH, ARCS (USDA Forest Service 2008a, 2016a), or a modified version of ARCS as described in the aquatic resource section, the following management direction (objectives and guidelines) would generally apply to recreation resources with some differences in terminology between the alternatives:

- New facilities and infrastructure should not be placed within long-term channel migration zones. If facilities must be located within the riparian management area (i.e., boat launches), locate them to minimize impacts on riparian conditions.
- Consider relocating existing facilities that are causing unacceptable impacts within the riparian area.
- Adjust trail management, dispersed and developed recreation practices that retard or prevent attainment of Riparian Management Objectives or disrupt natural hydrologic processes using practices such as education, use limitations, traffic control devices, facility relocation, and site-specific closures.
- Hazard trees may be felled and generally retained on-site to enhance aquatic and riparian resources.

In all six alternatives, the above riparian and aquatic resource objectives and guidelines would require corrective actions be taken on recreation resources that are impairing proper hydrologic function or causing unacceptable impacts within the riparian management area (RMA). The recreation management tools available to implement changes within the RMA would be the same across all alternatives.

Under all alternatives, recreation management direction specific to developed and dispersed recreation would remain the same. Management activities, specifically vegetation treatments (both mechanical and prescribed fire), may result in short or intermediate length closures of developed and dispersed recreation sites for public safety which would result in the displacement of users to other

recreation sites across the Forest or onto neighboring forests. Longer-term displacements could occur if the recreation site character is altered beyond what is acceptable to the user. For example, thinning trees in a camping area (developed or dispersed) may reduce vegetative screening between campsites and the road, which may affect the sense of privacy and result in increased noise and dust. The length of displacement would vary by treatment type, the amount of slash and debris piles, the time required to regrow vegetation, and the overall scenic quality of the area that exists after management actions are complete.

Management direction for Nationally Designated Trails and Roads would remain the same across all alternatives. No new scenic byways, or national recreation trails are proposed under any alternative. These special designation areas would continue to be managed to protect the values for which they were designated. Direction specific to the Pacific Northwest National Scenic Trail (PNT) developed through the PNT's trail Comprehensive Plan would be incorporated into the revised forest plan when completed in 2018 to 2019.

Wild and scenic river and wilderness management direction would remain the same under all alternatives. Both eligible wild and scenic river segments (Kettle and South Fork Salmo Rivers) on the Forest would be managed to ensure their future eligibility by protecting the values for which they were found eligible based on national direction and law. No new eligible wild and scenic river segments are proposed under any of the alternatives. Additional proposed wilderness is discussed under each alternative.

Management of recreation special uses would remain the same under all alternatives and be based on national direction and law. All existing recreation special uses would continue to occur on the Forest. However, it is possible that the land base used by a permittee could change based on the alternative. For example, backcountry areas selected as recommended wilderness could result in changes to where a mountain bike or OHV outfitter could operate, resulting in changes to the authorized trails and areas permitted for use by each operator. At this time, no changes to permits are expected, based on the types of uses currently authorized by permit on the Forest.

Management of motor vehicle use of roads (off-highway and highway-legal vehicles) would remain the same under all alternatives and be managed per the Forest's current-year motor vehicle use map, pursuant to the 2005 Travel Management Rule. Changes in the management of motor vehicle use of roads would continue to be made on a project-by-project basis based on the desired conditions, objectives, standards, and guidelines contained in the revised forest plan.

No Action Alternative

The following summarizes the effects to recreation resources associated with the implementation of the no action alternative. Issues analyzed include the identification of lands suitable for recreation use, motorized recreation trails, access, and recommended wilderness.

Under the no action alternative, the recreation suitability determinations and the ROS mapping completed as part of the 1988 forest plan for summer and winter motorized and non-motorized recreation opportunities would be retained. The number of summer motorized recreation trail miles and the acres of backcountry motorized recreation would remain unchanged from the existing condition. This alternative would provide the greatest number of summer motorized trail miles (along with alternatives P, O, and the proposed action) and the third fewest (of the six alternatives) acres managed for backcountry motorized recreation. Access for recreation would continue to be affected through project-specific decisions based on improving resource and habitat conditions. Road decommissioning would be expected to continue at a rate similar to recent years across the Forest

and should result in little or no change in the public's ability to participate in a variety of summer and winter dispersed and developed recreation opportunities across the Forest. The existing number of semi-primitive motorized (SPM) and semi-primitive non-motorized (SPNM) management area acres would be retained at a level that ranks third lowest amongst the alternatives. No recommended wilderness is proposed under this alternative. All backcountry recreation opportunities would continue across the Forest. The miles of trail open to mountain biking would not change from the existing condition. The no action alternative provides the greatest number of trail miles open to mountain biking of all the alternatives. Motorized equipment for trail maintenance and reconstruction would be allowed on all trails except for those in designated wilderness. Opportunities for over-snow vehicle recreation would be retained across the Forest with no change in the number of acres open to this form of recreation when compared to the existing condition. The no action alternative supports the largest number of acres open to over-snow vehicle recreation opportunities of the six alternatives.

Identification of Lands Suitable for Recreation Use

The no action alternative retains the recreation suitability determinations made in the 1988 forest plan (as amended) for summer and winter motorized and non-motorized recreation opportunities. All of the recreation activities and opportunities provided for in the 1988 forest plan would continue to be available under the no action alternative and there would be no effect to the lands identified as suitable for recreation under the 1988 forest plan. For a comparison between alternatives of management areas suitable for summer and winter motorized and non-motorized recreation opportunities, see table 239.

Under the no action alternative, no changes to the Forest's existing ROS mapping would occur. Recreation opportunities would still be available in a variety of ROS classes including semi-primitive non-motorized, semi-primitive motorized, roaded natural, roaded modified and rural, representing a broad array of natural settings, managerial, and social environments in which users could participate in their preferred activities.

Implementation of the no action alternative would provide the greatest number of total Forest acres open to both winter and summer motorized recreation opportunities when compared to the action alternatives. Total Forest acres open to non-motorized recreation opportunities remains fairly consistent (within 3,000 acres) among all the alternatives. Table 241 compares the number of management area acres closed to over-snow vehicle recreation opportunities by alternative and shows the total number of acres open to over-snow vehicles by alternative. For a comparison of the number of acres open to summer motorized and non-motorized recreation opportunities by alternative, see table 243.

Table 241. Total acres closed to over-snow vehicles by alternative

	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Active Management Area	0	0	0	0	132,500	0
Backcountry	0	90,800	19,000	129,100	4,800	174,300
Backcountry Motorized	0	9,500	800	4,800	800	4,800
Focused Restoration	0	51,400	0	57,500	0	0
General Restoration	0	121,800	62,500	120,400	0	0
Late Forest Structure	0	0	117,500	0	0	0
Recommended Wilderness	0	101,400	209,000	61,700	220,300	15,900

	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Research Natural Area	5,300	5,800	5,800	5,800	5,800	5,800
Responsible Management Area	0	0	0	0	0	117,000
Restoration Area	0	0	0	0	46,800	61,100
Scenic Byways	0	6,000	5,700	5,700	5,700	5,700
Semi-Primitive Non-Motorized	86,900	0	0	0	0	0
Scenic/Winter Range	76,100	0	0	0	0	0
Winter Range	126,500	0	0	0	0	0
Wilderness	31,400	31,400	31,400	31,400	31,400	31,400
Total Acres Closed to Over-snow Vehicle Recreation Opportunities	325,300	419,200	450,500	416,300	448,000	416,000
Total Acres Open to Over-snow Vehicle Recreation Opportunities	780,300	686,900	653,600	687,200	656,300	687,800
Total Acres by Alternative	1,105,600	1,106,100	1,104,100	1,103,500	1,104,300	1,103,800

*Acres vary by alternative due to the GIS methodology used to count boundary areas.

Motorized Recreation Trails

Implementation of the no action alternative would maintain the existing number of motorized and non-motorized trail opportunities currently available across the Forest. Under this alternative, approximately 181 miles of summer trail would be managed for summer motorized recreation opportunities and 342 miles of summer trail would be managed for summer non-motorized recreation opportunities. For a comparison of summer motorized and non-motorized recreation trail miles between alternatives, see table 242. Trails managed for summer motorized recreation would continue to provide opportunities for ATVs, motorcycles, and four-wheel drive vehicles greater than 50 inches wide (jeep trails). Trails managed for summer non-motorized recreation would continue to provide opportunities for hiking, mountain biking, and pack and saddle stock use. Under the no action alternative, there would be no change in the number of miles or the types of managed summer motorized and non-motorized recreation trail opportunities on the Forest.

Table 242. Comparison of summer motorized and non-motorized trail miles by alternative

	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Miles of Summer Motorized Trail	181	181	142	181	142	181
Miles of Summer Non-motorized Trail	342	342	382	342	382	342

The no action alternative would maintain the spatial distribution of existing summer motorized trail opportunities across the Forest and would continue to provide the existing mix of motorized and non-motorized trail systems within each of the three counties in which the Colville National Forest is located. Likewise, this alternative would maintain the number of backcountry acres managed for summer motorized recreation trail use at approximately 13,600 acres (1 percent of the Forest) as designated in the 1988 forest plan as semi-primitive motorized recreation management areas. The number of semi-primitive motorized acres available in the no action alternative represents the third fewest acres available for backcountry motorized recreation trails of all the alternatives. Overall,

summer motorized recreation trail opportunities would be allowed on approximately 906,200 acres (82 percent of the Forest). Summer non-motorized recreation trail opportunities would be allowed on nearly 100 percent of the Forest's land base (except for research natural areas), of which approximately 118,300 acres (11 percent) would provide for summer non-motorized recreation trail opportunities in a non-motorized setting (includes semi-primitive non-motorized recreation and wilderness management areas). For a comparison of management area acres open to motorized and non-motorized use, see table 243.

Under the no action alternative, there would be a greater opportunity to access summer non-motorized recreation trails than summer motorized recreation trails for several reasons. First, the number of non-motorized trail miles would outnumber motorized trail miles by nearly two to one. Second, the acres available for summer backcountry non-motorized trail opportunities would outnumber the acres available for summer backcountry motorized trail opportunities by approximately 104,700 acres. Third, additional non-motorized trails could be constructed anywhere on the Forest (except research natural areas) under the proposed action, while summer motorized recreation trails could only be located outside of old forest-dependent species habitat, caribou habitat, recreation/wildlife, research natural area, wilderness management, and semi-primitive non-motorized recreation management areas, which reduces the potential Forest acreage available for new summer motorized trail opportunities by 18 percent, as compared to new non-motorized trail opportunities. Fourth, the summer motorized trail opportunities in the no action alternative are geographically limited to remote areas of eastern Ferry County and the border between Stevens and Pend Oreille Counties, while summer non-motorized trail opportunities are located evenly across the Forest, with many of them easily accessible by passenger vehicle from communities adjacent to the Forest.

Table 243. Acres managed for summer backcountry motorized and backcountry non-motorized trail opportunities and total forest acres, by alternative

	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Acres Managed for Backcountry Motorized Trail Opportunities	13,600	61,700	6,700	54,600	6,600	53,700
Acres Managed for Backcountry Non-motorized Trail Opportunities, excluding Wilderness and Recommended Wilderness	86,900	90,800	20,200	129,100	4,800	174,300
Forest Acres Managed for Backcountry Non-motorized Trail Opportunities, Including Wilderness and Recommended Wilderness	118,300	223,600	260,600	222,200	256,500	221,700
Total Forest Acres Open to Motorized Trail Opportunities	906,200	874,700	838,900	875,700	842,000	876,300
Total Forest Acres Open to Non-motorized Trail Opportunities	1,100,900	1,100,400	1,098,400	1,097,900	1,098,600	1,098,000
Total Forest Acres	1,105,600	1,104,100	1,104,100	1,103,500	1,104,100	1,103,700

Note: Acres vary by alternative due to the GIS methodology used to count boundary areas.

Access

Under the no action alternative, desired conditions for road density are based on the specific habitat needs of various wildlife species such as caribou and grizzly bear. Road management decisions would be based on the need for public access, safety, forest management and resource needs. Decisions on road decommissioning would be made at the project level based on information provided by resource specialists and recommendations contained in the Forest's most recent Travel Analysis Report pursuant to subpart A of the 2005 Travel Management Rule. During these project-level discussions, reductions in road density could be proposed to meet resource needs that would reduce roaded access for recreation uses. The level of effect associated with reducing road density would be dependent on the length of open system roads that would be proposed for decommissioning—the greater the length, the greater the potential reduction in roaded recreation access. However, if Maintenance Level 1 roads—those roads already closed to vehicle use by the public—are selected for decommissioning instead of open system roads, then there would be a corresponding reduction in the potential loss of open road access for recreation use. Similarly, roads decommissioned in riparian areas would have a greater impact on roaded access for recreation use than those located in upland areas since most recreation use on the Forest occurs in riparian areas associated with lakeshores, rivers, and streams. A reduction in open road density would reduce access to dispersed recreation opportunities such as hunting, fishing, camping, driving for pleasure, and gathering of forest products. However, since most dispersed recreation activities can be enjoyed throughout the Forest, localized road decommissioning would likely result in users shifting their dispersed recreation access needs to nearby roads in order to participate in the same dispersed recreation activities, resulting in little to no reduction in the public's participation in or access to dispersed recreation opportunities on the Forest.

Under the no action alternative, a reduction in roaded access for trail and developed site recreation opportunities would not be anticipated since these opportunities are generally located along major travel routes. These major travel routes would typically be improved or rerouted (instead of decommissioned) to correct resource concerns to ensure continued access to the Forest's developed recreation infrastructure.

Implementation of the no action alternative would likely result in fewer impacts to roaded access for recreation than alternatives R and P, which have a desired condition for road density of 1 to 2 miles per square mile and could result in a greater reduction in system roads, especially in key watersheds and watersheds where the existing road densities are above the desired condition. The no action alternative would have similar effects on roaded access for recreation as the proposed action that has a desired condition for road density of 2 to 3 miles per square mile, which is close to the existing condition (at the Forest scale) for most watersheds. The no action alternative would have a similar effect on roaded access for recreation as alternatives B and O, which do not have a desired condition for road density and would cap the road miles at the level of the existing condition.

Recommended Wilderness

The no action alternative contains no recommended wilderness and would not contribute to the need to adequately represent underrepresented ecosystems (identified during the wilderness evaluation process) by providing additional wilderness in the Okanogan Highlands ecoregion. Management of backcountry areas would continue to be covered under direction contained in the 1988 forest plan for semi-primitive, motorized recreation (SPM) and semi-primitive, non-motorized recreation (SPNM).

This alternative maintains the existing condition for SPM and SPNM recreation opportunities and does not provide an option to increase wilderness based recreation opportunities on the Forest. The no action alternative retains approximately 13,600 (1 percent of the Forest) SPM acres for backcountry motorized recreation opportunities and approximately 86,900 (8 percent of the Forest) SPNM acres of backcountry for non-motorized recreation opportunities. A comparison of SPM (Backcountry Motorized in the action alternatives) and SPNM (Backcountry in the action alternatives) management area acres by alternative can be found in table 243.

Under this alternative, the Forest's only backcountry recreation rental cabin would continue to be located in an SPNM management area. Therefore, the cabin would remain available to the public for recreational lodging and access to the cabin would continue through non-motorized modes of transportation.

Existing motorized trail systems located in SPM management areas, including Owl Mountain, Jackknife, Twin Sisters, and South Huckleberry would continue to be managed for motorized use. As a result, there would be no change in existing summer backcountry motorized recreation opportunities if the no action alternative is implemented.

Likewise, there would be no change in the number of mountain bike trail miles that are located in SPM and SPNM management areas. All trails currently open to mountain bikes would continue to be open to that use under the no action alternative.

Table 244. Backcountry acres open to mountain bike trails and miles of existing trail that would be open to mountain bikes by alternative

	No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
Backcountry Acres Open to Mountain Bike Trails	100,500	152,600	26,900	183,700	11,400	228,000
Miles of Non-motorized Trail Open to Mountain Bike Use in a Backcountry Management Area	153	71	8	140	0	189
Total Miles of Non-motorized Trail Open to Mountain Bike Use	301	151	88	223	80	272

The number of trail miles that are open to motorized trail maintenance and reconstruction equipment across the Forest would remain the same. Therefore, the average number of hours and people needed to complete annual maintenance tasks should not change. As a result, trail maintenance and reconstruction costs would not be expected to change as a result of implementing the no action alternative.

Over-snow vehicle opportunities on the Forest would continue to be available at a level consistent with the existing condition. Existing SPNM, RNA, Winter Range, and wilderness management areas would continue to be closed to over-snow vehicle use. Implementation of the no action alternative would result in no change in legal over-snow vehicle recreation opportunities across the Forest.

Proposed Action

The proposed action provides for a balanced mix of wilderness, motorized, and non-motorized recreation opportunities to address the increases in visitor use due to population growth, and changing demographics. It offers a range of recreation settings by designating and distributing management areas in both the front and backcountry to accommodate how people use and access the Forest. It allows for the existing level of authorized road access with approximately 74 percent of the Forest in a roaded recreation setting (same as the 1988 forest plan).

The following summarizes the effects to recreation resources associated with the implementation of the proposed action. Issues analyzed include the identification of lands suitable for recreation use, motorized recreation trails, access, and recommended wilderness.

The proposed action retains the recreation suitability determinations completed as part of the 1988 forest plan for summer and winter motorized and non-motorized recreation opportunities. Changes would be made to the Forest's ROS map to accurately reflect increases in semi-primitive motorized and semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness, Backcountry and Backcountry Motorized management areas) and to reflect the increase in the Roaded Natural ROS class that resulted from the absorption of the ROS sub-class of Roaded Modified in the 1988 forest plan into the Roaded Natural ROS classification in the revised forest plan. The number of summer motorized recreation trail miles would remain the same and the acres of backcountry motorized recreation management areas would increase by approximately 48,000 acres when compared to the existing condition. This alternative would provide the greatest number of summer motorized trail miles (along with no action and alternatives P and O) and the most acres managed for backcountry motorized recreation. Road access to dispersed recreation opportunities, especially those in riparian areas, could be reduced slightly over the life of

the plan as projects are implemented to move the Forest toward a desired condition for road density of 2 to 3 miles per square mile. Expected levels of road decommissioning should result in little or no change in the public's ability to participate in a variety of summer and winter dispersed and developed recreation opportunities across the Forest.

The proposed action includes the third highest number of recommended wilderness acres, the third highest number of backcountry management area acres, and the highest number of backcountry motorized management area acres of the six alternatives. Inconsistent uses (such as mountain bike and chainsaw use) would be allowed to continue temporarily in recommended wilderness until the areas are designated as wilderness by Congress. Most backcountry recreation opportunities would continue across the Forest. However, the miles of trail open to mountain biking would be reduced if Congress designates the recommended wilderness as wilderness, resulting in the third lowest number of miles open to mountain biking when compared to the other alternatives. Trail miles in this document are based on the assumptions located on page 708, including: (1) that recommended wilderness will be designated as wilderness by Congress, and (2) that action will be taken to stop mechanized and motorized uses in designated wilderness.

Once the recommended wilderness areas are designated as wilderness by Congress, motorized equipment for trail maintenance and reconstruction would no longer be permitted on approximately 125 miles of trail accessing the recommended wilderness, resulting in a potential increase in trail maintenance and reconstruction costs across the Forest. Opportunities for over-snow vehicle recreation would be reduced as a result of an increase in acres associated with backcountry (semi-primitive non-motorized), research natural area, and recommended wilderness management areas as well as increases in designated winter range. The proposed action offers the third lowest number of acres open to over-snow vehicle recreation opportunities when compared to the other alternatives.

Identification of Lands Suitable for Recreation Use

The proposed action retains the recreation suitability determinations made in the 1988 forest plan (as amended) for summer and winter motorized and non-motorized recreation opportunities. All of the types of recreation activities and opportunities provided for in the 1988 forest plan would continue to be available under the proposed action, but may not be available in all of the same locations as under the no action alternative. For a comparison between alternatives of management areas suitable for summer and winter motorized and non-motorized recreation opportunities, see table 239.

Under the proposed action, changes would be made to the Forest's ROS map to accurately reflect increases in the semi-primitive motorized and semi-primitive non-motorized ROS classes as a result of increased acreages associated with recommended wilderness, backcountry, and backcountry motorized management areas. In addition, the ROS map would be updated to reflect the increase in the roaded natural ROS class as a result of the absorption of the 1988 forest plan's ROS sub-class of roaded modified into the roaded natural classification in the revised forest plan. Recreation opportunities would still be available across the Forest in a variety of ROS classes including semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural, representing a broad array of natural settings, managerial, and social environments in which users could participate in their preferred activities. The ROS class acreages for each alternative are summarized in table 245.

Table 245. Acres and percentage of the Forest in each (recreation opportunity spectrum) ROS class by alternative

ROS Class	No Action Acres (percent)	Proposed Action Acres (percent)	Alt. R Acres (percent)	Alt. P Acres (percent)	Alt. B Acres (percent)	Alt. O Acres (percent)
Urban (U)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rural (R) – 49 Degrees North Ski Area	2,000 (0.002%)	2,100 (0.002%)	2,100 (0.002%)	2,100 (0.002%)	2,100 (0.002%)	2,100 (0.002%)
Roaded Modified (RM)	551,000 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Roaded Natural (RN)	295,700 (27%)	810,000 (74%)	817,400 (74%)	818,300 (74%)	817,400 (74%)	817,400 (74%)
Semi-Primitive Motorized (SPM)	107,400 (10%)	62,100 (6%)	6,600 (0.6%)	54,800 (5%)	6,600 (0.6%)	54,800 (5%)
Semi-Primitive Non-Motorized (SPNM)	114,500 (10%)	196,200 (18%)	244,400 (22%)	195,300 (18%)	244,400 (22%)	196,200 (18%)
Primitive (P)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Wilderness	31,400 (3%)	31,400 (3%)	31,400 (3%)	31,400 (3%)	31,400 (3%)	31,400 (3%)
Total Acres	**1,105,200**	**1,106,100**	**1,104,100**	**1,103,600**	**1,104,300**	**1,103,800**

Note: Acres vary by alternative due to the GIS methodology used to count boundary areas.

Implementation of the proposed action would provide the 4th highest number of total Forest acres open to winter over-snow vehicle recreation opportunities and the 4th highest number of total Forest acres open to summer motorized recreation opportunities when compared to the other alternatives. Total Forest acres open to non-motorized recreation opportunities remains fairly consistent (within 3,000 acres) amongst all the alternatives. For a comparison of the number of acres open to winter over-snow vehicle recreation opportunities by alternative, see table 241. For a comparison of the number of acres open to summer motorized and non-motorized recreation opportunities by alternative, see table 243.

Motorized Recreation Trails

The proposed action would maintain the same number of summer motorized and non-motorized trail miles across the Forest as no action. Under this alternative, approximately 181 miles of summer trail would be managed for motorized recreation opportunities and 342 miles of summer trail would be managed for non-motorized recreation opportunities. For a comparison of summer trail miles managed for motorized and non-motorized recreation opportunities by alternative, see table 242. Trails managed for motorized recreation would continue to provide opportunities across the Forest for ATVs, motorcycles, and four-wheel-drive vehicles greater than 50 inches wide (jeep trails). Trails managed for summer non-motorized recreation would continue to provide opportunities for hiking, mountain biking, and pack and saddle use. There would be no change in the number of motorized trail miles or the types of managed motorized and non-motorized recreation trail opportunities on the Forest.

The proposed action would maintain the spatial distribution of existing summer motorized trail opportunities and the existing availability of summer motorized recreation trail opportunities located in backcountry settings. The proposed action would continue to provide the existing mix of motorized and non-motorized trail systems within each of the three counties in which the Colville National Forest is located. Under the proposed action, approximately 61,700 acres (6 percent of the Forest) would be designated as backcountry motorized management areas. The proposed action offers the most backcountry motorized management area acres of the six alternatives. In total, summer motorized recreation trail use would be allowed on approximately 874,700 acres (79 percent) across the Forest. Summer non-motorized recreation trail opportunities would be allowed on nearly 100 percent of the Forest's land base (except for research natural areas), of which approximately 223,700 acres (20 percent) would provide for summer non-motorized recreation trail opportunities in a non-motorized setting (includes backcountry, wilderness, and recommended wilderness management areas). For a comparison of management area acres open to motorized and non-motorized recreation trail opportunities, see table 243.

Access

Under the proposed action, the desired condition for road density on the Colville National Forest would be 2 to 3 miles per square mile, which is close to the existing forestwide road density. In those watersheds already meeting the desired condition, there would be no need to decommission roads to show movement toward the road density desired condition. If no roads are decommissioned, there would be no effect to roaded access for recreation use in those watersheds. However, it is still likely that some road decommissioning would occur in those watersheds meeting the desired condition for road density to improve resource and habitat conditions on a project-by-project basis. Effects of this type of road decommissioning would be the same as those described under the no action alternative.

In the remaining watersheds that would require reductions in road density to meet the desired condition, there would be a corresponding reduction in roaded access for recreation use depending on the specific roads selected to be decommissioned. The level of effect associated with reducing road density in these watersheds would be dependent on the length of open system roads that would be proposed for decommissioning—the greater the length, the greater the potential reduction in recreation access. However, if Maintenance Level 1 roads—those roads already closed to vehicle use by the public—are selected for decommissioning instead of open system roads, then there would be a corresponding reduction in the potential loss of open road access for recreation use. Similarly, roads decommissioned in riparian areas would have a greater impact on access for recreation use than those located in upland areas because most recreation use on the Forest occurs in riparian areas associated with lakeshores, rivers, and streams.

Under the proposed action, a reduction in roaded access for trail and developed site recreation opportunities would not be anticipated because these opportunities are generally located along major travel routes. These major travel routes would typically be improved or rerouted (instead of decommissioned) to correct resource concerns and ensure continued access to the Forest's recreation infrastructure. A reduction in open road density would reduce motorized access to dispersed recreation opportunities such as hunting, fishing, camping, driving for pleasure, and gathering of forest products. However, since most dispersed recreation activities can be enjoyed throughout the Forest, localized road decommissioning would likely result in users shifting their access needs to nearby roads in order to participate in the same dispersed recreation activities. As a result, a minor loss of road access would result in little to no reduction in the public's participation in or access to recreation opportunities on the Forest.

Implementation of the proposed action would likely result in fewer impacts to roaded access for recreation than alternatives R and P, which have a desired condition for road density of 1 to 2 miles per square mile and could result in a greater reduction in system roads, especially in key watersheds and watersheds where the existing road densities are above the desired condition. The proposed action would likely result in similar effects to roaded access for recreation as no action and alternatives B and O, all of which do not have a desired condition for road density and would implement road decommissioning projects based on resource and habitat needs identified during project-level analysis.

Recommended Wilderness

The proposed action recommends 9 percent (approximately 101,400 acres) of the Forest be recommended as additional wilderness, including the following areas that may be suitable for inclusion in the National Wilderness Preservation System: Salmo-Priest Adjacent, Abercrombie-Hooknose, Hoodoo, Profanity, and Bald-Snow. For a comparison of recommended wilderness acreage by alternative, see table 246. Each of the areas that may be suitable for inclusion in the National Wilderness Preservation System in this alternative were evaluated by the forest plan revision team according to the process identified in FSH 1909.12 Chapter 70 (January 31, 2007 version) and determined to contribute to the capability, availability, and need for additional wilderness in the Okanogan Highlands ecoregion. The southern end of the Profanity area that may be suitable for inclusion in the National Wilderness Preservation System and the northern end of the Bald-Snow area that may be suitable for inclusion in the National Wilderness Preservation System were not brought forward as recommended wilderness in the proposed action to allow for established recreation uses to continue including mountain biking, maintenance of an historic fire lookout, and use of a backcountry recreation rental cabin. These recreation opportunities were identified during the 2009 wilderness evaluation process and the Forest Supervisor at the time the proposed action was selected supported the public benefits associated with these recreation opportunities over the recreational need for the affected acres to be recommended as additional wilderness in the Okanogan Highlands ecoregion. At least one area that may be suitable for inclusion in the National Wilderness Preservation System under this alternative would be managed as recommended wilderness in each of the three counties located within the Forest's boundary.

Table 246. Acres of recommended wilderness by alternative

No Action	Proposed Action	Alt. R	Alt. P	Alt. B	Alt. O
0	101,400	209,000	61,700	220,300	15,900

Under this alternative, inconsistent recreation opportunities and motorized trail maintenance and reconstruction activities would be allowed to continue until Congress designates the recommended wilderness areas as wilderness. No new inconsistent uses would be allowed. Even with the continuation of inconsistent uses, the wilderness characteristics associated with the recommended wilderness areas listed in the proposed action are not expected to be altered prior to designation as wilderness by Congress.

Existing inconsistent uses within the recommended wilderness areas include mountain biking, chain saw use and motorized trail maintenance and reconstruction. These uses are of short duration, utilize existing developments (trails), and in the case of motorized trail maintenance and reconstruction, can increase (due to the lower cost of most types of motorized trail maintenance) the level of maintenance the existing trail system would receive on an annual basis over the life of the revised forest plan. Increased trail maintenance could reduce the likelihood of resource damage (excessive

erosion, slumps, etc., along trail routes) caused by wind and storm events, which would help maintain or improve the recommended wilderness area's natural appearance and the functioning of the recommended wilderness area's ecological systems and plant communities.

Allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness areas' "capability" determinations made as part of the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System. The "capability" determination was based on an assessment of the principal wilderness characteristics—natural, undeveloped, outstanding opportunities for solitude or primitive and unconfined recreation, special features and values, manageability—as identified in the Wilderness Act.

The natural appearance and ecosystem health of each recommended wilderness area would be unaltered by the presence of mountain biking and motorized trail maintenance. There would be no expected increase in the presence of non-native species, the presence of developments that would change the free-flowing nature of area streams, the level of light pollution, or the presence of pollutants. The recommended wilderness area would remain undeveloped except for the presence of trails and would continue to provide opportunities for solitude or primitive and unconfined recreation. Each recommended wilderness would continue to support the existing ecologic, geologic, scientific, educational, scenic, historical, and cultural features of significance contained within each recommended wilderness area. Finally, there would be no change in the Colville National Forest's ability to manage the boundary of each recommended wilderness area if mountain biking and motorized trail maintenance are allowed to continue.

The presence of mountain biking and motorized trail maintenance may affect the degree of solitude and level of primitive recreation that some users experience while recreating in the recommended wilderness areas while these activities are actively taking place. Whether the effect of these activities is positive or negative and how strong the effect is would depend on each individual user's value system and cannot be effectively measured. However, since mountain bike use and motorized trail maintenance do not represent long-term or irreversible commitments of resources, the non-esoteric effects to solitude and level of primitive recreation would be temporary. In addition, if the recommended wilderness areas are designated as wilderness by Congress, the effects on solitude and level of primitive recreation would be eliminated.

Allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness areas' "availability" determinations made as part of the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System. All NFS lands determined to meet wilderness "capability" requirements are considered potentially "available" for wilderness designation. The determination of "availability" is conditioned by the value of and need for the wilderness resource, compared to the value of and need for other resources. Since no new inconsistent uses would be allowed under the proposed action, there would be no change in the basis for the 2009 "availability" determination.

Likewise, allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness areas' "need" determinations made as part of the 2009 potential wilderness evaluation process. In determining whether there is a "need" to recommend an area as recommended wilderness, the following factors are considered:

1. The location, size, and type of other wildernesses in the general vicinity, their distance from the proposed area, the accessibility of the area to population centers and user groups, and public demand for wilderness.

2. Present visitor pressure on other wildernesses, the trends in use, changing patterns of use, population expansion factors, and trends and changes in transportation.

3. The extent to which nonwilderness lands on the NFS unit or other Federal lands are likely to provide opportunities for unconfined outdoor recreation experiences.

4. The need to provide a refuge for those species that have demonstrated an inability to survive in less than primitive surroundings or the need for a protected area for other unique scientific values or phenomena.

5. Within social and biological limits, management may increase the capacity of established wildernesses to support human use without unacceptable depreciation of the wilderness resource.

6. An area's ability to provide for preservation of identifiable landform types and ecosystems which is helpful in rounding out the National Wilderness Preservation System.

Factors 1, 2, 3, 5, and 6 would not be altered by the presence of mountain biking or motorized trail maintenance and reconstruction. Factor 4 has been analyzed by resource specialists (wildlife, rare plants, fisheries, etc.) in their respective analysis for the revised forest plan and no species were identified that would be unable to survive if mountain biking and motorized trail maintenance and reconstruction were allowed to continue. Therefore, mountain biking and motorized trail maintenance and reconstruction would not affect the "need" determination made in the 2009 wilderness evaluation process.

Ultimately, inconsistent uses, including mountain biking and motorized trail maintenance, were identified during the 2009 potential wilderness evaluation process and their presence did not preclude the areas that may be suitable for inclusion in the National Wilderness Preservation System from meeting the evaluation criteria (capability, availability, and need) for inclusion on the inventory. Therefore, allowing these inconsistent uses to continue at use rates similar to when the wilderness evaluations were completed should not detract from the inherent wilderness characteristics associated with the five recommended wilderness areas.

This alternative strives to balance the public's desire for additional wilderness with existing backcountry recreation opportunities such as mountain biking and OHV riding. As a result, not all of the areas that may be suitable for inclusion in the National Wilderness Preservation System that have wilderness characteristics were recommended as wilderness. Instead, this alternative retains approximately 61,700 acres (6 percent of the Forest) of backcountry for motorized recreation opportunities and approximately 90,800 acres (8 percent of the Forest) of backcountry for non-motorized recreation opportunities that do not conform with wilderness management direction such as mountain biking and the use of game carts. See table 243 for a comparison of backcountry and backcountry motorized management acres by alternative.

Eleven areas that may be suitable for inclusion in the National Wilderness Preservation System (Bodie Mountain, Clackamas Mountain, Cougar Mountain, Deer Creek, Grassy Top, Hall Mountain, Harvey Creek, Jackson Creek, Quartzite, South Fork Mountain, and Thirteenmile) are designated as backcountry management areas under the proposed action. In addition, the southern end of the Profanity area and the northern end of the Bald-Snow area were also retained as backcountry. Combined, these areas that may be suitable for inclusion in the National Wilderness Preservation System would provide approximately 75 miles of trail for backcountry mountain bike recreation

opportunities. Managing these areas as backcountry would allow the Forest to continue to manage its only backcountry rental cabin and to maintain an historic fire lookout.

The areas that may be suitable for inclusion in the National Wilderness Preservation System designated as backcountry motorized management areas in this alternative include the Owl Mountain, Jackknife, Twin Sisters, South Huckleberry and Lost Creek. Combined, these areas provide access to all of the Forest's existing backcountry motorized trail systems. As a result, there would be no change in the existing summer motorized vehicle recreation opportunities if this alternative was implemented.

If the recommended wilderness areas listed in this alternative become designated wilderness, mountain bike trail opportunities would no longer be available on approximately 101,400 acres across the Forest. This equates to a 150-mile (50 percent) reduction in the number of available mountain bike trail opportunities that are associated with the Forest's existing summer non-motorized trail system. For a comparison between alternatives of backcountry management acres open to mountain biking and the number of trail miles open to mountain biking, see table 244. Below is a list of the proposed action's recommended wilderness areas and the trails that would be closed to mountain bike use if the recommended wilderness is designated as wilderness by Congress.

- Bald Snow: Barnaby Buttes #7, Barnaby Buttes #70, Edds Mountain #3, Kettle Crest #13 South (portion of trail south of Snow Peak Cabin).
- Hoodoo: Hoodoo #17, Emerald Lake #94.
- Profanity: Wapaloosie #15, Timber Ridge #17, Copper Butte (Marcus)#8, Old Stage #1, Old Stage #75, Midnight Ridge #41, Lambert #47, Leona #49, Leona Loop #49.1, Stickpin #71, Ryan Cabin #30, Big Lick #30.1, Profanity #32, Long Alec #43.1, Taylor Ridge #74 (west of Forest road 6113 – Bulldog Cabin Road), Kettle Crest #13 North (north of its intersection with Jungle Hill Trail #16).
- Abercrombie – Hooknose: Sherlock Peak #139, South Fork Silver Creek #123, North Fork Silver Creek 119, Abercrombie #117, Flume Creek #502.
- Salmo-Priest Adjacent: Slate Creek #525, Halliday #522, North Fork Sullivan Creek #507, Red Bluff #553, Elk Creek #560, Crowell Ridge #515, Salmo Divide #535, Shedroof Cutoff #511.

If the recommended wilderness areas listed under the proposed action are designated as wilderness by Congress, trail maintenance and reconstruction costs would increase on the 150 miles of trail that access approximately 101,400 acres of recommended wilderness. This cost increase is based on the required change from using motorized (chainsaws, power toters, trail dozers, etc.) trail maintenance and reconstruction equipment to non-motorized equipment (cross-cut saws, pack mules, pulaskis, etc.) which would likely result in annual tasks, such as spring logout, and reconstruction efforts taking more time to complete, additional people, or both.

Implementation of the proposed action would prohibit over-snow vehicle use on approximately 93,900 acres currently open to over-snow vehicle recreation opportunities in the no action alternative as a result of an increase in acres associated with backcountry (semi-primitive non-motorized), research natural area, and recommended wilderness management areas as well as changes in designated winter range. However, the majority of the additional acres that would be closed to over-snow vehicle use under the proposed action consist of heavily vegetated slopes and terrain that is difficult to access and currently supports only limited over-snow vehicle recreation opportunities. Therefore, implementation of the proposed action would result in little to no reduction in the amount of over-snow vehicle recreation opportunities available on the Forest when compared to no action.

For a comparison of acres open to over-snow vehicle recreation opportunities by alternative, see table 241.

Alternative R

Alternative R responds to public comments that support old forest reserve land allocations where old forest habitat is the management emphasis and those who want to continue to use a 21-inch diameter limit on cutting live trees to maintain old structure forest habitats. It also responds to those who advocate for increased wilderness across the Forest.

Public issues concerning potential impacts that road access and summer and winter motorized trail use may have on aquatic, riparian, and wildlife habitats, including grizzly core areas and habitat connectivity, are addressed through low road densities, a low amount of backcountry motorized areas, and the high proportion of recommended wilderness areas.

This alternative is based on an alternative developed by a coalition of conservation groups.

The following summarizes the effects to recreation resources associated with the implementation of alternative R. Issues analyzed include the identification of lands suitable for recreation, motorized recreation trails, access, and recommended wilderness.

Alternative R retains the recreation suitability determinations completed as part of the 1988 forest plan for summer and winter motorized and non-motorized recreation opportunities. Changes would be made to the Forest's ROS map to accurately reflect decreases in the semi-primitive motorized ROS class and increases in the semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness) and to reflect the increase in the Roaded Natural ROS class that resulted from the absorption of the ROS sub-class of Roaded Modified in the 1988 forest plan into the Roaded Natural ROS classification in the revised forest plan. The number of summer motorized recreation trail miles would be reduced by 22 percent (along with alternative B, this represents the largest reduction in motorized trail miles of all the action alternatives) and the acres of backcountry motorized recreation management areas would be reduced by 51 percent (second largest reduction in acres of the action alternatives) when compared to the existing condition. Alternative R also reduces the Forest's existing backcountry jeep trail system from 39 miles of trail to zero. Trail miles in this document are based on the assumptions located on page 708, including: (1) that recommended wilderness will be designated as wilderness by Congress, and (2) that action will be taken to stop mechanized and motorized uses in designated wilderness.

Road access to dispersed recreation opportunities, especially those in riparian areas associated with key watersheds would be reduced over the life of the plan as projects are implemented to move the Forest toward a desired condition for road density of 1 to 2 miles per square mile. Expected levels of road decommissioning are expected to result in a gradual decrease in the public's ability to participate in a variety of summer and winter vehicle accessible dispersed recreation opportunities across the Forest. Alternative R includes the second highest number of recommended wilderness acres, the second lowest number of backcountry management area acres, and the second lowest number of backcountry motorized management area acres of the six alternatives. Inconsistent uses (such as mountain bike and chain saw use) would not be allowed to continue in recommended wilderness prior to designation as wilderness by Congress. Some existing backcountry recreation opportunities would no longer be available on the Forest (rental cabin, jeep trails). The miles of trail open to mountain biking would be reduced (a direct result of additional recommended wilderness areas), resulting in the second lowest number of miles open to mountain biking when compared to the other alternatives.

Motorized equipment for trail maintenance and reconstruction would no longer be permitted on approximately 213 miles of trail accessing recommended wilderness, resulting in a potential increase in trail maintenance and reconstruction costs across the Forest. Opportunities for over-snow vehicle recreation would be reduced when compared to the no action alternative as a result of the large increase in acres associated with recommended wilderness and additional acreage associated with RNAs and designated Winter Range. Alternative R provides the lowest number of acres open to over-snow vehicle recreation opportunities when compared to the other alternatives.

Identification of Lands Suitable for Recreation Use

Alternative R retains the recreation suitability determinations made in the 1988 forest plan (as amended) for summer and winter motorized and non-motorized recreation opportunities. All of the recreation activities and opportunities provided for in the 1988 forest plan would continue to be available under alternative R, but may not be available in all of the same locations as under the no action alternative. For a comparison between alternatives of management areas suitable for summer and winter motorized and non-motorized recreation opportunities, see table 239.

Under alternative R, changes would be made to the Forest's ROS map to accurately reflect decreases in the semi-primitive motorized ROS class and increases in the semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness) and to reflect the increase in the roaded natural ROS class that resulted from the absorption of the ROS sub-class of roaded modified in the 1988 forest plan into the roaded natural ROS classification in the revised forest plan. Recreation opportunities would still be available in a variety of ROS classes across the Forest including semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural, representing a broad array of natural settings, managerial, and social environments in which users could participate in their preferred activities. The ROS class acreages for each alternative are summarized in table 245.

Alternative R would provide both the lowest number of total Forest acres open to winter over-snow vehicle recreation opportunities and the lowest number of total Forest acres open to summer motorized recreation opportunities when compared to the other alternatives. Total Forest acres open to non-motorized recreation opportunities remains fairly consistent (within 3,000 acres) amongst all the alternatives. For a comparison of the number of acres open to winter over-snow vehicle recreation opportunities by alternative, see table 241. For a comparison of the number of acres open to summer motorized and non-motorized recreation opportunities by alternative, see table 243.

Motorized Recreation Trails

Compared to the no action alternative, alternative R decreases the miles of summer motorized recreation trails and increases the miles of summer non-motorized recreation trails available on the Forest. Under this alternative, approximately 142 miles of summer trail would be managed for motorized recreation opportunities and 382 miles of summer trail would be managed for non-motorized recreation opportunities. Converting 39 miles of motorized trail to a non-motorized classification results in a 22 percent decrease in the existing number of summer motorized recreation trail miles and an increase of 10 percent in the existing number of summer non-motorized recreation trail miles. For a comparison of summer trail miles managed for motorized and non-motorized recreation opportunities by alternative, see table 242. Implementation of alternative R would provide a reduced number of managed ATV and motorcycle trail opportunities across the Forest and would eliminate all of the Forest's existing trail opportunities (39 miles) associated with four- wheel-drive vehicles greater than 50 inches wide (jeep trails). Implementation of alternative R would increase the number of summer non-motorized recreation trail opportunities including hiking and pack and saddle

stock use as compared to the number of non-motorized recreation trail opportunities in the no action alternative.

Implementation of alternative R would decrease the spatial distribution of summer motorized recreation trail opportunities across the Forest as well as the availability of backcountry summer motorized trail opportunities. Unlike the no action alternative, which provides a mix of summer motorized and non-motorized trail opportunities throughout all three counties, alternative R would only provide a mix of summer motorized and non-motorized trail opportunities in Stevens and Pend Oreille Counties. In Ferry County, 39 miles of motorized trail would be converted to non-motorized trail, leaving 1.4 miles (less than 1 percent of the total trail miles in the county) of motorized trail available within the county. Likewise, the number of backcountry acres open to motorized recreation trail opportunities would be reduced from approximately 13,600 acres in the no action alternative to approximately 6,700 acres (the second fewest number of backcountry motorized management acres provided by any of the alternatives). This equates to a 51 percent reduction in backcountry areas open to motorized recreation trails.

Similarly, acres open to motorized recreation trail opportunities across the Forest would be reduced from approximately 906,200 acres in the no action alternative to approximately 838,900 acres in alternative R, a direct result of additional wilderness recommendations. This represents a 7.5 percent reduction in the number of acres available for motorized recreation trail opportunities across the Forest. Non-motorized recreation trail opportunities would be allowed on nearly 100 percent of the Forest's land base (except for RNAs) and the opportunity for trails to exist in a non-motorized setting (includes backcountry, wilderness, and recommended wilderness management areas) would increase from approximately 118,300 acres in the no action alternative to approximately 259,500 acres in alternative R, an increase of 219 percent. For a comparison of management area acres open to motorized and non-motorized recreation trail opportunities, see table 243.

Access

Under alternative R, the desired condition for road density on the Colville National Forest would be 1 to 2 miles per square mile, which is generally one-third to one-half lower than the existing condition for the Forest depending on the specific watershed. As a result, reductions in road density would be expected in the majority of roaded watersheds across the Forest to meet the desired condition. These reductions would likely be focused initially on the Forest's key watersheds (see alternative descriptions in chapter 2 for maps of key subwatersheds), where the restoration of failing road infrastructure would be a priority over the life of the revised forest plan. Given that projected Forest funding would allow for approximately 20 miles of decommissioning each year, the magnitude of potential road decommissioning over the 20-year life span of the forest plan would be approximately 400 miles, or 10 percent of the Forest's existing road system.

Reducing road density would likely result in a corresponding reduction in roaded access for recreation use depending on the specific roads selected to be decommissioned. The level of effect associated with reducing road density across all watersheds would be dependent on the length of open system roads that would be proposed for decommissioning—the greater the length, the greater the potential effect on recreation access. However, if some Maintenance Level 1 roads—those roads already closed to vehicle use by the public—are selected for decommissioning instead of open system roads, then there would be a corresponding reduction in the potential loss of open road access for recreation use. Similarly, roads decommissioned in riparian areas would have a greater impact on access for recreation use than those located in upland areas since most recreation use on the Forest occurs in riparian areas associated with lakeshores, rivers, and streams. Under this alternative,

decommissioning of roads located in riparian areas to move toward the desired condition for road density would be anticipated in key watersheds.

The proposed reduction in road density associated with alternative R would not be expected to result in a reduction in roaded access for trail and developed site recreation opportunities because these opportunities are generally located along major travel routes. These major travel routes would typically be improved or rerouted (instead of decommissioned) to correct resource concerns to ensure continued access to the Forest's recreation infrastructure. The proposed reduction in road density would likely reduce access to dispersed recreation opportunities such as hunting, fishing, camping, driving for pleasure, and gathering forest products. Since most dispersed recreation activities can be enjoyed throughout the Forest, localized road closures would likely result in users shifting their access needs to nearby roads. However, in key watersheds, where road decommissioning would be emphasized, road closures could reduce roaded access for dispersed recreation use to a level that would displace recreationists to other parts of the Forest i to participate in the same dispersed recreation activities.

At the Forest scale, the effect of decommissioning approximately 400 miles of road over a 20-year period would be a gradual decrease in roaded access for recreation use. The impact of this decrease in roaded access for recreation use would be focused on dispersed recreation opportunities and would be expected to be more obvious in riparian areas associated with key watersheds. Implementation of alternative R would likely result in greater impacts to roaded access for recreation than no action and alternatives B and O. Alternative R would have similar effects to roaded access as alternative P, which also has a desired condition for road density of 1 to 2 miles per square mile.

Recommended Wilderness

Alternative R recommends 19 percent (approximately 209,000 acres) of the Forest be recommended as additional wilderness including all inventoried areas that may be suitable for inclusion in the National Wilderness Preservation System (Abercrombie-Hooknose, Bald Snow, Cougar Mountain, Deer Creek, Hall Mountain, Harvey Creek, Hoodoo, Jackknife, Owl Mountain, Profanity, Quartzite, Salmo-Priest Adjacent, South Huckleberry, Thirteenmile, and Twin Sisters) on the Colville National Forest except for Lost Creek and those portions of Bodie Mountain, Clackamas Mountain, Jackson Creek, Grassy Top, and South Fork Mountain that are located primarily on adjacent Forests and would not meet the acreage requirements necessary to be recommended as wilderness on the Colville National Forest without a corresponding recommendation from the Idaho Panhandle and Okanogan-Wenatchee National Forests for the contiguous acres located on those units. For a comparison of recommended wilderness acreage by alternative, see table 246. Each of the areas that may be suitable for inclusion in the National Wilderness Preservation System in this alternative were evaluated by the forest plan revision team according to the process identified in FSH 1909.12 Chapter 70 (January 31, 2007 version) and determined to contribute to the capability, availability, and need for additional wilderness in the Okanogan Highlands ecoregion. Under alternative R, at least two areas that may be suitable for inclusion in the National Wilderness Preservation System would be recommended as wilderness in each of the counties in which the Forest is located.

This alternative recommends a large increase in wilderness and provides few opportunities for other motorized and mechanized backcountry recreation opportunities on the Forest. Several areas that may be suitable for inclusion in the National Wilderness Preservation System that contain well-established inconsistent uses (i.e., motorized trails, rental cabin, and mountain bike use) that may detract from the wilderness characteristics associated with the various areas that may be suitable for inclusion in the National Wilderness Preservation System are recommended as wilderness in alternative R. This alternative designates approximately 7,000 acres (less than 1 percent of the

Forest) of backcountry for motorized recreation opportunities and approximately 20,200 acres (1.8 percent of the Forest) of backcountry for recreation opportunities that do not conform with wilderness management direction, such as mountain biking. See table 243 for a comparison of backcountry and backcountry motorized management acres by alternative.

Under this alternative, recreation opportunities that would not conform to wilderness management direction (mountain biking, motorized trail use, motorized trail maintenance and reconstruction, historic structure maintenance, and rental cabin management) would not be allowed to continue prior to designation of the recommended wilderness areas as wilderness by Congress. As a result, the Forest's only backcountry cabin rental would need to be closed to the public and, over time, removed from the landscape. Likewise, a recently renovated historic fire lookout would be managed to a standard compatible with wilderness designation and may be allowed to slowly deteriorate over time. Since existing recreation opportunities that would not conform to wilderness management direction would not be allowed to continue prior to wilderness designation, there would be little or no potential that the wilderness characteristics associated with the identified recommended wilderness areas would be altered prior to their designation as wilderness by Congress.

Under alternative R, the Lost Creek area would be designated as a backcountry motorized management area. The three existing trails in this area that may be suitable for inclusion in the National Wilderness Preservation System are currently open to motorcycles only. The result of implementing alternative R would be a 39-mile (100 percent) reduction in backcountry motorized trail miles that are currently open to ATVs and four-wheel-drive vehicles greater than 50 inches wide and approximately a 70 percent decrease in the number of existing backcountry motorized recreation trail miles on the Forest.

Under this alternative, only those inventoried roadless areas included in the 2001 Roadless Rule inventory and the areas that may be suitable for inclusion in the National Wilderness Preservation System located primarily on adjacent national forests that would not meet the minimum acreage requirements to be recommended as wilderness would be designated as backcountry management areas. As a result, backcountry mountain bike trail opportunities would be eliminated on approximately 209,000 acres. This equates to a 213-mile (71 percent) reduction in the number of available mountain bike trail miles associated with the Forest's summer non-motorized trail system. For a comparison between alternatives of backcountry management acres open to mountain biking and the number of trail miles open to mountain biking, see table 244.

Below is a list of alternative R's recommended wilderness areas and the trails that would be closed to mountain bike and/or motorized use if the recommended wilderness areas are designated as wilderness by Congress.

- Cougar Mountain: 13 Mile #23
- Thirteen Mile: 13 Mile #23, Bear Pot #19.
- Bald Snow: Barnaby Buttes #7, Barnaby Buttes #70, Edds Mountain #3, Kettle Crest #13 South, Snow Peak #10, Sherman Peak Loop #72.
- Hoodoo: Hoodoo #17, Emerald Lake #94.
- Profanity: Columbia Mountain #24, Columbia Mountain Spur #24.1, Sherman Pass #82, Sherman Tie #96, Jungle Hill # 16, Wapaloosie #15, Timber Ridge #17, Copper Butte #8, Old Stage #1, Old Stage #75, Midnight Ridge #41, Lambert #47, Leona #49, Leona Loop #49.1, Stickpin #71, Ryan Cabin #30, Big Lick #30.1, Profanity #32, Long Alec #43.1, Taylor Ridge #74 (west of Forest road 6113 – Bulldog Cabin Road), Kettle Crest #13 North.

- Owl Mountain: Owl Mountain #102.
- Deer Creek: No trails.
- Jackknife: Thompson Ridge #107.
- Twin Sisters: Mack-King #98, Twin Sisters #109, US Mountain #76, US Spur #12600.
- South Huckleberry: South Huckleberry #12110, South Huckleberry 2 #12060.
- Quartzite: No trails.
- Abercrombie – Hooknose: Sherlock Peak #139, South Fork Silver Creek #123, North Fork Silver Creek 119, Abercrombie #117, Flume Creek #502.
- Salmo-Priest Adjacent: Slate Creek #525, Halliday #522, North Fork Sullivan Creek #507, Red Bluff #553, Elk Creek #560, Crowell Ridge #515, Salmo Divide #535, Shedroof Cutoff #511.
- Hall Mountain: Noisy Creek #588, Hall Mountain #540, Hall Mountain – Grassy Top #533.
- Harvey Creek: No trails.

Under alternative R, once the forest plan is approved and implemented, trail maintenance and reconstruction costs could increase on the 213 miles of trail that access approximately 209,000 acres of recommended wilderness. This cost increase is based on the required change from using motorized (chainsaws, power toters, trail dozers, etc.) trail maintenance equipment to non-motorized equipment (cross-cut saws, pack mules, pulaskis, etc.), which would likely result in annual tasks, such as spring logout, and reconstruction efforts taking more time to complete, additional people, or both.

Implementation of alternative R would prohibit over-snow vehicle use on approximately 125,200 acres currently open to over-snow vehicle recreation opportunities in the no action alternative as a result of the increase in acres associated with recommended wilderness, RNAs, and winter range. Approximately 55,000 acres of backcountry associated with the Twin Sisters, Jackknife, Owl Mountain and South Huckleberry areas that may be suitable for inclusion in the National Wilderness Preservation System are open to over-snow vehicles in the no action alternative and offer 39 miles of jeep trails (these trails are neither designated nor groomed for over-snow vehicle use) that are currently available for over-snow vehicle use. Implementation of alternative R would prohibit this use. As a result, implementation of alternative R would result in a high reduction in over-snow vehicle recreation opportunities across the Forest when compared to the no action alternative. For a comparison of acres open to over-snow vehicle recreation opportunities by alternative, see table 241.

Alternative P

Alternative P proposes the second highest amount of non-motorized backcountry of all alternatives and a lower amount of recommended wilderness than the proposed action to address public concerns that wilderness designation may result in lower revenue to local economies due to reduced recreational opportunities, such as mountain biking and cabin rental opportunities. The backcountry motorized management areas are similar to those in the proposed action. Participants in the Colville Collaborative group that worked on forest plan issues around wilderness and vegetation management agreed that the Kettle Crest was a special area for semi-primitive recreation opportunities, but did not agree that the area should be wilderness because of the impacts to recreation opportunities such as mountain biking and OHV riding as well as motorized trail maintenance. The proposed Kettle Crest Recreation Area (KCRA) was added as a component of this alternative to address public disagreement about recommending this area for wilderness. The backcountry and backcountry

motorized management areas within the KCRA would be managed to maintain their existing semi-primitive characteristics while allowing recreation activities that do not conform with wilderness designation to continue, such as mountain biking, OHV riding, and the use of a recreation rental cabin.

Public issues concerning potential impacts that desired road densities and motorized trails in the proposed action may have on aquatic, riparian, and wildlife habitats, including grizzly core areas and habitat connectivity, are addressed through lower road densities in the focused and general restoration management areas and the higher number of combined recommended wilderness and backcountry non-motorized management acres.

This alternative also responds to public comments that asked for additional protections for riparian areas and addresses public concerns that the proposed action may not provide adequate protection that is as effective as the 1988 forest plan amendments in managing activities within the riparian areas.

The following summarizes the effects to recreation resources associated with the implementation of alternative P. Issues analyzed include the identification of lands suitable for recreation, motorized recreation trails, access, and recommended wilderness.

Alternative P retains the recreation suitability determinations completed as part of the 1988 forest plan for summer and winter motorized and non-motorized recreation opportunities. Changes would be made to the Forest's ROS map to accurately reflect increases in semi-primitive motorized and semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness, backcountry and backcountry motorized management areas) and to reflect the increase in the Roaded Natural ROS class that resulted from the absorption of the ROS sub-class of Roaded Modified in the 1988 forest plan into the Roaded Natural ROS classification in the revised forest plan. The number of summer motorized recreation trail miles would remain the same and the acres of backcountry motorized recreation management areas would increase when compared to the existing condition. Trail miles in this document are based on the assumptions located on page 708, including: (1) that recommended wilderness will be designated as wilderness by Congress, and (2) that action will be taken to stop mechanized and motorized uses in designated wilderness.

This alternative would provide the greatest number of summer motorized trail miles (along with alternative O, the proposed action, and no action) and the second most acres managed for backcountry motorized recreation. Road access to dispersed recreation opportunities, especially those in riparian areas associated with key watersheds would be reduced over the life of the plan as projects are implemented to move the Forest toward a desired condition for road density of 1 to 2 miles per square mile. Anticipated levels of road decommissioning are expected to result in a gradual decrease in the public's ability to participate in a variety of vehicle supported summer and winter dispersed recreation opportunities across the Forest. Alternative P includes the fourth highest number of recommended wilderness acres, the second highest number of backcountry management area acres, and the second highest number of backcountry motorized management area acres of the six alternatives. In addition, this alternative includes approximately 80,300 acres of primarily backcountry and backcountry motorized management areas that would be designated as a recreation area along the Kettle Crest. Existing inconsistent uses within the recommended wilderness areas include mountain biking, chain saw use and motorized trail maintenance and reconstruction. Except for chain saw use, the use of motorized trail maintenance and reconstruction equipment would not be allowed in recommended wilderness under alternative P. Mountain bike and chain saw use would be allowed to continue in recommended wilderness until the areas are designated as wilderness by Congress. All backcountry recreation opportunities would continue across the Forest. However, the

miles of trail open to mountain biking would be reduced by 78 miles (if Congress designates the recommended wilderness as wilderness), resulting in the third highest number of miles open to mountain biking when compared to the other alternatives.

Under alternative P, the use of motorized equipment for trail maintenance and reconstruction (except for chain saw use) would no longer be permitted on approximately 78 miles of trail accessing the recommended wilderness, resulting in a potential increase in trail maintenance and reconstruction costs. The cost of trail maintenance and reconstruction would further increase on trails within the recommend wilderness if the areas are designated as wilderness by Congress since the use of chain saws for logout operations would no longer be allowed. Opportunities for over-snow vehicle recreation would be reduced as a result of an increase in acres associated with backcountry (semi-primitive non-motorized), research natural area, and recommended wilderness management areas as well as increases in designated winter range. Alternative P offers the third highest number of acres open to over-snow vehicle recreation opportunities when compared to the other alternatives.

Identification of Lands Suitable for Recreation Use

Alternative P retains the recreation suitability determinations made in the 1988 forest plan (as amended) for summer and winter motorized and non-motorized recreation opportunities. All of the recreation activities and opportunities provided for in the 1988 forest plan would continue to be available under alternative P, but may not be available in all of the same locations as under the no action alternative. For a comparison between alternatives of management areas suitable for summer and winter motorized and non-motorized recreation opportunities, see table 239.

Under alternative P, changes would be made to the Forest's ROS map to accurately reflect increases in semi-primitive motorized and semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness, backcountry and backcountry motorized management areas) and to reflect the increase in the roaded natural ROS class that resulted from the absorption of the ROS sub-class of roaded modified in the 1988 forest plan into the roaded natural ROS classification in the revised forest plan. Recreation opportunities would still be available in a variety of ROS classes across the Forest including semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural, representing a broad array of natural settings, managerial, and social environments in which users could participate in their preferred activities. The ROS class acreages for each alternative are summarized in table 245.

Implementation of alternative P would provide the third highest number of total Forest acres open to winter over-snow vehicle recreation opportunities and the third highest number of total Forest acres open to summer motorized recreation opportunities, when compared to the other alternatives. Total Forest acres open to non-motorized recreation opportunities remains fairly consistent (within 3,000 acres) amongst all the alternatives. For a comparison of the number of acres open to winter over-snow vehicle recreation opportunities by alternative, see table 241. For a comparison of the number of acres open to summer motorized and non-motorized recreation opportunities by alternative, see table 243.

Motorized Recreation Trails

Alternative P would maintain the same number of summer motorized and non-motorized recreation trail opportunities across the Forest as no action. Under this alternative, approximately 181 miles of summer trail would be managed for motorized uses and 342 miles of summer trail would be managed for non-motorized uses. For a comparison of summer trail miles managed for motorized and non-motorized recreation opportunities by alternative, see table 242. Trails managed for motorized use would continue to provide opportunities across the Forest for ATVs, motorcycles, and

four-wheel-drive vehicles greater than 50 inches wide (jeep trails). Trails managed for summer non-motorized use would continue to provide opportunities for hiking, mountain biking, and pack and saddle use. There would be no change in the number of miles or the types of managed motorized and non-motorized recreation trail opportunities on the Forest.

Alternative P would also maintain the spatial distribution of existing summer motorized recreation trail opportunities across the Forest and would continue to provide the existing mix of summer motorized and non-motorized trail systems within each of the three counties in which the Colville National Forest is located. Implementation of alternative P would increase the number of backcountry acres managed for summer motorized recreation trail opportunities from approximately 13,600 acres in the no action alternative to approximately 54,600 acres. This equates to a 400 percent increase in backcountry motorized management area acres. These backcountry motorized areas would include all of the existing motorized backcountry trail opportunities on the Forest. Overall, summer motorized recreation trail opportunities would be allowed on approximately 875,600 acres (79 percent of the Forest). Non-motorized recreation trail opportunities would be allowed on nearly 100 percent of the Forest's land base (excluding RNAs) and the opportunity for trails to exist in a non-motorized setting (including backcountry, wilderness, and recommended wilderness management areas) would equal approximately 222,200 acres, equaling 20 percent of the Forest's land base. For a comparison of management area acres open to motorized and non-motorized recreation trail opportunities, see table 243.

Access

Under alternative P, the desired condition for road density on the Colville National Forest would be 1 to 2 miles per square mile, which is approximately one-third to one-half lower than the existing condition for the Forest, depending on the specific watershed. As a result, reductions in road density would be expected in the majority of watersheds across the Forest to meet the desired condition. These reductions would likely be focused initially on the Forest's key watersheds, where the restoration of failing road infrastructure would be a priority over the life of the forest plan. Given that projected Forest funding would allow for approximately 20 miles of decommissioning each year, the magnitude of potential road decommissioning over the 20-year life span of the forest plan would be approximately 400 miles, or 10 percent of the Forest's existing road system.

Reducing road density would likely result in a corresponding reduction in roaded access for recreation use, depending on the specific roads selected to be decommissioned. The level of effect associated with reducing road density across all watersheds would be dependent on the length of open system roads that would be proposed for decommissioning—the greater the length, the greater the potential effect on recreation access. However, if some Maintenance Level 1 roads—those roads already closed to vehicle use by the public—are selected for decommissioning instead of open system roads, then there would be a corresponding reduction in the potential loss of open road access for recreation use. Similarly, roads decommissioned in riparian areas would have a greater impact on access for recreation use than those located in upland areas because most recreation use on the Forest occurs in riparian areas associated with lakeshores, rivers, and streams.

The proposed reduction in road density associated with alternative P would not be expected to result in a reduction in roaded access for developed recreation site and trail access because these opportunities are generally located along major travel routes. These major travel routes would typically be improved or rerouted (instead of decommissioned) to correct resource concerns to ensure continued access to the Forest's recreation infrastructure. However, the proposed reduction in road density would likely reduce access to dispersed recreation opportunities such as hunting, fishing, camping, driving for pleasure, and gathering forest products. Since most dispersed recreation

activities can be enjoyed throughout the Forest, localized road closures would likely result in users shifting their access needs to nearby roads. However, in key watersheds, where road decommissioning would be emphasized, road closures could reduce roaded access for dispersed recreation use to a level that would displace recreationists to other parts of the Forest to participate in the same dispersed recreation activities.

At the Forest scale, the effect of decommissioning approximately 400 miles of road over a 20-year period would be a gradual decrease in roaded access for recreation use. The impact of this decrease in roaded access for recreation use would be focused on dispersed recreation opportunities and would be expected to be more obvious in riparian areas associated with key watersheds. Implementation of alternative P would likely result in greater impacts to roaded access for recreation than no action and alternatives B and O. Alternative P would have similar affects to roaded access as alternative R.

Recommended Wilderness

Alternative P recommends nearly 6 percent (approximately 61,700 acres) of the Forest as additional wilderness, including the following areas that may be suitable for inclusion in the National Wilderness Preservation System: Salmo-Priest Adjacent, Abercrombie-Hooknose, and the majority of Bald Snow (the area generally north of Snow Peak Cabin and west of the Kettle Crest #13 North trail as well as the area north of Sherman Peak within approximately one-half mile of State Highway 20 is designated as Backcountry, not Recommended Wilderness). For a comparison of recommended wilderness area acreage by alternative, see table 246. Each of the areas that may be suitable for inclusion in the National Wilderness Preservation System in this alternative were evaluated by the forest plan revision team according to the process identified in FSH 1909.12 Chapter 70 (January 31, 2007 version) and determined to contribute to the capability, availability, and need for additional wilderness in the Okanogan Highlands ecoregion. At least one area that may be suitable for inclusion in the National Wilderness Preservation System under this alternative would be recommended as potential wilderness in each of the three counties located within the Forest's boundary.

This alternative attempts to balance the public's desire for additional wilderness with existing backcountry recreation opportunities such as mountain biking and OHV riding. As a result, not all of the Forest's areas that may be suitable for inclusion in the National Wilderness Preservation System that possess wilderness characteristics were recommended as wilderness in this alternative. Instead, alternative P retains approximately 54,600 acres (5 percent of the Forest) of backcountry for motorized recreation opportunities, and approximately 129,100 acres (12 percent of the Forest) of backcountry for recreation opportunities that do not conform with wilderness management direction such as mountain biking, rental cabins, and historic structure maintenance. See table 243 for a comparison of backcountry and backcountry motorized management acres by alternative.

In addition, this alternative recommends approximately 80,300 acres be included in a recreation area along the Kettle Crest in Ferry County that would include all of the Profanity, Hoodoo, and Twin Sisters areas that may be suitable for inclusion in the National Wilderness Preservation System and the part of the Bald-Snow area that may be suitable for inclusion in the National Wilderness Preservation System not included in a recommended wilderness management area. The recreation area would support the existing outstanding recreational trail (motorized and non-motorized) values associated with the Kettle Crest region, while also maintaining the existing semi-primitive characteristics that make these areas popular with both motorized and non-motorized recreationists. Within the Kettle Crest Recreation Area (KCRA), areas that may be suitable for inclusion in the National Wilderness Preservation System would be managed as either backcountry (Profanity, Bald-Snow, and Hoodoo) or backcountry motorized (Twin Sisters) and all existing recreation opportunities

would be retained. Acres attributable to the KCRA are included in the backcountry and backcountry motorized acres listed in the above paragraph.

The designation of the KCRA could, over time, increase the number of recreationists to the Kettle Crest region of the Forest for both non-motorized and motorized recreation opportunities at a quicker rate than is expected for the rest of the Forest. How much of a potential increase in use and what types of use may increase is unknown. However, results of the NVUM survey in table 238 and the recreation trend analysis completed suggests that the greatest increase in trail use will be hiking, followed by motorized trail use, bicycling, and horseback riding. It is possible that the combined additional use and the noise emitted from motorized trail use in the Twin Sisters Backcountry Motorized MA as well as the noise stemming from vehicle access on the Albian Hill Road (forest road 2030) and the numerous trailhead access roads on the west side of the Kettle Crest could decrease the level of solitude (when compared to the existing condition) users would experience in the Profanity, Hoodoo, and Bald-Snow Backcountry MAs and the Twin Sisters Backcountry Motorized MA.

Under this alternative, inconsistent uses would be allowed to continue until Congress designates the recommended wilderness areas as wilderness. Existing inconsistent uses within the recommended wilderness areas include mountain biking, chain saw use, and motorized trail maintenance and reconstruction. Except for chain saw use, the use of motorized trail maintenance and reconstruction equipment would not be allowed in recommended wilderness under alternative P. Furthermore, no new inconsistent uses would be allowed.

Even with the continuation of mountain bike and chain saw use, the existing wilderness characteristics associated with the recommended wilderness areas listed in alternative P are not expected to be altered prior to designation as wilderness by Congress. These inconsistent uses are of short duration, utilize existing developments (trails), and in the case of chain saw use, can increase (due to the lower cost of trail logout) the level of maintenance the existing trail system would receive on an annual basis over the life of the revised forest plan. Increased trail maintenance could reduce the likelihood of resource damage caused by wind and storm events, which would help maintain or improve the recommended wilderness area's natural appearance and the functioning of the recommended wilderness area's ecological systems and plant communities.

Allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness areas' "capability" determinations made as part of the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System. The "capability" determination was based on an assessment of the principal wilderness characteristics—natural, undeveloped, outstanding opportunities for solitude or primitive and unconfined recreation, special features and values, manageability—as identified in the Wilderness Act.

The natural appearance and ecosystem health of each recommended wilderness area would be unaltered by the presence of mountain biking and motorized trail maintenance. There would be no expected increase in the presence of non-native species, the presence of developments that would change the free-flowing nature of area streams, the level of light pollution, or the presence of pollutants. The recommended wilderness area would remain undeveloped except for the presence of trails and would continue to provide opportunities for solitude or primitive and unconfined recreation. Each recommended wilderness would continue to support the existing ecologic, geologic, scientific, educational, scenic, historical, and cultural features of significance contained within each recommended wilderness. Finally, there would be no change in the Colville National Forest's ability

to manage the boundary of each recommended wilderness area if mountain biking and motorized trail maintenance are allowed to continue.

The presence of mountain biking and motorized trail maintenance may affect the degree of solitude and level of primitive recreation that some users experience while recreating in the recommended wilderness areas while these activities are actively taking place. Whether the effect of these activities is positive or negative and how strong the effect is will depend on each individual user's value system and cannot be effectively measured. However, since mountain bike use and motorized trail maintenance do not represent long-term or irreversible commitments of resources, the non-esoteric effects to solitude and level of primitive recreation would be temporary. In addition, when the recommended wilderness areas are designated as wilderness by Congress, the effects on solitude and level of primitive recreation would be eliminated assuming that the wilderness legislation passed by Congress prohibits these uses.

Allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness areas' "availability" determinations made as part of the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System. All NFS lands determined to meet wilderness "capability" requirements are considered potentially "available" for wilderness designation. The determination of "availability" is conditioned by the value of and need for the wilderness resource compared to the value of and need for other resources. Since no new inconsistent uses would be allowed under alternative P, there would be no change in the basis for the 2009 "availability" determination.

Likewise, allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness areas' "need" determinations made as part of the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System. In determining whether there is a "need" to recommend an area as recommended wilderness, the following factors are considered:

1. The location, size, and type of other wildernesses in the general vicinity, their distance from the proposed area, the accessibility of the area to population centers and user groups, and public demand for wilderness.

2. Present visitor pressure on other wildernesses, the trends in use, changing patterns of use, population expansion factors, and trends and changes in transportation.

3. The extent to which nonwilderness lands on the NFS unit or other Federal lands are likely to provide opportunities for unconfined outdoor recreation experiences.

4. The need to provide a refuge for those species that have demonstrated an inability to survive in less than primitive surroundings or the need for a protected area for other unique scientific values or phenomena.

5. Within social and biological limits, management may increase the capacity of established wildernesses to support human use without unacceptable depreciation of the wilderness resource.

6. An area's ability to provide for preservation of identifiable landform types and ecosystems which is helpful in rounding out the National Wilderness Preservation System.

Factors 1, 2, 3, 5, and 6 would not be altered by the presence of mountain biking or motorized trail maintenance and reconstruction. Factor 4 has been analyzed by resource specialists (wildlife, rare

plants, fisheries, etc.) in their respective analysis for the revised forest plan and no species were identified that would be unable to survive if mountain biking and motorized trail maintenance and reconstruction were allowed to continue. Therefore, mountain biking and motorized trail maintenance and reconstruction would not affect the "need" determination made in the 2009 wilderness evaluation process.

Ultimately, inconsistent wilderness uses, including mountain biking and chain saw use, were identified during the 2009 evaluation process and their presence did not preclude the roadless areas from meeting the evaluation criteria (capability, availability, and need) for inclusion on the inventory of potential wilderness areas. Therefore, allowing these inconsistent uses to continue at use rates similar to when the wilderness evaluations were completed should not detract from the inherent wilderness characteristics associated with the three recommended wilderness areas.

The areas that may be suitable for inclusion in the National Wilderness Preservation System that would be designated as backcountry motorized management areas in this alternative include Owl Mountain, Jackknife, Twin Sisters, South Huckleberry and Lost Creek. Combined, these areas would provide access to all of the Forest's existing backcountry motorized trail systems. As a result, there would be no loss of existing summer motorized recreation use if this alternative was implemented.

Implementation of alternative P would designate 13 areas that may be suitable for inclusion in the National Wilderness Preservation System as backcountry management areas including: northern part of Bald-Snow, Bodie Mountain, Clackamas Mountain, Cougar Mountain, Deer Creek, Grassy Top, Hall Mountain, Harvey Creek, Hoodoo, Jackson Creek, Quartzite, South Fork Mountain and Thirteenmile. Combined, these areas that may be suitable for inclusion in the National Wilderness Preservation System contain approximately 53 miles of backcountry mountain bike trail opportunities. However, if the recommended wilderness areas listed in this alternative become wilderness, mountain bike trail opportunities would no longer be available on approximately 61,700 acres. This equates to approximately a 90-mile (30 percent) reduction in the number of available mountain bike trail opportunities that are associated with the Forest's existing summer non-motorized trail system. As a result, alternative P provides the third highest number of mountain bike trail miles of all the alternatives. For a comparison between alternatives of backcountry management acres open to mountain biking and the number of trail miles open to mountain biking, see table 244. Managing these areas as backcountry would also allow the Forest to continue to manage its only backcountry recreation rental cabin and to maintain a popular historic fire lookout.

Below is a list of alternative P's recommended wilderness areas and the trails that would be closed to mountain bike use if the recommended wilderness areas are designated as wilderness by Congress.

- Bald Snow: Barnaby Buttes #7, Barnaby Buttes #70, Edds Mountain #3, Kettle Crest #13 South (portion of trail south of Snow Peak Cabin).
- Abercrombie – Hooknose: Sherlock Peak #139, South Fork Silver Creek #123, North Fork Silver Creek 119, Abercrombie #117, Flume Creek #502.
- Salmo-Priest Adjacent: Slate Creek #525, Halliday #522, North Fork Sullivan Creek #507, Red Bluff #553, Elk Creek #560, Crowell Ridge #515, Salmo Divide #535, Shedroof Cutoff #511.

If the recommended wilderness areas listed under alternative P are designated as wilderness by Congress, trail maintenance and reconstruction costs could increase on the 90 miles of trail that access approximately 61,700 acres of recommended wilderness. This cost increase is based on the required change from using motorized (chainsaws, power toters, trail dozers, etc.) trail maintenance equipment to non-motorized equipment (cross-cut saws, pack mules, pulaskis, etc.), which would

likely result in annual tasks, such as spring logout, and reconstruction efforts taking more time to complete, additional people, or both.

Implementation of alternative P would prohibit over-snow vehicle use on approximately 91,900 acres currently open to over-snow vehicle recreation opportunities in the no action alternative as a result of an increase in acres associated with backcountry (semi-primitive non-motorized), research natural area, and recommended wilderness management areas as well as changes in designated winter range. However, the majority of the additional acres that would be closed to over-snow vehicle use under alternative P consist of heavily vegetated slopes and terrain that is difficult to access and currently supports only limited over-snow vehicle recreation opportunities. Therefore, implementation of alternative P would result in little to no reduction in the amount of over-snow vehicle recreation opportunities available on the Forest when compared to no action. For a comparison of acres open to over-snow vehicle recreation opportunities by alternative, see table 241.

Alternative B

Alternative B emphasizes two management areas that focus on forest vegetation; Restoration, which emphasizes old forests, and Active, which emphasizes timber production. These are generally the Focused Restoration and General Restoration management areas in the proposed action and other alternatives. The Regional Forester's Forest Plan Amendment #2 (Eastside Screens) from the 1988 forest plan provides direction for managing vegetation.

This alternative also responds to those advocating for increased wilderness and to public concerns that the amount and location of summer and winter motorized use may impact aquatic, riparian and wildlife habitats. Alternative B provides for the highest acreage of recommended wilderness across all alternatives and the least amount of summer motorized and non-motorized backcountry recreation opportunities.

Input from the Northeast Washington Forestry Coalition's alternative on vegetation, road, aquatic management and wilderness recommendations are included in this alternative. Proposed management not provided in the coalition's alternative comes from the proposed action.

The following summarizes the effects to recreation resources associated with the implementation of alternative B. Issues analyzed include the identification of lands suitable for recreation, motorized recreation trails, access, and recommended wilderness.

Alternative B retains the recreation suitability determinations completed as part of the 1988 forest plan for summer and winter motorized and non-motorized recreation opportunities. Changes would be made to the Forest's ROS map to accurately reflect decreases in the semi-primitive motorized ROS class and increases in the semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness) and to reflect the increase in the roaded natural ROS class that resulted from the absorption of the ROS sub-class of roaded modified in the 1988 forest plan into the roaded natural ROS classification in the revised forest plan. The number of summer motorized recreation trail miles would be reduced by 22 percent (along with alternative R, this represents the largest reduction in motorized trail miles of all the action alternatives) and the acres of backcountry motorized recreation management areas would be reduced by 51 percent (the largest reduction in acres of the action alternatives) when compared to the existing condition. Trail miles in this document are based on the assumptions located on page 708, including: (1) that recommended wilderness will be designated as wilderness by Congress, and (2) that action will be taken to stop mechanized and motorized uses in designated wilderness.

Alternative B also reduces the Forest's existing backcountry jeep trail system from 39 miles of trail to zero. Access for recreation would continue to be affected through project specific decisions based on improving resource and habitat conditions. Road decommissioning would be expected to continue at a rate similar to recent years across the Forest and should result in little or no change in the public's ability to participate in a variety of summer and winter dispersed and developed recreation opportunities across the Forest. Alternative B includes the highest number of recommended wilderness acres, the lowest number of backcountry management area acres, and the lowest number of backcountry motorized management area acres of the six alternatives. Inconsistent uses (such as mountain biking, chain saw use, motorized recreation and rental cabins) would not be allowed to continue in recommended wilderness prior to designation as wilderness by Congress. Some existing backcountry recreation opportunities would no longer be available on the Forest (rental cabin, jeep trails). The miles of trail open to mountain biking would be reduced (a direct result of additional recommended wilderness areas), resulting in the lowest number of miles open to mountain biking when compared to the other alternatives. Motorized equipment for trail maintenance and reconstruction would no longer be permitted on approximately 221 miles of trail accessing recommended wilderness, resulting in a potential increase in trail maintenance and reconstruction costs across the Forest. Opportunities for over-snow vehicle recreation would be reduced when compared to no action, as a result of the large increase in acres associated with recommended wilderness. As a result, alternative B provides the second lowest number of acres open to over-snow vehicle recreation opportunities when compared to the other alternatives.

Identification of Lands Suitable for Recreation Use

Alternative B retains the recreation suitability determinations made in the 1988 forest plan (as amended) for summer and winter motorized and non-motorized recreation opportunities. All of the recreation activities and opportunities provided for in the 1988 forest plan would continue to be available under alternative B, but may not be available in all of the same locations as under the no action alternative. For a comparison between alternatives of management areas suitable for summer and winter motorized and non-motorized recreation opportunities, see table 239.

Under alternative B, changes would be made to the Forest's ROS map to accurately reflect decreases in the semi-primitive motorized ROS class and increases in the semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness) and to reflect the increase in the roaded natural ROS class that resulted from the absorption of the ROS sub-class of roaded modified in the 1988 forest plan into the roaded natural ROS classification in the revised forest plan. Recreation opportunities would still be available in a variety of ROS classes across the Forest including semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural, representing a broad array of natural settings, managerial, and social environments in which users could participate in their preferred activities. The (ROS class acreages for each alternative are summarized in table 245.

Implementation of alternative B would provide both the second lowest number of total Forest acres open to winter over-snow vehicle recreation opportunities and the second lowest number of total Forest acres open to summer motorized recreation opportunities when compared to the other alternatives. Total Forest acres open to non-motorized recreation opportunities remains fairly consistent (within 3,000 acres) amongst all the alternatives. For a comparison of the number of acres open to winter over-snow vehicle recreation opportunities by alternative, see table 241. For a comparison of the number of acres open to summer motorized and non-motorized recreation opportunities by alternative, see table 243.

Motorized Recreation Trails

Compared to the no action alternative, alternative B decreases the miles of summer motorized recreation trails and increases the miles of summer non-motorized recreation trails available on the Forest. Under this alternative, approximately 142 miles of summer trail would be managed for motorized recreation opportunities and 382 miles of summer trail would be managed for non-motorized recreation opportunities. Converting 39 miles of motorized trail to a non-motorized classification results in a 22 percent decrease in the existing number of summer motorized recreation trail miles and an increase of 10 percent in the existing number of summer non-motorized recreation trail miles. For a comparison of summer trail miles managed for motorized and non-motorized recreation opportunities by alternative, see table 242. Implementation of alternative B would provide a reduced number of managed ATV and motorcycle trail opportunities across the Forest and would eliminate all of the Forest's existing trail opportunities (39 miles) associated with four-wheel-drive vehicles greater than 50 inches wide (jeep trails). Implementation of alternative B would increase the number of summer non-motorized recreation trail opportunities including hiking and pack and saddle stock use as compared to the number of non-motorized recreation trail opportunities in the no action alternative.

Alternative B also decreases the spatial distribution of motorized recreation trail opportunities across the Forest as well as the availability of backcountry motorized trail opportunities. Unlike the no action alternative, which provides a mix of summer motorized and non-motorized trail opportunities throughout all three counties, alternative B would only provide a mix of summer motorized and non-motorized trail opportunities in Stevens and Pend Oreille Counties. In Ferry County, 39 miles of motorized trail would be converted to non-motorized trail, leaving 1.4 miles (less than 1 percent of the total trail miles in the county) of motorized trail available within the county. The number of backcountry acres open to motorized use would be reduced from approximately 13,600 acres in the no action alternative to approximately 6,600 acres in alternative B. This equates to a 51 percent reduction in backcountry areas open to motorized recreation trails. Similarly, total acres open to summer motorized recreation trail opportunities would be reduced from approximately 906,200 acres in the no action alternative to approximately 842,000 acres in alternative B. This represents a 7 percent reduction in the number of acres available for summer motorized recreation trail opportunities. Summer non-motorized recreation trail opportunities would be allowed on nearly 100 percent of the Forest's land base (excluding RNAs) and the opportunity for trails to exist in a non-motorized setting (includes backcountry, wilderness, and recommended wilderness management areas) would increase from approximately 118,300 acres in the no action alternative to approximately 256,600 acres in alternative B, an increase of 217 percent. For a comparison of management area acres open to motorized and non-motorized recreation trail opportunities, see table 243.

Access

Under alternative B, the Forest's road system would be capped at approximately 4,000 miles for the entire Forest. No roads would be allowed to be added to the Forest's road system unless an equal distance was decommissioned. Road management decisions would be based on the need for public access, safety, forest management and resource needs. Decisions on road decommissioning would be made at the project level based on information provided by resource specialists and recommendations contained in the Forest's most recent Travel Analysis Report pursuant to subpart A of the 2005 Travel Management Rule. During these project-level discussions, reductions in road density could be proposed to meet resource needs that would reduce roaded access for recreation uses. The level of effect associated with reducing road density would be dependent on the length of open system roads that would be proposed for decommissioning—the greater the length, the greater

the potential reduction in roaded recreation access. However, if Maintenance Level 1 roads—those roads already closed to vehicle use by the public—are selected for decommissioning instead of open system roads, then there would be a corresponding reduction in the potential loss of open road access for recreation use. Similarly, roads decommissioned in riparian areas would have a greater impact on roaded access for recreation use than those located in upland areas because most recreation use on the Forest occurs in riparian areas associated with lakeshores, rivers, and streams. A reduction in open road density would reduce access to dispersed recreation opportunities such as hunting, fishing, camping, driving for pleasure, and gathering of forest products. However, since most dispersed recreation activities can be enjoyed throughout the Forest, localized road decommissioning would likely result in users shifting their dispersed recreation access needs to nearby roads to participate in the same dispersed recreation activities resulting in little to no reduction in the public's participation in or access to dispersed recreation opportunities on the Forest.

Under alternative B, a reduction in roaded access for trail and developed site recreation opportunities would not be anticipated because these opportunities are generally located along major travel routes. These major travel routes would typically be improved or rerouted (instead of decommissioned) to correct resource concerns to ensure continued access to the Forest's developed recreation infrastructure.

Implementation of alternative B would likely result in fewer impacts to roaded access for recreation than alternatives R and P which have a desired condition for road density of 1 to 2 miles per square mile and could result in a greater reduction in system roads, especially in key watersheds and watersheds where the existing road densities are above the desired condition. Alternative B would have similar effects on roaded access for recreation as the proposed action, which has a desired condition for road density of 2 to 3 miles per square mile, which is close to the existing condition (at the Forest scale) for most watersheds. Alternative B would have a similar effect on roaded access for recreation as no action and alternative O, which do not have a desired condition for road density.

Recommended Wilderness

Alternative B recommends 20 percent (approximately 220,300 acres—the highest amount of all alternatives) of the Forest be recommended as additional wilderness, including all the areas that may be suitable for inclusion in the National Wilderness Preservation System on the Forest except for Lost Creek. For a comparison of recommended wilderness acreage by alternative, see table 246. Based on the Northeast Washington Forestry Coalition's wilderness recommendations, this alternative also recommends as additional wilderness those portions of the Bodie Mountain, Clackamas Mountain, Jackson Creek, Grassy Top, and South Fork Mountain areas that may be suitable for inclusion in the National Wilderness Preservation System that are located primarily on adjacent national forests. By Forest Service policy, those areas that may be suitable for inclusion in the National Wilderness Preservation System located primarily on adjacent national forests that would not meet the minimum acreage requirements necessary to be recommended as wilderness on the Colville National Forest alone would typically be evaluated for wilderness recommendation through the Idaho Panhandle and Okanogan-Wenatchee National Forests' respective forest plan revision processes. The preferred alternative for the Idaho Panhandle forest plan revision process did not support the South Fork Mountain or Grassy Top areas as recommended wilderness and the Okanogan-Wenatchee forest plan process did not support the Jackson Creek, Bodie Mountain, and Clackamas Mountain areas as recommended wilderness in its proposed action for forest plan revision. Each of the areas that may be suitable for inclusion in the National Wilderness Preservation System in this alternative were evaluated by the forest plan revision team according to the process identified in FSH 1909.12 Chapter 70 (January 31, 2007 version) and determined to contribute to the capability, availability, and need for additional wilderness in the Okanogan Highlands ecoregion.

Under alternative B, at least two areas that may be suitable for inclusion in the National Wilderness Preservation System would be recommended as wilderness in each of the counties in which the Forest is located.

This alternative recommends a large increase in wilderness and provides few opportunities for other motorized and mechanized backcountry recreation opportunities on the Forest. Several areas that may be suitable for inclusion in the National Wilderness Preservation System that contain well-established inconsistent uses (i.e., motorized trails, rental cabin, chain saw use and mountain bike use) that may detract from the wilderness characteristics associated with the various areas that may be suitable for inclusion in the National Wilderness Preservation System are recommended as wilderness in alternative B. This alternative designates approximately 6,600 acres (0.6 percent of the Forest) of backcountry for motorized recreation opportunities and approximately 4,800 acres (0.4 percent of the Forest) of backcountry for recreation opportunities that do not conform with wilderness management direction, such as mountain biking. See table 243 for a comparison of backcountry and backcountry motorized management acres by alternative. Under alternative B, recreation opportunities that would not conform to wilderness management direction (mountain biking, motorized trail use, motorized trail maintenance and reconstruction, historic structure maintenance and rental cabin management) would not be allowed to continue prior to congressional designation of the recommended wilderness areas as wilderness. As a result, the Forest's only backcountry cabin rental would be closed to the public and, over time, removed from the landscape. Likewise, a recently renovated historic fire lookout would be managed to a standard compatible with wilderness designation and may be allowed to slowly deteriorate over time. Since existing recreation opportunities that would be inconsistent with wilderness management direction would not be allowed prior to wilderness designation, there would be little or no potential that the wilderness characteristics associated with these recommended wilderness areas would be altered by existing inconsistent uses prior to their designation as wilderness by Congress.

Under alternative B, the Lost Creek area would be designated as the Forest's only backcountry motorized management area. The three existing trails in this area that may be suitable for inclusion in the National Wilderness Preservation System are currently open to motorcycles only. The result of implementing alternative B would be a 39-mile (100 percent) reduction in backcountry motorized trail miles that are currently open to ATVs and 4-wheel-drive vehicles greater than 50 inches wide. Overall, this alternative would result in approximately a 70 percent decrease in the number of existing backcountry summer motorized recreation trail miles on the Forest.

Under this alternative, only those inventoried roadless areas included in the 2001 Roadless Rule inventory (Bangs, Dry Canyon Breaks) that would not meet the minimum acreage requirements to be recommended as wilderness would be designated as backcountry management areas. As a result, backcountry mountain bike trail opportunities would be eliminated on approximately 220,300 acres across the Forest. This equates to a 221-mile (73 percent) reduction in the number of available mountain bike trail miles associated with the Forest's summer non-motorized trail system. For a comparison between alternatives of backcountry management acres open to mountain biking and the number of trail miles open to mountain biking, see table 244.

Below is a list of alternative B's recommended wilderness areas and the trails that would be closed to mountain bike and/or motorized use if the recommended wilderness areas are designated as wilderness by Congress.

- Bodie Mountain: No trails.
- Clackamas Mountain: Maple Mountain #312

- Jackson Creek: No trails.
- Cougar Mountain: 13 Mile #23
- Thirteen Mile: 13 Mile #23, Bear Pot #19.
- Bald Snow: Barnaby Buttes #7, Barnaby Buttes #70, Edds Mountain #3, Kettle Crest #13 South, Snow Peak #10, Sherman Peak Loop #72.
- Hoodoo: Hoodoo #17, Emerald Lake #94.
- Profanity: Columbia Mountain #24, Columbia Mountain Spur #24.1, Sherman Pass #82, Sherman Tie #96, Jungle Hill # 16, Wapaloosie #15, Timber Ridge #17, Copper Butte #8, Old Stage #1, Old Stage #75, Midnight Ridge #41, Lambert #47, Leona #49, Leona Loop #49.1, Stickpin #71, Ryan Cabin #30, Big Lick #30.1, Profanity #32, Long Alec #43.1, Taylor Ridge #74 (west of Forest road 6113 – Bulldog Cabin Road), Kettle Crest #13 North.
- Owl Mountain: Owl Mountain #102.
- Deer Creek: No trails.
- Jackknife: Thompson Ridge #107.
- Twin Sisters: Mack-King #98, Twin Sisters #109, US Mountain #76, US Spur #12600.
- South Huckleberry: South Huckleberry #12110, South Huckleberry 2 #12060.
- Quartzite: No trails.
- Abercrombie – Hooknose: Sherlock Peak #139, South Fork Silver Creek #123, North Fork Silver Creek 119, Abercrombie #117, Flume Creek #502.
- Salmo-Priest Adjacent: Slate Creek #525, Halliday #522, North Fork Sullivan Creek #507, Red Bluff #553, Elk Creek #560, Crowell Ridge #515, Salmo Divide #535, Shedroof Cutoff #511.
- Hall Mountain: Noisy Creek #588, Hall Mountain #540, Hall Mountain – Grassy Top #533.
- Harvey Creek: No trails.
- Grassy Top: Pass Creek – Grassy Top #503, Hall Mountain – Grassy Top #533.
- South Fork Mountain: No trails.

Under alternative B, once the forest plan is approved and implemented, trail maintenance and reconstruction costs could increase on the 221 miles of trail that access approximately 220,300 acres of recommended wilderness. This cost increase is based on the required change away from using motorized (chainsaws, power toters, trail dozers, etc.) trail maintenance equipment to non-motorized equipment (cross-cut saws, pack mules, pulaskis, etc.), which would likely result in annual tasks, such as spring logout, and reconstruction efforts taking more time to complete, additional people, or both.

Implementation of alternative B would prohibit over-snow vehicle use on approximately 122,700 acres currently open to over-snow vehicle recreation opportunities in the no action alternative as a result of the increase in acres associated with recommended wilderness, RNAs, and winter range. Approximately 55,000 acres of backcountry associated with the Twin Sisters, Jackknife, Owl Mountain, and South Huckleberry areas that may be suitable for inclusion in the National Wilderness Preservation System are open to over-snow vehicles in the no action alternative and offer 39 miles of jeep trails (these trails are neither designated nor groomed for over-snow vehicle use) that are currently available for over-snow vehicle use. Implementation of alternative B

would prohibit this use. As a result, implementation of alternative B would result in a high reduction in over-snow vehicle recreation opportunities across the Forest when compared to the no action alternative. For a comparison of acres open to over-snow vehicle recreation opportunities by alternative, see table 241.

Alternative O

Alternative O emphasizes summer and winter motorized and non-motorized opportunities in an unroaded backcountry setting and minimizes recommended wilderness. In addition, the Kettle Crest Recreation Area (KCRA) is proposed to address public disagreement about recommending this area for wilderness. Participants in the Colville Collaborative group that worked on forest plan issues around wilderness and vegetation management agreed that the Kettle Crest was a special area for semi-primitive recreation opportunities, but did not agree that the area should be wilderness because of the impacts to recreation opportunities such as mountain biking and OHV riding as well as motorized trail maintenance. The proposed Kettle Crest Recreation Area was added as a component of this alternative to address public disagreement about recommending this area for wilderness. The backcountry and backcountry motorized management areas within the KCRA would be managed to maintain their existing semi-primitive characteristics while allowing for non-wilderness recreation activities to continue, such as mountain biking, OHV riding, and use of a rental cabin, in a semi-primitive setting.

This alternative proposes two management areas to address vegetation management: the Restoration MA to restore the historical range of variation, and the Responsible MA that emphasizes timber production. The total percentage of the Forest allocated to vegetation management—72 percent—is similar to alternative B's 73 percent, though alternative O has a greater percentage in the Restoration MA than alternative B.

This alternative comes from a series of public, collaborative meetings run by the Forest Service that focused on motorized recreation, wilderness recommendations, and vegetation management and reflects areas of general agreement among participants in those meetings. The Forest Service fully developed this alternative using the proposed action to fill in the gaps not addressed in the collaborative process.

The following summarizes the effects to recreation resources associated with the implementation of alternative O. Issues analyzed include the identification of lands suitable for recreation, motorized recreation trails, access, and recommended wilderness.

Alternative O retains the recreation suitability determinations completed as part of the 1988 forest plan for summer and winter motorized and non-motorized recreation opportunities. Changes would be made to the Forest's ROS map to accurately reflect increases in semi-primitive motorized and semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness, backcountry and backcountry motorized management areas) and to reflect the increase in the roaded natural ROS class that resulted from the absorption of the ROS sub-class of roaded modified in the 1988 forest plan into the roaded natural ROS classification in the revised forest plan. The number of summer motorized recreation trail miles would remain the same and the acres of backcountry motorized recreation management areas would increase when compared to the existing condition. This alternative would provide the greatest number of summer motorized trail miles (along with alternative P, the proposed action, and no action) and the third most acres managed for backcountry motorized recreation. Access for recreation would continue to be affected through project-specific decisions based on improving resource and habitat conditions. Trail miles in this document are based on the assumptions located on page 708, including: (1) that recommended

wilderness will be designated as wilderness by Congress, and (2) that action will be taken to stop mechanized and motorized uses in designated wilderness.

Road decommissioning would be expected to continue at a rate similar to recent years across the Forest and should result in little or no change in the public's ability to participate in a variety of summer and winter dispersed and developed recreation opportunities across the Forest. Alternative O includes the second lowest number of recommended wilderness acres, the highest number of backcountry management area acres, and the third highest number of backcountry motorized management area acres of the six alternatives. In addition, this alternative includes approximately 99,000 acres of primarily backcountry and backcountry motorized management areas that would be designated as a recreation area along the Kettle Crest. Inconsistent uses (such as mountain bike and chainsaw use) would be allowed to continue in recommended wilderness until the areas are designated as wilderness by Congress. All backcountry recreation opportunities would continue across the Forest. However, the miles of trail open to mountain biking would be reduced minimally (a direct result of additional recommended wilderness areas), resulting in the second highest number of miles open to mountain biking when compared to the other alternatives. Once the recommended wilderness areas are designated as wilderness by Congress, motorized equipment for trail maintenance and reconstruction would no longer be permitted on approximately 29 miles of trail. Opportunities for over-snow vehicle recreation would be reduced as a result of an increase in acres associated with backcountry (semi-primitive non-motorized), research natural area, and recommended wilderness management areas as well as increases in designated winter range. Alternative O offers the second highest number of acres open to over-snow vehicle recreation opportunities when compared to the other alternatives.

Identification of Lands Suitable for Recreation Use

Alternative O retains the recreation suitability determinations made in the 1988 forest plan (as amended) for summer and winter motorized and non-motorized recreation opportunities. All of the recreation activities and opportunities provided for in the 1988 forest plan would continue to be available under alternative O, but may not be available in all of the same locations as under the no action alternative. For a comparison between alternatives of management areas suitable for summer and winter motorized and non-motorized recreation opportunities, see table 239.

Under alternative O, changes would be made to the Forest's ROS map to accurately reflect increases in semi-primitive motorized and semi-primitive non-motorized ROS classes (a result of increases in acres associated with recommended wilderness, backcountry and backcountry motorized management areas) and to reflect the increase in the roaded natural ROS class that resulted from the absorption of the ROS sub-class of roaded modified in the 1988 forest plan into the roaded natural ROS classification in the revised forest plan. Recreation opportunities would still be available in a variety of ROS classes across the Forest including semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural, representing a broad array of natural settings, managerial, and social environments in which users could participate in their preferred activities. The ROS class acreages for each alternative are summarized in table 245.

Implementation of alternative O would provide both the second highest number of total Forest acres open to winter over-snow vehicle recreation opportunities and the second highest number of total Forest acres open to summer motorized recreation opportunities when compared to the other alternatives. Total Forest acres open to non-motorized recreation opportunities remains fairly consistent (within 3,000 acres) amongst all the alternatives. For a comparison of the number of acres open to winter over-snow vehicle recreation opportunities by alternative, see table 241. For a

comparison of the number of acres open to summer motorized and non-motorized recreation opportunities by alternative, see table 243.

Motorized Recreation Trails

Alternative O would maintain the same number of motorized and non-motorized trail opportunities across the Forest as no action. Under this alternative, approximately 181 miles of summer trail would be managed for motorized uses and 342 miles of summer trail would be managed for non-motorized uses. For a comparison of summer trail miles managed for motorized and non-motorized recreation opportunities by alternative, see table 242. Trails managed for motorized use would continue to provide opportunities for ATVs, motorcycles, and 4-wheel–drive vehicles greater than 50 inches wide (jeep trails). Trails managed for summer non-motorized use would continue to provide opportunities for hiking, mountain biking, and pack and saddle use. Implementation of alternative O would result in no change in the number of miles or the types of managed motorized and non-motorized recreation trail opportunities on the Forest, as compared to no action.

Alternative O would also maintain the spatial distribution of existing summer motorized trail opportunities across the Forest and would continue to provide the existing mix of summer motorized and non-motorized trail systems within each of the three counties in which the Colville National Forest is located. Alternative O would increase the number of backcountry acres managed for summer motorized trail use from approximately 13,600 acres in the no action alternative to approximately 53,700 acres. This equates to almost a 400 percent increase in backcountry acres that would be managed for summer motorized trail use. The additional backcountry motorized management acres would include all of the existing summer motorized backcountry trail opportunities on the Forest. Overall, summer motorized trail recreation opportunities would be allowed on approximately 876,300 acres (80 percent) across the Forest. Summer non-motorized recreation trail opportunities would be allowed on nearly 100 percent of the Forest's land base (excluding RNAs) and the opportunity for trails to exist in a non-motorized setting (including backcountry, wilderness, and recommended wilderness management areas) would equal approximately 221,700 acres, equaling 20 percent of the Forest's land base. For a comparison of management area acres open to motorized and non-motorized recreation trail opportunities, see table 243.

Access

Under alternative O, the Forest's road system would be capped at approximately 4,000 miles for the entire Forest. No roads would be allowed to be added to the Forest's road system unless an equal distance was decommissioned. Road management decisions would be based on the need for public access, safety, forest management and resource needs. Decisions on road decommissioning would be made at the project level based on information provided by resource specialists and recommendations contained in the Forest's most recent Travel Analysis Report pursuant to subpart A of the 2005 Travel Management Rule. During these project level discussions, reductions in road density could be proposed to meet resource needs that would reduce roaded access for recreation uses. The level of effect associated with reducing road density would be dependent on the length of open system roads that would be proposed for decommissioning—the greater the length, the greater the potential reduction in roaded recreation access. However, if Maintenance Level 1 roads—those roads already closed to vehicle use by the public—are selected for decommissioning instead of open system roads, then there would be a corresponding reduction in the potential loss of open road access for recreation use. Similarly, roads decommissioned in riparian areas would have a greater impact on roaded access for recreation use than those located in upland areas since most recreation use on the Forest occurs in riparian areas associated with lakeshores, rivers, and streams. A reduction in open

road density would reduce access to dispersed recreation opportunities such as hunting, fishing, camping, driving for pleasure, and gathering of forest products. However, since most dispersed recreation activities can be enjoyed throughout the Forest, localized road decommissioning would likely result in users shifting their dispersed recreation access needs to nearby roads in order to participate in the same dispersed recreation activities resulting in little to no reduction in the public's participation in or access to dispersed recreation opportunities on the Forest.

Under alternative O, a reduction in roaded access for trail and developed site recreation opportunities would not be anticipated because these opportunities are generally located along major travel routes. These major travel routes would typically be improved or rerouted (instead of decommissioned) to correct resource concerns to ensure continued access to the Forest's developed recreation infrastructure.

Implementation of alternative O would likely result in fewer impacts to roaded access for recreation than alternatives R and P which have a desired condition for road density of 1 to 2 miles per square mile and could result in a greater reduction in system roads, especially in key watersheds and watersheds where the existing road densities are above the desired condition. Alternative O would have similar effects on roaded access for recreation as the proposed action, which has a desired condition for road density of 2 to 3 miles per square mile, which is close to the existing condition (at the Forest scale) for most watersheds. Alternative O would have a similar effect on roaded access for recreation as no action and alternative B, which do not have a desired condition for road density.

Recommended Wilderness

Alternative O recommends 1.5 percent (approximately 15,900 acres—the second lowest amount of the alternatives) of the Forest as additional wilderness including the Salmo-Priest Adjacent area. For a comparison of recommended wilderness acreage by alternative, see table 246. The Salmo-Priest Adjacent area was evaluated by the forest plan revision team according to the process identified in FSH 1909.12 Chapter 70 (January 31, 2007 version), and it was determined that it contributed to the capability, availability, and need for additional wilderness in the Okanogan Highlands ecoregion. This alternative recommends additional wilderness in Pend Oreille County only. No areas that may be suitable for inclusion in the National Wilderness Preservation System would be recommended as wilderness in Ferry or Stevens Counties. If the recommended wilderness area becomes wilderness, this alternative would concentrate the Forest's wilderness recreation opportunities into the extreme northeastern corner of the Forest.

This alternative strives to maintain all of the existing motorized, mechanized (mountain bike), and non-motorized recreation opportunities on the Forest while providing for a limited amount of additional wilderness area. As a result, the majority of areas that may be suitable for inclusion in the National Wilderness Preservation System on the Forest that have wilderness characteristics were not recommended as wilderness in this alternative. Instead, alternative O would designate approximately 53,700 acres (5 percent of the Forest) of backcountry for motorized recreation opportunities and approximately 174,300 acres (16 percent of the Forest) of backcountry for non-motorized recreation opportunities that do not conform with wilderness management direction such as mountain biking, use of recreation rental cabins and maintenance of historic structures. See table 243 for a comparison of backcountry and backcountry motorized management acres by alternative.

In addition, this alternative recommends approximately 99,000 acres be included in a recreation area along the Kettle Crest in Ferry County that would include all of the Profanity, Bald-Snow, Hoodoo, and Twin Sisters areas that may be suitable for inclusion in the National Wilderness Preservation System. This KCRA would support the existing outstanding recreational trail (motorized and non-

motorized) values associated with the Kettle Crest region while also maintaining many of the existing semi-primitive characteristics that make these areas popular with both motorized and non-motorized recreationists. Within the KCRA, areas that may be suitable for inclusion in the National Wilderness Preservation System would be managed as either backcountry (Profanity, Bald-Snow, and Hoodoo) or backcountry motorized (Twin Sisters) and all existing recreation opportunities would be retained. Acres attributable to the KCRA are included in the backcountry and backcountry motorized acres listed in this paragraph.

The designation of the KCRA could, over time, increase the number of recreationists to the Kettle Crest region of the Forest for both non-motorized and motorized recreation opportunities at a quicker rate than is expected for the rest of the Forest. How much of a potential increase in use and what types of use may increase is unknown. However, results of the NVUM survey in table 238 and the recreation trend analysis completed suggests that the greatest increase in trail use will be hiking, followed by motorized trail use, bicycling, and horseback riding. It is possible that the combined additional use and the noise emitted from motorized trail use in the Twin Sisters Backcountry Motorized MA as well as the noise stemming from vehicle access on the Albian Hill (forest road 2030), Hall Creek (forest road 2050600), and South Fork Sherman Creek (forest road 2020) Roads and the numerous trailhead access roads on the west and east sides of the Kettle Crest could decrease the level of solitude (when compared to the existing condition) users would experience in the Profanity, Hoodoo, and Bald-Snow Backcountry MAs and the Twin Sisters Backcountry Motorized MA.

Under this alternative, recreation opportunities that are inconsistent with wilderness management direction, as well as motorized trail maintenance and reconstruction, would be allowed to continue in the Salmo-Priest Adjacent recommended wilderness area until Congress designates the recommended wilderness area as wilderness. No new inconsistent uses would be allowed. Even with the continuation of inconsistent uses, the wilderness characteristics associated with the recommended wilderness area listed in alternative O are not expected to be altered prior to designation as wilderness by Congress.

Existing inconsistent uses within the recommended wilderness area include mountain biking, chain saw use, and motorized trail maintenance and reconstruction. These uses are of short duration, utilize existing developments (trails), and in the case of motorized trail maintenance and reconstruction, can increase (due to the lower cost of most types of motorized trail maintenance) the level of maintenance the existing trail system would receive on an annual basis over the life of the revised forest plan. Increased trail maintenance could reduce the likelihood of resource damage caused by wind and storm events which would help maintain or improve the recommended wilderness area's natural appearance and the functioning of the recommended wilderness area's ecological systems and plant communities.

Allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness area's "capability" determination made as part of the 2009 wilderness evaluation process. The "capability" determination was based on an assessment of the principal wilderness characteristics—natural, undeveloped, outstanding opportunities for solitude or primitive and unconfined recreation, special features and values, manageability—as identified in the Wilderness Act.

The natural appearance and ecosystem health of each recommended wilderness area would be unaltered by the presence of mountain biking and motorized trail maintenance. There would be no expected increase in the presence of non-native species, the presence of developments that would change the free-flowing nature of area streams, the level of light pollution, or the presence of

pollutants. The recommended wilderness area would remain undeveloped except for the presence of trails and would continue to provide opportunities for solitude or primitive and unconfined recreation. The recommended wilderness would continue to support the existing ecologic, geologic, scientific, educational, scenic, historical, and cultural features of significance contained within the recommended wilderness. Finally, there would be no change in the Colville National Forest's ability to manage the boundary of the recommended wilderness area if mountain biking and motorized trail maintenance are allowed to continue.

The presence of mountain biking and motorized trail maintenance may affect the degree of solitude and level of primitive recreation that some user's experience while recreating in the recommended wilderness area while these activities are actively taking place. Whether the effect of these activities are positive or negative and how strong the effect is will depend on each individual user's value system and cannot be effectively measured. However, since mountain bike use and motorized trail maintenance do not represent long-term or irreversible commitments of resources, the non-esoteric effects to solitude and level of primitive recreation would be temporary. In addition, when the recommended wilderness areas are designated as wilderness by Congress, the effects on solitude and level of primitive recreation would be eliminated assuming that the wilderness legislation passed by Congress prohibits these uses.

Allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness area's "availability" determination made as part of the 2009 wilderness evaluation process. All NFS lands determined to meet wilderness "capability" requirements are considered potentially "available" for wilderness designation. The determination of "availability" is conditioned by the value of and need for the wilderness resource compared to the value of and need for other resources. Since no new inconsistent uses would be allowed under alternative O, there would be no change in the basis for the 2009 "availability" determination.

Likewise, allowing mountain biking and motorized trail maintenance and reconstruction to continue would not affect the recommended wilderness area's "need" determination made as part of the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System. In determining whether there is a "need" to recommend an area as recommended wilderness, the following factors are considered:

1. The location, size, and type of other wildernesses in the general vicinity, their distance from the proposed area, the accessibility of the area to population centers and user groups, and public demand for wilderness.

2. Present visitor pressure on other wildernesses, the trends in use, changing patterns of use, population expansion factors, and trends and changes in transportation.

3. The extent to which nonwilderness lands on the NFS unit or other Federal lands are likely to provide opportunities for unconfined outdoor recreation experiences.

4. The need to provide a refuge for those species that have demonstrated an inability to survive in less than primitive surroundings or the need for a protected area for other unique scientific values or phenomena.

5. Within social and biological limits, management may increase the capacity of established wildernesses to support human use without unacceptable depreciation of the wilderness resource.

6. An area's ability to provide for preservation of identifiable landform types and ecosystems, which is helpful in rounding out the National Wilderness Preservation System.

Factors 1, 2, 3, 5, and 6 would not be altered by the presence of mountain biking or motorized trail maintenance and reconstruction. Factor 4 has been analyzed by resource specialists (wildlife, rare plants, fisheries, etc.) in their respective analysis for the revised forest plan and no species were identified that would be unable to survive if mountain biking and motorized trail maintenance and reconstruction were allowed to continue. Therefore, mountain biking and motorized trail maintenance and reconstruction would not affect the "need" determination made in the 2009 wilderness evaluation process.

Ultimately, inconsistent uses, including mountain biking, chain saw use, and motorized trail maintenance and reconstruction, were identified during the 2009 evaluation process for areas that may be suitable for inclusion in the National Wilderness Preservation System and their presence did not preclude the roadless areas from meeting the evaluation criteria (capability, availability, and need) for inclusion on the inventory of potential wilderness areas. Therefore, allowing these inconsistent uses to continue at use rates similar to when the wilderness evaluations were completed should not detract from the inherent wilderness characteristics associated with the Salmo-Priest Adjacent roadless area.

The areas that may be suitable for inclusion in the National Wilderness Preservation System that would be designated as backcountry motorized management areas in this alternative include Owl Mountain, Jackknife, Twin Sisters, South Huckleberry and Lost Creek. Combined, these five areas would provide access to all of the Forest's existing backcountry motorized trail systems. As a result, implementation of alternative O would result in no change in the amount of summer motorized recreation trail opportunities when compared to no action.

Under this alternative, 15 areas that may be suitable for inclusion in the National Wilderness Preservation System would be designated as backcountry management areas including: Abercrombie-Hooknose, Bald Snow, Bodie Mountain, Clackamas Mountain, Cougar Mountain, Deer Creek, Grassy Top, Hall Mountain, Harvey Creek, Hoodoo, Jackson Creek, Profanity, Quartzite, South Fork Mountain, and Thirteenmile. Combined, these areas contain the majority of backcountry mountain bike trail opportunities on the Forest. However, if the Salmo-Priest Adjacent recommended wilderness area listed in this alternative becomes wilderness, mountain bike trail opportunities would be eliminated from approximately 16,000 acres across the Forest. This equates to approximately a 29 mile (10 percent) reduction in the number of available mountain bike trail opportunities that are associated with the Forest's existing summer non-motorized trail system. As a result, this alternative would provide the second highest amount of mountain bike trail miles of all the alternatives. For a comparison between alternatives of backcountry management acres open to mountain biking and the number of trail miles open to mountain biking, see table 244. Managing these lands as backcountry, instead of wilderness, would also allow the Forest to continue to manage its only backcountry rental cabin and to maintain a popular historic fire lookout.

Below is a list of alternative O's recommended wilderness area and the trails that would be closed to mountain bike use if the recommended wilderness is designated as wilderness by Congress.

- Salmo-Priest Adjacent: Slate Creek #525, Halliday #522, North Fork Sullivan Creek #507, Red Bluff #553, Elk Creek #560, Crowell Ridge #515, Salmo Divide #535, Shedroof Cutoff #511.

If the recommended wilderness areas listed under alternative O are designated as wilderness by Congress, trail maintenance and reconstruction costs could increase on the 29 miles (the lowest

mileage increase of all the alternatives) of trail that access the approximately 15,900 acres of recommended wilderness. This cost increase is based on the required change from using motorized (chainsaws, power toters, trail dozers, etc.) trail maintenance and reconstruction equipment to non-motorized equipment (cross-cut saws, pack mules, pulaskis, etc.) which would likely result in annual tasks, such as spring logout, and reconstruction efforts taking more time to complete, additional people, or both.

Implementation of alternative O would prohibit over-snow vehicle use on approximately 90,700 acres currently open to over-snow vehicle recreation opportunities in the no action alternative as a result of an increase in acres associated with backcountry (semi-primitive non-motorized), research natural area, and recommended wilderness management areas as well as changes in designated winter range. However, the majority of the additional acres that would be closed to over-snow vehicle use under Alternative O consist of heavily vegetated slopes and terrain that is difficult to access and currently supports only limited over-snow vehicle recreation opportunities. Therefore, implementation of alternative O would result in little to no reduction in the amount of over-snow vehicle recreation opportunities available on the Forest when compared to the no action alternative. For a comparison of acres open to over-snow vehicle recreation opportunities by alternative, see table 241.

Cumulative Effects (Common to All Alternatives)

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

No major changes in recreation management on lands adjacent to the Colville National Forest were identified that would contribute to cumulative effects.

The affected environment for cumulative effects includes those lands covered by the management plans for the Confederated Tribes of the Colville Reservation and the Kalispel Indian Reservation lands, lands administered by the Okanogan-Wenatchee and Idaho Panhandle National Forests, other Federal and State lands, and lands of other ownerships both within and adjacent to the Colville National Forest boundary. Recreation management of adjacent national forests and other lands adjacent to the Colville National Forest is expected to continue unchanged from current management practices. As a result, there are no past, present, or reasonably foreseeable major changes in recreation management on lands adjacent to the Colville National Forest that would contribute to cumulative effects.

Scenery

This scenery analysis provides an overview of the scenic resources of concern, and focuses on the issues likely to affect the scenic resources including Old Forest Management and Timber Production, Motorized Recreation Trails, Access, Recommended Wilderness, Wildlife, and Riparian and Aquatic Resource Management.

Affected Environment

Scenic Resources

Scenery provides the setting for all activities experienced by forest visitors. Forest scenery is an integral part of the larger landscape and way of life in northeastern Washington. Forest lands provide a scenic backdrop for travel, work, play, and daily life. Forest scenery contributes to casual and inexpensive recreation experiences near home, and contributes to a general sense of well-being, security, and constancy. Many people point to their tie to the landscape, regardless of administration or ownership, as a major reason for living in northeast Washington.

Beyond the local level, the scenery of northeastern Washington is a factor in drawing new and return tourists to the area, as well as contributing to people's decisions to move to northeastern Washington. In addition to influencing choices in where people visit and settle, scenic conditions can influence how people perceive the health of ecosystems and can be an indicator of whether or not management practices are successful.

Scenic landscapes are an important forest resource valued by many people. National Forest System lands are places where many people go to escape urban environments and immerse themselves in natural-appearing environments. People's definition of the national forest is largely based on landscape images from their own experiences in the forest or images conveyed to them by the media. They have expectations regarding the content and form of forest landscapes; therefore, it is important to realize that the designation of scenic landscapes is based on cultural values and perceptions of nature. Landscapes that are culturally perceived as having high scenic quality are generally associated with sustainable ecosystems; however, not all sustainable ecosystems are perceived as landscapes with high scenic quality. Some high quality landscapes are a result of past human activity. Regardless of whether a scenic landscape is a result of natural processes or past human activity, it is a resource whose aesthetic qualities should be maintained and/or enhanced. To ensure that landscapes are both highly scenic and ecologically sustainable, scenic integrity objectives and scenic resource management objectives related to landscape character, sense of place, scenic integrity and scenic stability (sustainability) as outlined in the Scenery Management System (SMS), would be compatible with other forest resource management objectives.

The SMS is a systematic approach to inventory, analyze, and monitor the scenic resources. The system is used in the context of ecosystem management to determine the relative value and importance of scenery, assist in establishing overall resource objectives, and ensure high-quality scenery for future generations. The Colville National Forest uses *Landscape Aesthetics - A Handbook for Scenery Management* (Dept. of Agriculture Handbook #701, USDA Forest Service 1995c) to inventory scenic resources for the forest plan revision. Landscape Character, Scenic Integrity and Scenic Sustainability (Stability) are the three basic building blocks of SMS. Understanding the valued attributes of the landscape and their condition from a social and ecologic perspective is the framework to all SMS application.

Some important concepts relative to scenery include:

SMS recognizes natural disturbance processes such as fire, insects, and disease, to be part of the natural landscape and play an important role in maintaining healthy, sustainable, and scenic landscapes. These disturbance regimes are evaluated as part of an evolving landscape and can create positive changes to the scenery integrity of a landscape. A more diverse mosaic of vegetation, increased species diversity, and diversity of age classes are all potential results of natural disturbance processes that would be compared with positive attributes defined in desired landscape character descriptions. SMS planning also recognizes that without these disturbance processes, the likelihood of catastrophic events is increased and the resulting landscape would likely not meet established desired conditions for vegetation, scenery, or other natural resources.

SMS recognizes ecological processes and the resulting landscapes as a dynamic ecosystem. Instead of basing objectives for scenery on one landscape condition at one point in time, the objectives are linked to a range of conditions that link to the historical range of variability. Long-term results as opposed to immediate results are considered when analyzing the effects to scenic resources. For instance, immediately after a fire, there are short-term effects such as red needles, burned trunks, snags, and possibly little or no understory vegetation. Depending on the intensity of the fires, these effects are often short-term (one or two years). As the landscape recovers, the short-term effects diminish and long-term changes such as: mosaic of vegetation patterns, snags punctuating the new growth canopies, and variety in colors and textures begin to appear. These changes add interest and diversity to the landscape and the effects to the scenic resources are considered positive by most people.

SMS recognizes that some man-made components of a landscape contribute to the landscape's valued character and are considered as positive attributes to the overall scenic quality. This premise is different from the Visual Management System (VMS) where most human-made features were considered a negative impact to the natural environment. SMS recognizes that some human-made features add to the aesthetics of certain landscapes and are identified as positive attributes of those landscapes. Examples of human-made features that may be identified as valued, positive cultural attributes include: reservoirs, old barns, historic log cabins, split rail fencing, agricultural or rural settings, ghost towns, etc.

The following describes the existing condition for the Colville National Forest landscape character and sense of place, scenic integrity and scenic stability (sustainability).

Landscape Character and Sense of Place

The Colville National Forest contains a complex and diverse range of landscapes. The landscape character in highly unique across the entire forest with a variety of landscape patterns consisting of large scale patterns of vegetation and sense of place zones, landform of geologic features such as rocky peaks and outcrops, canyons, steep cliffs and talus slopes, and water form features of marshes, streams, rivers, potholes, ponds, lakes, and waterfalls unique to a specific landscape character type. At the regional scale, the Forest is characterized as Okanogan Highlands landscape character type. The Okanogan Highlands character type is generally rolling terrain of moderate slopes with broad rounded summits. Scattered peaks rise well above the general terrain dividing the area into several upland areas separated by a series of broad north-south river valleys. The western edge has a series of large flats and plateaus.

Sense of place is addressed to display how the area is perceived by the public, and to display the physical setting in which the project area lies. The sense of place definition is "The identity of a place created by people's social meanings and attachments, including valued scenery and recreation

settings, cultural and spiritual values, economic, social and biophysical characteristics." Managers using the concept of sense of place must define a specific framework for the definition and use of sense of place. Place based planning recognizes that people are part of the natural environment, and integrates peoples' values into environmental planning. The sense of place zones document how people value the forest landscape and are displayed in a map at the beginning of desired landscape character descriptions included in appendix A of the Scenic Resources Specialist Report. District meetings were conducted across the Forest going through a sense of place process to develop a geographic spatial map. The Forest specialists interviewed various Forest staff and involved the public at 12 meetings to further refine the sense of place values. Sense of place varies in scale; the entire forest would fall into a regional scale while the watershed scale is more of the community scale. Given the large size of the Forest, over 1 million acres, the forest was separated into five sense of place areas in order to comprehensively/adequately describe the scenic resources. Since scenery is intrinsically linked to biological and hydrological processes, the sense of place zones are divided according to watershed boundaries. The five zones are Okanogan Highlands, Salmo Priest Remote Dispersed, East of Kettle Crest, West of Kettle Crest and Front Country Dispersed.

The landscape character types experienced at the community scale that are more relevant to the Colville National Forest user and sense of place ranges from the Okanogan Highlands and Salmo Priest Remote Dispersed landscape area at north eastern corner near the Canadian border and Idaho border, to the middle zone landscape areas of East of Kettle Crest, West of Kettle Crest, Front Country Dispersed and the Okanogan Highlands at the western edge of the Forest. Sense of place based planning recognizes that people are part of the natural environment, and integrates peoples' values into defining landscape character based on how people use the landscape and are tied to the land. The Salmo-Priest Wilderness area contributes to world-class scenery and has its own sense of place and as presented in the Wilderness narrative.

In addition to the physical environment, Forest Service facilities evoke a strong sense of identity across all sense of place zones. The Rocky Mountain Province style contributes to the historic and cultural landscape character and defines sense of place and rustic style. "Rustic Style: In the first half of this century, the National Park Service and the Forest Service adapted the rustic style, which had been developed from models such as Swiss chalets and 19th century Adirondack lodges. Influential examples include the Old Faithful Inn at Yellowstone (1904) and the Timberline Lodge on Mt. Hood (1937). Rustic-style buildings, often built by the CCC, are highly crafted structures featuring native stone and unhewn logs. The scale of details can be massive, even in the cases of kiosks or cabins. The rustic style was popularized in the 1900-to-1940 era by resort developers like Averill Harriman, who called Sun Valley, Idaho, the St. Moritz of America. In the Rocky Mountain Province, the public associates images of rustic style lodges with recreation" (Built Environment Image Guide Pg. 4-6, USDA Forest Service 2001b). Remnants of CCC era facilities such as ranger stations, guard stations, work stations, and fire lookouts are highly valued with destination areas such as Log Flume and White Mountain, Growden CCC Historic Site, Columbia Mountain Lookout and Mill Pond being important. All CCC era-developed recreation facilities of picnic shelters/stoves/rock barrier walls, etc., at numerous campgrounds located across the Forest contribute to the landscape character. In addition, Native American usage has occurred throughout the landscape for over 7,000 years, providing a social and cultural connection to the vegetation and landform through time especially related to salmon fishing, hunting, and plant gathering in traditional areas. Mineral exploration and production has been substantial in areas as well as logging, cattle grazing, and human settlement patterns that contribute to the cultural and social valued landscape character. In particular, homesteading has left behind visual evidence of settlement patterns and remains of cabins in remote areas are fairly common to see.

The sense of place tied to the scenic landscape setting for the Colville National Forest is tied to year-round recreational experiences; accessing developed recreation sites of campgrounds, day use sites, boat launch facilities, and trails and trailheads offering motorized and non-motorized opportunities. The Pacific Northwest National Scenic Trail is a regional draw and traverses east to west along the northern end of the Forest. A large portion of the sense of place for the Forest is tied to the "big backyard" experience people seek with a variety of year round seasonal recreation activities that occur with dispersed camping, hunting, sight-seeing, driving for pleasure, huckleberry picking, mountain biking, equestrian riding, snowmobile riding, cross-country skiing, snowshoeing, wildlife viewing, fall color viewing, and other dispersed use.

Scenic Classes

Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and of the positive response it evokes in people. Based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns and cultural features, the scenery is rated on a three-point scale:

- Class A – Distinctive, where landform, vegetation patterns, water characteristics and cultural features combine to provide unusual, unique or outstanding scenic quality.
- Class B – Typical, where landform, vegetation patterns, water characteristics and cultural features combine to provide ordinary or common scenic quality.
- Class C – Indistinctive, where the landscape does not have characteristics that add to the variety, unity, vividness, mystery, intactness, order, harmony or uniqueness of the scenery.

The scenic attractiveness rating is applied to the process of evaluating the value of the area's scenery resource. Inherent scenic attractiveness within the landscape character and sense of place zones were validated from the inventory done for the Colville Forest Plan in 1988 and carried forward to this plan revision. The existing Variety Class map was developed through the Visual Management System and is available in hard copy inventory. This inventory was used to identify concern levels for landscape travel corridors on the Colville National Forest. This inventory was supplemented with new information gained through constituent assessment to express scenic integrity concerns and general biophysical impressions by scientists to express ecological integrity concerns. The existing visual concern level 1 and 2 roads and trails were reviewed on a map in an interdisciplinary team setting to determine the need for change. Specialists updated visual sensitivity level corridors to meet current need and desired condition in order to depict new concern level travel corridors. In addition to using the original sensitivity level maps, the updated ROS layer, the new Sense of Place layer, the updated IRA layer and the updated recreation sites, wild and scenic river, and scenic byway layers were used to determine scenic values. New areas identified of scenic concern were sent through IRM to map Seen Areas. An example of a new travel route with a high level of concern is Flowery Trail which was assigned a concern level 1. Several GIS maps were adjusted over the process to determine the concern levels for roads. These draft map exercises are available as project background support dated June 13, 2007, July 16, 2007; August 7, 2007; November 6, 2007; November 14, 2007; and November 19, 2007. Concern levels were only assigned to only nationally designated recreation or scenic trails for the mapping. The remaining trails would assume the SIO for the proposed management areas where they go through and to address the foreground of all trails to be managed for a High SIO in a narrative format for standards, guidelines and objectives.

Across the Forest there are areas rated as Scenic Attractiveness Class A – Distinctive, where landform, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique or outstanding scenic quality. Class A landscape types include all Wilderness,

Recommended Wilderness, Proposed Wild and Scenic Rivers, Scenic Byways, Backcountry Areas, and Research Natural Areas. Some outstanding landform features include Hoodoo Canyon, Bodie Mountain, and the Kettle Crest Range. Examples of Class A and Class B water forms include Sullivan Lake, Peewee Falls, the Wedge and Little Pend Oreille Lakes and numerous small lakes in the upper elevations. All Proposed Wild and Scenic Rivers such as the Kettle River and Salmo River add distinct variety and are rated Class A. Most of the big backyard areas are representative of Scenic Attractiveness Class B – Typical, where landform, vegetation patterns, water characteristics and cultural features combine to provide ordinary or common scenic quality. There are areas characterized as Scenic Attractiveness Class C – Indistinctive, where the landscape does not have characteristics that add to the variety, unity, vividness, mystery, intactness, order, harmony or uniqueness of the scenery. Class C areas would be found in the lower-elevation foothills outside of the forested environment where the terrain has little topographic relief and no apparent variation in areas of similar vegetation, waterforms are often not visually apparent.

Vegetation within the Colville National Forest reflects a diverse, resilient, and dynamic landscape that has been shaped by both natural and human disturbances. Natural disturbances, from insects and diseases, fires, winds, floods, or landslides, all contribute to an ever-changing patchwork of structure and species composition at various scales on the landscape. Human disturbances result from land use choices that include cattle grazing, timber harvest, road construction, water diversions or dams, or species introductions that also influence the ever-changing patchwork of structure and species across the landscape. Combined natural disturbances and human disturbances influence the dynamic line, form, color, and texture features of the landscape. Vegetation on the forest scale is highly variable with a wide number of species. Five categories have been identified to help in understanding the relationships within and between vegetation communities and how these interactions create scenic landscapes. Each of these vegetation groups contributes to distinct scenic values that support a variety of human uses. The five categories are Douglas-fir Dry, Northern Rocky Mountain Mixed Conifer, Spruce/Subalpine fir, Subalpine Fir/Lodgepole pine, Western redcedar/Western hemlock. In addition, several understory/ground cover habitat types contribute to unique landscape character that include Alpine and Subalpine Vegetation, Montane Herbaceous, Montane Shrubland, Riparian Shrub and Deciduous Forest and Wetland/Riparian Herbaceous. The vegetation character is further described in the Desired Landscape Character Descriptions in appendix A of the Scenic Resources Specialist Report.

Scenic Integrity

Scenic integrity is the amount of human-caused deviation in form, line, color, and texture of a landscape. Scenic integrity serves as a frame of reference for measuring scenic integrity levels based on the valued attributes of the existing landscape character being viewed. The degrees of integrity vary from VERY HIGH to VERY LOW. Scenic integrity was measured on the Colville National Forest through Visual Quality Objective levels defined by the Forest Service Visual Management System's Chapter 1 USDA Handbook # 462.

The **Existing Scenic Integrity** (Condition) identifies temporary deviations from the landscape character of a particular place and is a general indicator or impression of ecological conditions and/or trends that puts valued landscape character attributes at risk. (Very High, High, Moderate, Low, Very Low).The highest scenic integrity ratings are given to those landscapes where the valued landscape attributes appear complete and little or no visible deviations are evident. Scenic Integrity is used to describe both existing (Existing Scenic Integrity) and desired (Scenic Integrity Objective) conditions. *(Landscape Aesthetics, A Handbook for Scenery Management, USDA, FS HB 701, page 2-1).*

The following table displays the six scenic integrity objectives and conditions associated with each level (how people perceive them). Table 247. Scenic Integrity and Condition. (USDA Forest Service 1995c, Landscape Aesthetics, p A-1)

Table 247. Scenic integrity objectives

Scenic Integrity Objective (SIO)	Definition
Very High	Landscape is intact with only minor changes from the valued landscape character associated with significant scenic landscapes. This SIO is typically (but not exclusively) associated with specially designated areas such as wilderness or other designations that imply the landscape is natural appearing and only ecological changes occur.
High	Management activities are unnoticed and the landscape character *appears* unaltered.
Moderate	Management activities are noticeable but are subordinate to the landscape character. The landscape appears slightly altered
Low	Management activities are evident and sometimes dominate the landscape character but are designed to blend with surroundings by repeating line, form, color, texture of landscape character attributes. The landscape appears altered.
Very Low	Management activities create a “heavily altered landscape.” Changes may strongly dominate the landscape.
Unacceptably Low (Not a management objective, used for inventory only)	Management activities create an extremely altered landscape. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale from the landscape character. Landscapes at this level of integrity need rehabilitation.

The Colville National Forest has a full range of scenic integrity levels from Very High, to High, Moderate, Low and Very Low; Wilderness and Recommended Wilderness is Very High.

Scenic Stability (Sustainability)

Scenic stability/sustainability is the ability of an ecosystem to maintain ecological processes and functions, biological diversity and productivity over time. The general health of the forest contributes to scenic resources, where uncharacteristic wildfire and insect and disease outbreaks can alter the natural appearance in areas where the ecosystem is out of the historical range of variability.

The Landscape Aesthetics Handbook 701 speaks to achieving landscape character goals by designing a transition strategy that moves the existing landscape character to the desired landscape character. During this Forest Planning process the mapping of where the desired landscape character is not represented on the ground is not necessary to the development of suitability layers primarily from vegetation and fire resources. The development of a map that depicts where the existing landscape character deviates from the desired landscape character simply documents the information for later use at the project level. While the time line necessary for reaching that goal “should exclude excessive increments of change” (Scenery Management System pg. 5-9, USDA Forest Service 1995c), the needed changes can be identified and tracked through the use of a mapping layer. This layer is a “working layer” that would be utilized at the project level, it would not be a fixed or static layer in time and can be revised as the landscape character changes through either project implementation of management activities (i.e., vegetation thinning, prescribed burning, closing and restoring roads) or natural occurring events (i.e., wildfire, flooding, landslides).

In landscape areas where an ecosystem is out of the historical range of variability the forest setting may exist at a lower scenic integrity during treatment activity and recovery in order to restore and sustain the landscape character to the assigned scenic integrity objective (SIO). An example of an area that is identified on the enhancement layer are the wildland-urban interface (WUI) areas. Most of these areas are now allocated to the Retention Visual Quality Objective, and would likely have a High SIO in the forest plan. Because the identified WUI areas may not be sustainable due to past fire suppression, causing fuel buildups and now under fire risk to communities, developed recreation facilities, and concentrated use areas, treatments need to occur not only to make them safer, but to also sustain the landscape character and scenic integrity in the future. This area would then be one that would be allowed to exist in a lower scenic integrity state in the short term while treatments were occurring in order to bring it to a sustainable state that can be maintained in the long term. During the transition period, there would be variations of high, moderate, to low scenic integrity levels across the WUI landscape while treatments were occurring, as to not have the whole landscape existing in a low scenic integrity level. The landscape character to be perpetuated would be a mosaic character, the areas of moderate to high landscape character would be coordinated and compatible with meeting other natural resource goals of leaving wildlife or riparian corridors and retaining landscape patches of varying scales. The landscape architect would be assisting silviculturists, fire and fuels planners and the interdisciplinary team in developing prescriptions to come up with acceptable methods and treatments that would accomplish all goals.

A new scenery indicator has been developed for use within the Forest Service Scenery Management System (applied in this analysis according to procedures described in the August 30, 2007 Appendix J of the SMS Handbook #701). Scenic stability is the degree to which the desired scenic character can be sustained through time and ecological progression. The existing scenic stability analysis focuses on the single major scenery attribute of vegetation, addressing its ecosystem conditions identified by field observation and Fire Regime Condition Class (FRCC) 7 coarse-scale data on vegetation and fire history data. Ecosystem changes to other minor scenery attributes such as landform, rock outcrops, and winter snowfall are not as critical to the Colville National Forest area's scenic character as its vegetation, since these changes are relatively stable over time regardless of fire behavior and human activities.

Evaluating scenic stability is done by considering conditions necessary to sustain desired scenic character of stands within the natural and historic range of the landscape. Appropriate stand density, species composition, and fuel loads are necessary for stands to maintain the inherent characteristics through their lifecycle. When trends such as increasing stand density, encroachment of less resilient species, increasing fuel loads, and high levels of mortality exist, the expected consequences are change in the scenic character that are beyond the historic scale. Examples of these consequences are large canopy openings from intense wildfires, large stands of dead and dying timber, and loss of distinctive characteristic such as open, large tree character pine stands and multi-layered mixed species stands. Gradual trends over time have altered the species composition, stand structure, and age classes of the forest vegetation. Stands of large mature ponderosa pine that provide an open forest are diminished due to encroaching mixed conifer species, and past harvest practices that removed pine to release shade-tolerant species.

The analysis to determine scenic stability would need to be done at the project level because the landscape is dynamic and conditions change. Tree density needs to be determined at the project level to integrate range of natural or historical variability.

Scenic stability levels are defined as follows:

Very High Stability—All dominant and minor scenery attributes of the valued scenic character are present and are likely to be sustained.

High Stability—All dominant scenery attributes of the valued scenic character are present and are likely to be sustained. However, there may be scenery attribute conditions and ecosystem stressors that present a low risk to the sustainability of the dominant scenery attributes.

Moderate Stability—Most dominant scenery attributes of the valued scenic character are present and are likely to be sustained. A few may have been lost or are in serious decline.

Low Stability—Some dominant scenery attributes of the valued scenic character are present and are likely to be sustained. Known scenery attribute conditions and ecosystem stressors may seriously threaten or have already eliminated the others.

Very Low Stability—Most dominant scenery attributes of the valued scenic character are seriously threatened or absent due to their conditions and ecosystem stressors and are not likely to be sustained. The few that remain may be moderately threatened but are likely to be sustained.

No Stability—All dominant scenery attributes of the valued scenic character are absent or seriously threatened by their conditions and ecosystem stressors. None are likely to be sustained, except relatively permanent attributes such as landforms.

The greatest hazard to scenery resources is large stand-replacement fires that would burn much more intensely due to the stocking levels, species compositions, ladder fuels and canopy closure that have developed over time, and large epidemics of insect or disease. The fire regime condition classes rate these factors and give an indication of the potential for fire intensity.

Condition Class: Condition class is a description of how far "current conditions" have deviated from historical conditions. Three condition classes have been developed to categorize the current condition with respect to each of the five historic fire regime groups. Current conditions are a function of the degree of departure from historical fire regimes resulting from alterations of key ecosystem components such as; species composition, vegetation structural stage, stand age, and canopy closure. The higher the condition class number the higher the relative risk of fire, insect, or disease caused losses to natural resources and other key ecosystem components. A higher condition class rating or percent from departure shows a higher risk of loss to key ecosystem components landscape wide.

The three condition classes are:

Condition Class 1: Fire regimes are within or near historical ranges, and the risk of losing key ecosystem components is low.

Condition Class 2: Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate.

Condition Class 3: Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high.

Existing Scenic Stability Summary

The considerations to the stability of scenery resources are to be determined at the project level where project stand conditions related to departure from historical fire regimes and tree density levels are determine overstocked conditions. The following ratings apply to scenic stability levels of very high, high, moderate, low, very low, and no stability:

The **FRCC 1 (Low)** corresponds to the definitions for "High" and "Very High" Scenic Stability levels described above. Both classifications have scenery attribute conditions that are within the range of natural or historical variability.

FRCC 2 (Moderate) corresponds to the definitions for "Moderate and Low" scenic stability. Both classifications include conditions outside the range of natural or historical variability.

FRCC 3 (High) corresponds to the definitions for "Very Low" and "No" Scenic Stability. They are far beyond the range of natural or historical variability.

Need for Change

Old Forest Management and Timber Production

In the revision of the forest plan, three broad scale concerns drove the need to consider how we address old forest management, especially the current reserve system approach at the landscape scale. These are:

- The recent history of uncharacteristic levels of disturbances resulting from fire and insect and disease activity that would likely continue into the future.
- The interaction between disturbances and climate change that elevates the importance of restoring landscape resiliency.
- Uncertainty about the recovery and viability of old forest-dependent species given the increased risk of uncharacteristically severe disturbances that is likely to be exacerbated by climate change impacts.

The proposed action describes management of old forest vegetation by providing desired structural stage distribution for multi and single strata old forest across the landscape. To meet the large tree desired conditions, old trees and enough of the younger larger trees would be retained. Retention of large, younger trees that are in the best condition and are not limiting growth of nearby old trees through resource competition would be prioritized. Desired conditions for old forest habitats would be at, or toward, the high end of the range of variability (considering historical and future variability) within areas that are capable of providing old forest habitat structures. Desired conditions would be described by conifer-dominated vegetation group. Habitat capable areas would include the following forest series: Douglas-fir, grand fir, western hemlock, and Pacific silver fir. If habitat amounts were not currently available, areas would be identified for future old forest habitat. The proposed action does not zone the Forest into reserves and matrix or general forest.

The proposed action also describes details for providing old forest habitat for specific surrogate wildlife species (e.g., American marten, northern goshawk, and northern spotted owls).

Motorized Recreation Trails

The 1988 forest plan provides direction for summer and winter motorized uses, including identifying areas where such use may not be authorized or is limited, mainly for protection of aquatic, plant, and wildlife habitats.

The proposed action would continue to provide recreational access on NFS lands and a wide range of recreational opportunities, while limiting or prohibiting winter and summer motorized activities in certain areas to provide quality aquatic, plant, and wildlife habitat. Other areas, such as wilderness, are closed to motorized use to provide a range of recreational experiences.

The goal for recreation settings and experiences would include providing a spectrum of high quality, nature-based outdoor recreational settings where visitors access the Forest, including access to the biological, geological, scenic, cultural, and experiential resources of the Forest. Where the visitor's outdoor recreational experience involves few conflicts with other users, access is available for a broad range of dispersed recreation activities such as dispersed camping, boating, mushroom and berry picking, hunting, and fishing and these experiences are offered in an environmentally sound manner, are within budget limits, and contribute to the local economy.

It should be noted that the proposed action makes broad, strategic decisions that apply at the landscape scale. The 2005 Travel Management Rule prescribed a process for making site-specific decisions to designate roads, trails, and areas for motorized travel thereby, closing undesignated roads, trails and areas to motorized use. Over the past few years, implementation of the Travel Management Rule has occurred on the Forest in a separate process with the objective of providing a motor vehicle use map showing roads, trails, and areas designated for summer motorized use and resulting in the closure undesignated roads, trails, and areas for summer motorized use.

Access

Three broad concerns drove the need to address road density: (1) the Forest is no longer able to afford to properly maintain road system at current operational maintenance levels, (2) the current road system is not aligned with current and future resource management objectives, and (3) the existing road management direction is confusing and difficult to follow because it is scattered throughout the 1988 forest plan, forest plan amendments, national-level decisions (the Roadless Rule), and interim policy. The 1988 forest plan includes much direction about managing the road system.

The proposed action provides a strategic vision to guide the location and overall density of roads in the future. It includes management areas that delineate where there is a need to manage for specific road densities. These are the Active Restoration management areas B and C. These areas have aquatic and wildlife habitats that would benefit from reducing the negative impacts of roads by managing toward road densities of 2 or 3 miles per square mile. A wide spectrum of travelway types would be present in Active Restoration B and C, ranging from maintenance level 1 through 5 roads, or primitive roads to highways. Road densities would include all maintenance levels and be measured within each management area within a 5th field watershed.

The proposed action states that the goal is for the Forest to continue to have an access system of authorized roads that is safe, affordable, and environmentally sound, that meets obligations to public and private cooperators, and is efficient to manage. However, any NFS road that is not needed to meet resource or social and economic objectives, and/or user-created roads, would be decommissioned and the landscape restored.

Recommended Wilderness

By law, all NFS lands must be evaluated for possible wilderness recommendation during the plan revision process. The result of that evaluation shows whether a need exists for additional wilderness and what trade-offs may exist if the area is eventually designated part of the national wilderness system.

Currently, the Salmo-Priest Wilderness covers about 3 percent of the Colville National Forest and evaluation showed a need for additional wilderness opportunities on the Forest. A review of possible areas showed some are available to fill this need. The proposed action considered recommending approximately 101,400 acres of additional wilderness. About 13,500 acres would be recommended

for addition to the existing Salmo-Priest Wilderness and the remaining 87,900 acres would include recommending portions of the Abercrombie-Hooknose, Bald Snow, Profanity, and Hoodoo areas. All parcels would be managed as recommended wilderness, where existing uses would continue until Congress took action on the recommendation.

When congressional designation is complete, these areas are managed according to the desired conditions for designated wilderness in the forest plan. The proposed action clarifies that the following selected activities could continue to be authorized in recommended wilderness areas:

- Summer off-highway vehicle use and winter motorized use (existing use could continue, but no additional use is allowed).
- Mechanized uses (existing use could continue, but no additional use is allowed).
- Vegetation management activities would not be authorized in recommended wilderness areas.

Wildlife

The proposed action describes the need to maintain or restore ecological conditions that contribute to the recovery and viability of terrestrial plant and wildlife species The 1988 forest plan needs to be updated to reflect new species listings, new designated critical habitat, and current science related to plant and animal species and their habitats. A considerable body of information is now available concerning the viability of terrestrial wildlife and plant species of management focus.

Riparian and Aquatic Resource Management

The 1988 forest plan includes riparian management direction from the Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California (PACFISH, USDA and USDI 1995), and the Inland Native Fish Strategy (INFISH, USDA Forest Service 1994c and 1995a). These approaches appear to have either maintained or improved riparian and aquatic habitat conditions at the watershed and larger scales. The changes presented in the proposed action combined the three separate pieces of direction into one place, the revised forest plan, and fulfills the intent of replacing the interim direction (PACFISH and INFISH) with longer-term management direction

Riparian management areas are designated in the 1988 forest plan. The proposed action carries forward this approach with some changes in widths and more information on desired conditions for riparian areas. Generally, the area widths would increase on those lands within the INFISH amendment area, for lakes and ponds greater than 1 acre and intermittent streams. Riparian management areas would remain the same for those areas of the Forest within the PACFISH amendment area.

Riparian management areas would include portions of watersheds where aquatic and riparian-dependent resources receive primary emphasis and where special management direction applies. Riparian management areas would be designated for all permanently flowing streams, lakes, wetlands, seeps, springs and intermittent streams, and unstable sites that may influence these areas.

Objectives for riparian management areas would give emphasis to maintaining or restoring the riparian and aquatic structure and function of intermittent and perennial streams, confer benefits to riparian-dependent plant and animal species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, contribute to improved water quality and flows, and contribute to a greater connectivity of the watershed for both riparian and upland species.

Desired conditions for riparian management areas within any given watershed are to have compositions of native flora and fauna and a distribution of physical, chemical, and biological conditions commensurate with natural processes.

Environmental Consequences

Methodology

Risks to scenic resources were identified. Level of risk is assessed using acres or percent of Forest allocated to a management area that is associated with the risk, either increasing or decreasing the risk.

Assumptions

- Assume the budget levels would continue along current trend lines, with the possibility of the amount varying by 20 percent plus or minus.
- The expected amount of acres treated (prescribed fire or timber harvest) is the same across all alternatives.
- Use the PNW-GTR-862 prepared by Gaines to guide consideration of climate change.
- Under all action alternatives, scenic integrity objectives for management areas and scenery plan direction remains the same.

Issue Indicators

Generally, effects to scenic resources are from visible management changes that can be detected by the casual forest visitor. Types of activities that create changes are ground-disturbing activities such as road building, mining, construction of facilities, and vegetation management activities, including timber harvest. These activities can adversely affect the scenic stability. In addition, the general health of the forest contributes to scenic resources, where uncharacteristic wildfire and insect and disease outbreaks can alter the natural appearance. Changes in appearance of the landscape character can adversely affect a forest visitor's sense of place, or the value of the setting to the visitor. The indicators listed in table 248 were used to evaluate each management issue and to develop the variations between the alternatives.

The three indicators used to measure the effects to scenery resources are landscape character, scenic integrity, and scenic stability. These three indicators evaluate the intensity and duration of effects as well as the degree to which the alternatives would affect the stability of scenery attributes over the long term.

- Landscape Character is the naturally established landscape pattern in a geographic area that that makes each landscape identifiable or unique. It includes both the visual and cultural values and consists of the combination of physical, biological and cultural attributes that are valued by constituents. (SMS Handbook)
- Scenic Integrity is the degree to which the scenery is free from visible disturbances that detract from the natural and socially valued appearance, including disturbances due to human activities or extreme natural events inconsistent with the historical range of variability. (SMS Handbook)
- Scenic Stability is the degree to which the Desired Scenic Character can be sustained through time and ecological progression. (SMS Handbook, Appendix J)

Spatial and Temporal Context for Effects Analysis

The affected environment for direct and indirect effects is the lands administered by the Colville National Forest. The analysis addresses effects over the life of the plan, which is 10 to 15 years.

Table 248. Evaluation criteria and key indicators for scenic resources

Issue	Evaluation Criteria	Key Indicator(s)
Old Forest Management and Timber Production	Evaluate where old forest management would be emphasized on the landscape and the trend of likelihood of uncharacteristic wildfire, and insect and disease outbreaks, and the affect to landscape character and scenic stability.	Proposed vegetation management direction for vegetation in each alternative.
Motorized Recreation Trails	Evaluate change in motorized recreation trails locations and the effect to landscape character, sense of place and scenic stability.	Proposed motorized trail opportunities for each alternative.
Access	Evaluate change in road miles or average road density and the effect to landscape character and scenic stability.	Desired road density or road miles for each alternative.
Recommended Wilderness	Evaluate the change in areas in very high scenic integrity objective and the affect to landscape character, sense of place and scenic stability.	Percent of total forest acreage in recommended wilderness management areas.
Wildlife	Evaluate the change in areas managed for wildlife and the affect to landscape character and scenic stability.	Proposed vegetation management direction for wildlife in each alternative.
Riparian and Aquatic Resource Management	Evaluate the change in areas managed for riparian and aquatic resource management and the affect to landscape character and scenic stability	Proposed riparian and aquatic resource management direction for vegetation in each alternative.

No Action Alternative

Old Forest Management and Timber Production

Risks of uncharacteristic wildfire to scenic resources would continue. The potential for uncharacteristically large and severe wildfire disturbance events would continue at present levels and is predicted to increase due to climate change. There is likely to be a downward trend in ecological resilience, especially in the face of climate change scenarios that predict increased occurrence of insect and disease outbreaks; and more, larger areas burned by uncharacteristic wildfires. The extent and intensity of wildfire is likely to continue or increase over the long term, which increases risks to scenic stability and landscape character.

Motorized Recreation Trails

About 12 percent of the Forest is in management areas that don’t allow motorized trails in a backcountry setting (an area without roads.) Due to budget trends, the amount of motorized trail access is unlikely to increase significantly in the future, so the changes to scenic resources from introducing new trails into areas that currently are not accessible by motorized trail is negligible.

Access

Currently, there are about 4,000 miles of NFS roads, and about 83 percent of the Forest is suitable for road construction. The 1988 forest plan includes standards and guidelines that limit road densities to between 0.4 to 2 miles per square mile in deer and elk winter range; grizzly bear habitat areas; and lynx habitat. Budget trends and need to provide quality wildlife and aquatic habitat would likely result in maintaining or reducing the total miles of NFS roads. Any reduction in roads would reduce risks to scenic stability. Risks to landscape character and scenic integrity would remain the same or be slightly reduced over the next 10 years.

Recommended Wilderness Areas

There is no recommended wilderness on the Forest. The Forest has one wilderness area—Salmo-Priest—which covers about 3 percent of the total forest area. Landscape character and scenic integrity would remain the same.

Wildlife

The wildlife habitat would be managed as it currently exists, landscape character and scenic stability would remain the same.

Riparian and Aquatic Resource Management

The riparian and aquatic resource habitat would be managed as it currently exists, landscape character and scenic stability would remain the same or be slightly reduced in areas where negative scenic deviations exist.

Summary of Effects

Scenic integrity objectives are established for management areas that do not change by alternatives, except for where recommended wilderness areas are located. SIO zones overlay the management areas. The direction for scenery management applies regardless of the management area boundary. Applicability of plan direction is guided by the principle that where there is an overlap of scenery management direction with other plan components, the most restrictive plan direction applies depending on site-specific conditions and the activity or use. The proposed action and alternatives R, P, B, and O would result in the following effects.

Old Forest Management and Timber Production

The proposed action and alternative P emphasize use of a landscape approach to vegetation management expected to result, in the long term, in a Forest more resilient to uncharacteristic wildfire, and disease and insect outbreaks. In general, the vegetation management would be spread out more on the landscape scale with variable density thinning practices. There is likely to be improvement in ecological resilience. Risks of uncharacteristic wildfire to scenic resources would decrease. There should be fewer occurrences of uncharacteristic insect and disease outbreaks. The risks to scenic stability and landscape character would decrease. In the long term, scenic sustainability and resiliency would be improved by managing for the vegetative historical range of variability spread over the landscape.

Alternatives R, B, and O emphasize old forest management in fixed reserves and emphasize timber production outside those areas. In general, vegetation management would be contained to a smaller landscape area with boundaries with a heavier shelterwood type of prescription. This approach is less likely to improve ecological resilience in the face of predicted climate change scenarios. Risks of uncharacteristic wildfire, and insect and disease outbreaks would likely continue. These alternatives,

R, B, and O would increase risks to scenic stability and landscape character. In the long term, scenic sustainability and resiliency would be reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale.

Both wildfires and prescribed fires generate smoke and particulates that can temporarily degrade visibility and scenic resources. Effects to air quality from vegetation management, such as prescribed burning, are likely to result in short-term impacts to visibility. Each prescribed burn would have unique characteristics, and the smoke impacts can be mitigated by following sound smoke management practices. Due to budget trends, the amount of prescribed burning activity on the Forest is likely to remain the same. In addition, the amount remains the same for all alternatives. Impacts from prescribed burning to scenic stability and landscape character are expected to be small, short-term, and the same for all alternatives. Also, see discussion in the cumulative effects section.

Table 249. Effects on scenic resources from vegetation management

	No Action	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Vegetation Management-landscape approach or fixed reserves Percent of total forest acres for late forest structures Trend for landscape character and scenic stability	Old forest management areas (Fixed reserves) MA-1 and Eastside Screens standard to maintain all late and old seral and/or structural live trees ≥ 21 inches d.b.h. MA-1 + Eastside Screens incorporate about 3% of the Forest Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale	Landscape approach for late forest structures Late forest structures are actively managed for restoration purposes on 71% of the Forest. **23% of forest in Focused Restoration areas and 49% in General Restoration areas** Scenic sustainability and resiliency improved by managing for the vegetation HRV spread over the landscape	Fixed reserves for late forest structure on 51% of landscape **22% in General Restoration areas** Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale	Landscape approach for late forest structure Late forest structures are actively managed for restoration purposes on 72% of the Forest **28% of forest in Focused Restoration areas and 44% in General Restoration areas** Scenic sustainability and resiliency improved by managing for the vegetation HRV spread over the landscape	Fixed reserves for late reserve structure on 44% of landscape, limited to dry plant associations only. 25% of each forest stand would remain un-thinned in all treatment units. Eastside Screens standard to maintain all late and old seral and/or structural live trees ≥ 21 inches d.b.h. Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale	Fixed reserves for late forest structure on 39% of landscape, limited to dry plant association only. 25% of each forest stand would remain un-thinned in all treatment units. Eastside Screens standard to maintain all late and old seral and/or structural live trees ≥ 21 inches d.b.h. Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale

	No Action	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Timber Production – percent of total forest acres Trend for landscape character and scenic stability	Timber management allowed in MA-3A (Recreation), MA-5 (Scenic/Timber), MA-6 (Scenic/ Winter Range), MA-7 (Wood/ Forage), and MA-8 (Winter Range). These management areas incorporate 83% of the Forest PWSQ 41 mmbf Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale	Timber production allowed in Focused and General Restoration areas which include 71% of the Forest PWSQ 62 mmbf Scenic sustainability and resiliency improved by managing for the vegetation HRV spread over the landscape	Timber production allowed in General Restoration areas. These areas include 22% of the Forest Timber production would not be allowed in late forest structure management areas PWSQ 14 mmbf Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale	Timber production allowed in Focused and General Restoration areas which include 72% of the Forest PWSQ 62 mmbf Scenic sustainability and resiliency improved by managing for the vegetation HRV spread over the landscape	The Active Management Area emphasizes even-aged management for timber production on 44% of the Forest. Additional standards limit timber harvest prescriptions PWSQ 37 mmbf Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale	The Responsible Management Area emphasizes even-aged management for timber production on 39% of the Forest. Additional standards limit harvest prescriptions PWSQ 38 mmbf Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale

Motorized Recreation Trails

Motorized recreation trails can affect scenic conditions, especially where changes in recreation activities can improve or adversely affect landscape character, sense of place and scenic integrity for the forest visitor. The proposed action and alternatives P and O would continue with current management areas where backcountry motorized or backcountry non-motorized uses are allowed. There would be no change to the landscape character, sense of place, and scenic integrity for the forest visitor under those alternatives. However, in alternatives R and B, all but 1 percent of the backcountry motorized area would be allocated to recommended wilderness. If Congress designates these areas as wilderness, motorized and mechanized uses are not allowed.

Alternatives R and B would change the landscape character on 20 percent of the Forest for the forest visitor (see also page 715 and table 243). This would be an adverse impact to the motorized recreationist by changing the sense of place from destination backcountry motorized landscape character to a non-motorized landscape character. Scenic integrity would improve in areas where negative deviations exist where motorized impacts occur. Conversely, an improved landscape setting for the non-motorized recreationist user would occur by changing the landscape character and adding new sense of place from motorized to a more quiet non-motorized experience.

Table 250. Effects on scenic resources from motorized recreation

	No Action	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Backcountry (non-motorized) Management Area – percentage of total forest acres	Currently 8 percent	8 percent	2 percent	12 percent	Less than 1 percent	16 percent
Change to landscape character, sense of place and scenic integrity for motorized users	No change to the landscape character, sense of place and scenic integrity for the forest visitor	No change to the landscape character, sense of place and scenic integrity for the forest visitor	The sense of place would change for motorized users from a destination backcountry motorized landscape character to a non-motorized landscape character. Scenic integrity would improve in areas where negative deviations exist where motorized impacts occur. Conversely, an improved landscape setting for the non-motorized recreationist user would occur by changing the landscape character and adding new sense of place from motorized to a more quiet non-motorized experience.	No change to the landscape character, sense of place and scenic integrity for the forest visitor	The sense of place would change for motorized users from a destination backcountry motorized landscape character to a non-motorized landscape character. Scenic integrity would improve in areas where negative deviations exist where motorized impacts occur. Conversely, an improved landscape setting for the non-motorized recreationist user would occur by changing the landscape character and adding new sense of place from motorized to a more quiet non-motorized experience.	No change to the landscape character, sense of place and scenic integrity for the forest visitor

Access

Forest roads are typically unpaved and used recreationally and for resource management purposes. Roads create horizontal form, line and color contrasts with the adjacent landscape and can detract from scenic integrity and landscape character, especially when the road density is higher than 1 to 2 miles per square mile. Alternatives with lower road densities would have fewer roads. Alternatives R and P have lower road densities, which would provide the most improvement in landscape character and scenic integrity. The proposed action has a higher road density but would reduce road density in areas where it is higher than 3 miles per square mile. The trend would improve landscape character and scenic integrity. Alternatives B and O both cap road miles at existing levels, which has a range of miles per square mile, either above or below 1 to 2 miles per square mile. In all alternatives, the number of miles of road would trend downward. Alternatives R and P are likely to have the least miles of road in the long term. A reduction in road miles is likely to improve scenic stability and landscape character, so alternatives R and P are likely to improve scenic resources the most among the alternatives.

Table 251. Effects on scenic resources from access

	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Desired road density range. Effect to landscape character and scenic stability.	2-3 miles per square mile. Applicable in Active Restoration Mgmt. Areas which cover 71% of forest. Road density would be reduced in areas where it is higher than 3 miles per square mile. The trend would improve landscape character and scenic integrity.	1-2 miles per square mile. Applicable in Active Restoration Mgmt. Areas which cover 73% of forest. Most improvement in landscape character and scenic integrity on landscape scale.	1-2 miles per square mile. Applicable in Active Restoration Mgmt. Areas which cover 72% of forest. Most improvement in landscape character and scenic integrity on landscape scale	Cap USFS road miles at current level. Applicable to about 74% of the total Forest Service. Least improvement in landscape character and scenic integrity on landscape scale.	Cap USFS road miles at current level. Applicable to about 74% of the total Forest Service. Least improvement in landscape character and scenic integrity on landscape scale.

Recommended Wilderness Areas

Areas recommended for wilderness would move from a high scenic integrity objective to very high scenic integrity objective where only ecological changes occur. Ground-disturbing activities would be very limited. If Congress designates these areas as wilderness, the scenic integrity objective would be very high and ground-disturbing activities even more limited. Alternatives R and B recommend the highest amount of wilderness and largest increase in the amount of very high scenic integrity area on the Forest. In recommended wilderness areas, the experience for visitor uses would be limited to non-motorized uses, but mechanical use (mountain bikes) could continue to occur, changing the sense of place and landscape character for those users similar to the motorized recreation trails management issue. If the recommended wilderness becomes wilderness, the sense of place would change for mountain bike users by eliminating the opportunity and backcountry experience for mechanized use.

Table 252. Effects on scenic resources from recommended wilderness

	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Recommended Wilderness – percentage of total forest acres.	9 percent	19 percent	6 percent	20 percent	1 percent
Effect to landscape character, sense of place and scenic stability	Slight change to the landscape character, sense of place and scenic integrity for the forest visitor.	The sense of place would change in areas for motorized/ mechanized users from a destination backcountry motorized landscape character to a non-motorized wilderness landscape character. Scenic integrity would improve in areas where negative deviations exist where motorized impacts occur.	Slight change to the landscape character, sense of place and scenic integrity for the forest visitor.	The sense of place would change in areas for motorized/ mechanized users from a destination backcountry motorized landscape character to a non-motorized wilderness landscape character. Scenic integrity would improve in areas where negative deviations exist where motorized impacts occur.	Least change to the landscape character, sense of place and scenic integrity for the forest visitor.

Wildlife

Differences in management for wildlife habitat between alternatives are similar to the old forest management and timber production issue, driven by how vegetation is managed. Generally, wildlife management objectives are compatible with landscape character goals and scenic integrity objectives. The proposed action and alternative P emphasize use of a landscape approach to vegetation management expected to result, in the long term, in a forest more resilient to uncharacteristic wildfire, and disease and insect outbreaks. In general, the vegetation management would be spread out more on the landscape scale with variable density thinning practices. There is likely to be improvement in ecological resilience. Risks of uncharacteristic wildfire to scenic resources would decrease. There should be fewer occurrences of uncharacteristic insect and disease outbreaks. The risks to scenic stability and landscape character would decrease. In the long term, scenic sustainability and resiliency would be improved by managing for the vegetative historical range of variability spread over the landscape.

Alternatives R, B, and O emphasize old forest management in fixed reserves and emphasize timber production outside those areas. In general, vegetation management would be contained to a smaller landscape area with boundaries with a heavier shelterwood type of prescription. This approach is less likely to improve ecological resilience in the face of predicted climate change scenarios. Risks of uncharacteristic wildfire, and insect and disease outbreaks would likely continue. These alternatives (R, B, and O) would increase risks to scenic stability and landscape character. In the long term, scenic sustainability and resiliency would be reduced by focusing vegetation management in specific areas and not on a dynamic landscape scale.

Table 253. Effects on scenic resources from wildlife

	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Proposed vegetation management for wildlife-percentage of total forest acres	9 percent	19 percent	5 percent	20 percent	1 percent
Effect to landscape character and scenic stability	Scenic sustainability and resiliency improved by managing for the vegetation HRV spread over the dynamic landscape.	Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas (reserves) and not on a dynamic landscape scale.	Scenic sustainability and resiliency improved by managing for the vegetation HRV spread over the dynamic landscape.	Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas (reserves) and not on a dynamic landscape scale.	Scenic sustainability and resiliency reduced by focusing vegetation management in specific areas (reserves) and not on a dynamic landscape scale.

Riparian and Aquatic Resource Management

Differences in management for aquatic resources between alternatives are not expected to produce noticeably different effects to scenic resources; however, scenic integrity would improve in the long term as riparian and aquatic habitats become more natural appearing. Generally, riparian and aquatic management objectives are compatible with landscape character goals and scenic integrity objectives. The sense of place may be disruptive in places where recreation occurs in riparian/aquatic areas, especially near lakes or streams if use is displaced.

Table 254. Effects on scenic resources from riparian and aquatic resource management

	Proposed Action	Alternative R	Alternative P	Alternative B	Alternative O
Proposed riparian and aquatic management for vegetation - percentage of total forest acres	**Acres of RHCA/RMA** 179,200 RHCA acres 16% Colville National Forest (CNF) ownership	**Acres of RHCA/RMA** Same as the proposed action and alternatives P and O	**Acres of RHCA/RMA** Same as the proposed action and alternatives R and O	**Acres of RHCA/RMA** 150,700 RHCA acres	**Acres of RHCA/RMA** Same as the proposed action and alternatives P and R
	Key and priority watersheds 371,900 acres in key watersheds; 34% CNF ownership	**Key and priority watersheds** 451,500 acres in key watersheds; 41% CNF ownership	**Key and priority watersheds** 457,900 acres; 41% CNF ownership	**Key and priority watersheds** 214,300 acres; 19% CNF ownership	**Key and priority watersheds** Same as alternative R
Effect to landscape character and scenic stability	Measureable objectives for key watersheds Scenic integrity and landscape character would improve in the long term as riparian and aquatic habitats become more natural appearing	Measurable objectives for key watersheds Scenic integrity and landscape character would improve in the long term as riparian and aquatic habitats become more natural appearing	Scenic integrity and landscape character would improve in the long term as riparian and aquatic habitats become more natural appearing	Scenic integrity and landscape character would improve in the long term as riparian and aquatic habitats become more natural appearing	Scenic integrity and landscape character would improve in the long term as riparian and aquatic habitats become more natural appearing

Monitoring Recommendations

Monitoring and evaluation efforts provide information to: detect magnitude and duration of changes in conditions including scenic integrity and landscape character, formulate and test hypotheses as to cause of the changes, and help better understand these causes and predict impacts.

Monitoring Types

There are three types of monitoring: implementation, effectiveness, and validation.

- Implementation monitoring determines whether the standards and guidelines were followed. Some agencies call it "compliance" monitoring or said another way "Did we do what we said we would do?"
- Effectiveness monitoring determines if the application of the management plan achieved or is headed in the right direction to achieve the desired future condition, in other words did the management practice or activity do what was intended. Did the standards and guides function as intended or were they not effective?
- Validation monitoring determines if new information exists which alters the validity of the assumptions upon which the plan was based. Such considerations might include changes in resource conditions, changes in constituent values and expectations or changes in legal requirements.

Monitoring Landscape Character

The objective of Landscape character implementation and effectiveness monitoring is to determine if the landscape character goal is being met or is moving toward the desired character over time. For example, the goal may be to maintain open, park-like stands of large ponderosa pine with yellow-plated bark with 20 percent in seeding/saplings, 40 percent in a black bark stage, and 20 percent in small saw timber.

> **Objective**: To determine if the landscape character is moving in the direction of the landscape character goal.
>
> **Method**: Identify through field review the percentage of vegetation (or other elements in the landscape character) that is moving toward the landscape character goal.
>
> **Unit of Measure**: Percent of acres.

Landscape character validation is addressed through a continual constituent analysis process determining such things as the landscape character preferred by people.

Monitoring Scenic Integrity

Implementation monitoring is usually done through spot checking the scenic integrity level of activities one year after completion to see if they are in compliance with the land and resource management plan.

> **Objective**: To determine if the scenic integrity levels for projects adopted in the forest plan by management area are being achieved.
>
> **Method**: Identify through field review a stratified sample of projects in high, moderate, and low integrity levels. Sampling intensity should increase with the level of scenic integrity objective.
>
> **Unit of Measure**: Identify total projects within each viewshed or geographic area, including how many and what percent were monitored. Of those monitored, how many and what percent met the scenic integrity standard for the area.

Effectiveness can be checked by summarizing the existing scenic integrity levels for each viewshed or geographic area.

> **Objective**: Are the cumulative effects of all resource activities within a viewshed meeting the integrity level standards.
>
> **Method**: Determine the percentages of each integrity level being met within each viewshed. Determine if the percentages are consistent with the forest plan.
>
> **Unit of Measure**: Total acres in each viewshed that are consistent with forest plan standards.

Validation is addressed through a continual constituent analysis process, determining such things as the lowest level of scenic quality acceptable to people.

Cumulative Effects (Common to all Alternatives)

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The affected environment for cumulative effects includes the Confederated Tribes of the Colville Reservation, lands administered by the Idaho Panhandle National Forests and other Federal agencies; and lands of other ownership both within and adjacent to the Colville National Forest boundaries. Smoke from wildland and prescribed fires can adversely affect scenic resources in the short term. The National Park Service, State of Washington, and Indian Tribes manage large tracts of lands in surrounding areas. Smoke from prescribed burning operations on these lands could individually, or in combination with other fires, affect scenic resources on the Forest and in surrounding communities. Coordination and approvals of prescribed fires through Washington state would help prevent the cumulative impacts of these burns from creating unacceptable impacts to scenic resources. Under all alternatives, wildfires would continue to periodically cause temporary deterioration of scenic resources.

For all alternatives, cumulative impacts on scenic resources from forest management on private lands, where scenic integrity is not an objective, would be to have a heavily altered landscape on private lands. Where the view is comprised of adjacent Federal lands, which manage for scenic resources, the cumulative effect is likely to be a natural-appearing landscape with high scenic integrity.

Lands and Special Uses

This lands and special use analysis focused on the issues likely to affect land special uses including access, recommended wilderness, and riparian and aquatic resource management. Recreation special uses are addressed in the Recreation section of this document.

The lands program area includes several different activities: special uses and land ownership/realty actions. The affected environment description is divided into two broad areas. Special use authorizations include permits, term permits, leases or easements which allow occupancy, use, rights or privileges of NFS lands. Land ownership includes boundary management, land exchanges, purchases, and other activities that are primarily real estate type activities.

Affected Environment

The Colville National Forest lies within the northeastern corner of Washington state. The Forest encompasses 1.1 million acres and occupies nearly one-third of the total area of Ferry, Pend Oreille, and Stevens Counties. To the north, the Forest is bordered by British Columbia; to the west by the Okanogan

National Forest; to the east by the Idaho Panhandle National Forests; and to the south by a portion of the Colville Confederated Tribes Indian Reservation, State, and private lands.

Many lands within the boundary of what would become the Colville National Forest were severed from the public domain, becoming private through a variety of land disposal authorities including homesteading, mineral patents, statehood and railroad land grants. The majority of the valley floors were patented, and to a large extent, the remaining forested lands in the higher elevations became National Forest Reserves, and later National Forest System (NFS) lands. Railroad grants in Pend Oreille County in 1908 left a checkerboard pattern of private, State, and NFS lands, which continues to the present. Many former railroad grant lands are now owned and managed by a number of private forest resource companies.

Today, the forest, streams, lakes, mountains, and valleys of the Colville National Forest are literally the backyard of many residents in Ferry, Stevens and Pend Oreille Counties. According to the State of Washington's Office of Financial Management Forecasting Division, between the years 2004 and 2014 the populations of Ferry, Stevens and Pend Oreille Counties were expected to increase 4.93 percent, 7.86 percent, and 11.1 percent, respectively. Under Washington State RCW 43.62.035, which codifies the Growth Management Act, the Office of Financial Management shall determine the percentage increase in population for each county over the preceding 10-year period as of April 1 each year for growth management planning. Projections are statements about the future based on a particular set of assumptions. The Growth Management Act projections present high, medium, and low growth expectations for each county in the state. The medium series is considered the most likely expectation because it is based on assumptions that have been validated with past and current information. By the year 2040, using medium growth expectations, the populations of Ferry, Stevens, and Pend Oreille Counties are expected to increase 2 percent, 17 percent, and 9 percent, respectively. (State of Washington, Office of Financial Management, Forecasting Division 2012).

These population trends present opportunities and challenges for both the Forest and its neighbors. Individuals; Federal, State, and local agencies; private industry; and other entities benefit from the goods and services the national forest provides. Increases in county populations are expected to inflate the demand for access, goods and services. At the same time, the Forest must actively manage access, vegetation, recreation, property boundaries, and other issues to protect the interests of the public as a whole. Increased housing density in areas adjoining NFS lands adds to the potential for encroachment, trespass, and unauthorized use and occupation of NFS lands. Balancing the need for goods and services while protecting the interests of the public would be a challenge into the future for the Lands Special Use program because of a downward trend in Forest Service budget allocations and personnel.

Special Uses

Occupancy and use of NFS lands for public and private purposes through the issuance of special use authorizations and easements, continues to be allowed where the use is consistent with natural resource management goals. Authorized occupancy encumbers NFS lands, which, in turn, affects management decisions and actions. Special use authorizations are used to authorize occupancy and use of NFS lands by Federal, State, and local agencies; private industry; and individuals. Many different public laws regulate activities under special use authorizations.

Special uses are those that cannot be reasonably accommodated off-Forest, or, in some cases are Forest-dependent, and include both land and recreation uses. This section addresses land-type special uses that include, but are not limited to, access to private property, communication sites, utility transmission rights-of-way, research studies, community and water uses. Recreation special uses are addressed in the recreation section. Some special uses are temporary in length; however, some occupancy, especially

utility transmission rights-of-way and communication sites are long-term commitments of NFS lands and typically have authorization terms of 20 or more years.

As of December 2016, there are 297 land special use authorizations issued for uses on the Colville National Forest. The Forest anticipates that number will increase during the life of the revised plan as the communities around the Forest expand and State agencies, counties, cities and towns, public utilities, and private citizens request new authorizations or amendments to existing authorizations.

Road Authorizations

Road authorizations comprise 64 percent of the land special use authorizations issued on the Forest. Permits and easements granted by the Forest Service provide access across the Forest to non-NFS land where appropriate. These authorizations ensure the protection of NFS lands and resources. Authorization holders contribute to road maintenance commensurate with use.

Over 130 Forest Road and Trail Act easements are granted to forest product companies, county and state public road departments, and to state resource management agencies. The majority of Forest Road and Trail Act easements have been granted in Cost Share areas, where forest product companies and/or the State have granted reciprocal easements to the United States over their lands to facilitate the construction and maintenance of a mutually beneficial road system. The remaining Forest Road and Trail Act easements have been granted to Ferry, Stevens, and Pend Oreille Counties and are maintained as part of their county road system.

Over 60 Federal Land Management Policy Act easements and permits have been granted or issued to private property owners and/or associations for access to their property. These roads are generally not part of the forest road transportation system, and authorization holders are responsible for maintaining these roads. The number of applications submitted by landowners requesting access to private property has increased appreciatively in the past several years, and that trend is expected to continue.

Requests for private access roads across NFS lands are increasing as residential development occurs on adjacent private lands, and as people retire to live on property that was formerly used on a seasonal basis. As of the year 2000, 20 to 30 percent of housing in Pend Oreille County was considered seasonal and/or recreational housing, with a high likelihood of many housing units transitioning to retirement properties (State of Washington, Office of Financial Management; Decennial Census 2010).

Communication Sites

The Forest has nine designated communication sites (sites) where Federal, State and local agencies have located their internal communication equipment, and commercial telecommunication companies are authorized to transmit and receive communications. Each site has an approved Communication Site Plan that defines the maximum power permissible at the site; protects NFS resources including soil, vegetation, and scenery; and guides the operation, maintenance and development of the site. No additional sites are proposed for development at this time, and new proposed sites would be analyzed on a case-by-case basis.

These sites are located on mountain tops where snow accumulation limits access during the winter, with a limited capacity for expansion. Occupancy is authorized under a Communication Site Lease or Communication Site Permit for Federal agencies. Three leases are issued to facility owners who rent space to other users including State and county governments and wireless service providers. Some single-use sites are authorized to wireless service providers, state agencies, and the Department of Homeland Security, U.S. Customs and Border Patrol. All sites on the Forest are designated for low power uses. Infrastructure associated with these sites includes roads, powerlines, propane tanks, and telephone service.

For the past several years, wireless service providers (Verizon, AT&T Mobility/Cingular Wireless) have expanded their data delivery capabilities (4G/LTE), which has required infrastructure replacement and/or the addition of back-up generators at several sites. Tower standards have recently changed, and existing tower load capacity is challenged with the addition of new antennas and microwave dishes. Communication towers installed at several sites are reaching the ends of their useable lifespan and need replacement. Requests for site improvements and replacements are expected to continue into the future, and challenge the Forest's ability to respond with limited available budget and personnel. See appendix J for a map showing designated communication sites on the Forest.

Table 255. Designated communication sites

Communication Site Name/Lease Holders	County	Location
Bisbee Mountain – Verizon – Washington State Dept. of Transportation	Ferry	Latitude 48 38' 02.54" North Longitude 118 09' 25.75" West
Bodie Mountain – Washington State Dept. of Natural Resources – Forest Service	Ferry	Latitude 48 49' 38.58" North Longitude 118 49' 58.024" West
Chewelah Peak – SBA Structures	Stevens	Latitude 48 17' 01.21" North Longitude 117 34' 22.79" West
Deer Mountain – Pend Oreille PUD #1	Pend Oreille	Latitude 48 47' 57.39" North Longitude 117 26' 37.45" West
Flagstaff Mountain – SBA Structures – Verizon – AT&T – Dept. of Homeland Security, U.S. Customs and Border Patrol – Forest Service	Stevens	Latitude 48 54' 31.38" North Longitude 117 52' 09.41" West
Flume Creek – Pend Oreille County Emergency Management – Dept. of Energy, Bonneville Power Administration	Pend Oreille	Latitude 48 55' 08.53" North Longitude 117 24' 57.71" West
Owl Mountain – Orient-Laurier TV Club	Ferry	Latitude 48 58' 32.377" North Longitude 118 14' 6.851" West
Ruby Mountain – Pend Oreille Telephone Company	Pend Oreille	Latitude 48 30' 08" North Longitude 117 19' 32" West
Sand Ridge – Dept. of Homeland Security, U.S. Customs and Border Patrol	Pend Oreille	Latitude 48 49' 05.79" North Longitude 117 19' 05.42" West

Forest Service Administrative Repeater Sites

There are 13 radio repeater sites used for Forest Service administrative communications, including two at designated communication sites listed above. Most of the Forest Service communication facilities are located on NFS lands, plus one on Tribal lands and two on State-owned lands, where the Forest Service leases space. The Forest's administrative communication sites currently do not have Communication Site Plans. Administrative Communication Site Plans should be developed that describe the extent of each site's development potential, with the intent of protecting the integrity of critical Forest Service communications and equipment.

Table 256. Forest Service repeater locations

Forest Service Repeater Site Name	County	Land Ownership
Bodie Mountain	Ferry	Forest Service
Calispell Peak	Stevens	Forest Service
Flagstaff Mountain	Stevens	Forest Service
Grizzly	Ferry	Colville Confederated Tribal Lands
Jackknife	Ferry	Forest Service
Monumental	Stevens	State of Washington
Mt. Leona	Ferry	Forest Service
North Baldy	Pend Oreille	Forest Service
Red Top	Stevens	Forest Service
Sullivan	Pend Oreille	Forest Service
Salmo	Pend Oreille	Forest Service
Togo Mountain	Ferry	Forest Service
Quartz Mountain	Ferry	Forest Service

Water Uses

There are 33 special use authorizations issued on the Forest for water-related uses including irrigation ditches and pipelines, domestic water developments, and municipal water systems that include dams and weirs. Holders of those authorizations have demonstrated they hold a state water right for the diversion of water for a beneficial use. Forest Service authorizations do not confer a water right, but allow the occupancy for the storage and transmission of water, and for water system infrastructure. The U.S. Geological Survey and the Pend Oreille Public Utility District #1 hold permits for stream gaging stations to monitor temperature and flow rates of streams and rivers.

Utilities and Energy Corridors

Utilities include linear features such as power, gas, telephone, water and fiber optic lines. The Energy Policy Act of 2005 directed the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior to designate energy transport corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on Federal lands. In portions of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming large energy corridors were designated where future utilities would be located. Those corridors were named Section 368 Corridors after the section of the Energy Policy Act of 2005 where they were described. There are no Section 368 designated energy corridors on the Colville National Forest.

There are 19 special use authorizations issued on the Forest for distribution voltage and high energy powerlines. Avista, and Public Utility Districts in Ferry, Stevens and Pend Oreille County deliver low voltage power (12Kv and less) to their customers in their respective counties. These powerlines are frequently, but not exclusively, located along road corridors on NFS lands. The Department of Energy Bonneville Power Administration (BPA) operates and maintains 5 high voltage powerlines in large right-of-ways that bisect the Forest, delivering power generated from the Pend Oreille Public Utility District #1 (PUD) Box Canyon Dam, and Seattle City Light's Boundary Dam to the western power grid. In addition to powerlines, access roads and trails are also authorized to BPA to facilitate operations and maintenance of their infrastructure. The PUD and Seattle City Light also operate short segments of high voltage lines from their power stations to tie into the BPA grid. Powerline pole replacements, transmission tower and

road maintenance, hazard tree removal and other vegetation treatment activities are performed regularly by these utilities.

There is one gas line authorized under permit on the Forest. The gas line provides service to the Republic Ranger District compound in the town of Republic, Washington, in Ferry County.

Telephone and fiber optic lines provide a backbone of communication for businesses and the citizens of Ferry, Stevens and Pend Oreille County. The majority of telephone lines are overhead lines, with service connections buried when conditions allow. Fiber optic lines are usually buried underground to protect the lines and conduit. Fiber optic conduit runs alongside State Highway 20 on NFS lands in Ferry and Stevens Counties, and along county roads in Pend Oreille County. All new telephone service connections and fiber optic lines should be buried whenever and wherever possible.

Requests for new utilities, and upgrades to existing utilities should be concentrated within existing energy and utility corridors before new permit areas are considered. Designated energy corridors on the Forest include BPA transmission and state highway rights-of-way, and county roads located on NFS lands. See appendix J for a map showing designated communication sites and energy corridors (county roads are too small to show on this scale of map).

There are no solar or wind generation farms authorized under permit on the Forest, and there is low potential for those renewable energy sources to be developed.

Military Training Survival School

The U.S. Air Force AETC, 336th Combat Crew Training Group, located at Fairchild Air Force Base, Spokane, Washington, operates a Survival, Evasion, Resistance, and Escape School on the Colville National Forest. The Survival School has been permitted on the Colville National Forest since 1966. This school is operated under a long term Special Use Permit that expires December 31, 2030. The school provides training to all Air Force crewmembers, future survival instructors, combat rescue officers, and specialized training to all branches of the military. The Survival School consists of both classroom and outdoor training. Most of the outdoor training occurs on the Colville National Forest. The training requires small groups of students to live on the Forest under primitive conditions and practice techniques for personal sustenance, overland travel, shelter, and recovery. The Survival School is supported by two command posts located on the Newport Ranger District.

Other Authorized Uses

The remainder of the Forest land special use authorizations include agricultural uses, public service infrastructure (stockpile sites, warehouses), an airstrip operated by the Washington State Department of Transportation, research and site surveys, and education uses. These uses are expected to continue on the Forest. Persons who have personal property that is in trespass, are issued short-term permits to provide them time to plan and remove their property from NFS lands.

Hydropower

The abundant water resources in northeastern Washington support hydroelectric projects on the Forest, which are authorized under Federal Energy Regulatory Commission (FERC) Licenses. The FERC license is the authorizing instrument that contains the conditions under which the licensee operates and maintains the hydroelectric project and lands within the license boundary. The Forest Service is a cooperating agency to the FERC regarding the management of NFS lands and resources within the license boundary.

Seattle City Light operates Boundary Dam (FERC Project #2144) on the Pend Oreille River in northern Pend Oreille County. The FERC issued Seattle City Light a new 42-year License on March 20, 2013.

Conditions were incorporated into the license that requires Seattle City Light to perform mitigation measures on NFS lands outside of the licensed area. Some of those mitigation measures would require the issue of temporary or longer term permits for the occupancy of NFS lands. On March 20, 2013, the FERC issued an Order "Accepting the Surrender of License and Authorizing Disposition of Project Facilities" to the PUD for the Sullivan Creek Project (FERC Project #2225) located on Sullivan Creek, a tributary to the Pend Oreille River in northern Pend Oreille County. The Surrender of the License is expected to be effective by the year 2021, following completion of all surrender conditions including the removal of Mill Pond dam and the restoration of the former impoundment. The Sullivan Lake dam and impoundment would be retained by the PUD and authorized under special use permit.

The PUD also operates the Box Canyon Hydroelectric Project (FERC Project # 2042) on the Pend Oreille River. One-hundred-ninety acres of NFS lands are directly affected by the Project operation. The PUD, Colville National Forest, Kalispel Tribe of Indians, State agencies and others are working to implement 4e and 10a License Conditions on NFS lands, including, but not limited to, recreation administration and maintenance, and off-site mitigations to improve fish habitat.

Boundary Management

The Forest protects its property boundaries through a boundary management program. The program also provides support for all resource areas including vegetation management; trespass and encroachment identification/resolution; as well as land and easement grant, purchase, or exchange. Work is performed by State-licensed Forest Service land surveyors or State-licensed land surveyors contracted by the Forest Service. Trespasses or encroachments onto NFS lands are identified and resolved as soon as practicable by coordination between the Forest Service responsible official (generally a district ranger) and landowner.

Each year a portion of the Forest's 1,500 miles of boundary line are surveyed or maintained to the Forest Service's standards. Currently, the boundary management program surveys or maintains 15 to 30 miles of the total 1,500 miles of Forest boundary line annually. The known lifespan of a marked boundary is 30 years, with decay of this valuable infrastructure beginning at 15 years.

The occupancy and use of land adjacent to the Forest has been on the rise, and is expected to further increase in the years ahead. Instances of trespass and encroachment are also expected to increase. Because of this, boundary line maintenance would become more critical to the successful protection of NFS lands. The expected increase in road authorizations over time would require an increase in boundary management support for road/easement mapping purposes as well.

Land Ownership: Exchange, Acquisitions, and Access

The Forest acquires and disposes of lands through land exchange, purchase, donation, transfers or sale consistent with national policy, regional priorities, the Forest 1999 Land Adjustment Plan, and budget. The most recent acquisition occurred in 2016 with acquisition of 2,391 acres of private timberlands in the Sheep Creek drainage in northern Stevens County.

The Forest acquires access rights-of-way across non-NFS lands as needed to meet resource management objectives and public access needs. Rights-of-way are acquired from landowners using easements, term easements, limited easements, or permits for roads crossing private lands. Temporary or limited rights-of-way may be acquired when landowners are unwilling or unable to grant full public access, or when permanent access is not in the public interest or necessary to address long-term resource management objectives.

Withdrawals

Certain NFS lands have been withdrawn from settlement, sale, location or entry from some or all of the general land, mining and/or leasing laws. The purposes of the withdrawals are to limit activities under those laws to maintain other values in the area or reserve the area for a particular public purpose or program, especially in areas with a history of mineral findings. Withdrawals on the Forest have been established to protect capital improvements such as administrative sites, recreation areas, roadside zones, seed orchards; or to protect resources with special or significant values such as research natural and wilderness areas. Additional wilderness areas, wild and scenic rivers, segments of the Pacific Northwest National Scenic Trail, and research natural areas are potential candidates for future withdrawals. Revocation of withdrawal requests can be made to the Secretary of Interior when the lands are no longer needed for the purpose they were withdrawn for. Requests for new withdrawals, extensions of withdrawals, or revoking of withdrawals is initiated by a specific Forest program area such as recreation or botany, but supported by the Lands program area. Applications for new and/or extension of withdrawals, and requests for revocation of withdrawn areas are prepared by the Forest and submitted to the Secretary of Interior for consideration and action.

Need for Change

Comments submitted on the proposed action were reviewed to determine how they would be considered in the analysis. Old forest management, motorized recreation trails, road access, recommended wilderness, wildlife habitat, and riparian and aquatic resource management were identified as significant issues used to formulate alternatives. No lands issues drove the creation of an alternative.

Environmental Consequences

Methodology

This section describes the methodology and analysis processes used to determine the environmental consequences on lands and special uses from implementing alternative P. Environmental consequences are not site-specific at the broad forest planning level and are described with qualitative descriptions supported by past trends, records, special use authorizations, and changes in land ownership.

Assumptions

- Land special uses would continue to occupy certain portions of the Forest where those uses are compatible with management area direction.
- New uses would be proposed, and existing holders of instruments would request changes or alterations to their existing permitted uses.
- Existing permit holders may be required to implement best management practices and/or resource protection measures to comply with new Forest standards and guides.
- Land special uses have to comply with Federal and State laws and regulations. These include but are not limited to laws such as the Clean Water Act and the Endangered Species Act.
- Special use permits would be issued in accordance with Forest Service Manual 2700, Forest Service Handbook 2709.11, and regulations found in 36 CFR 251 Subpart A.
- Requests for access to private lands within the Forest boundary would continue as populations increase, land parcels are subdivided, and conversions of recreation property to full-time residential property continue.

- The acquisition and disposal of lands through exchange, purchase, donation, transfers, or sale would continue.
- New applications for and extensions of existing withdrawals would continue. Requests for revocation of withdrawals that are no longer needed to protect capital improvements or resources would be made to the Secretary of the Interior.

Methods of Analysis

Methodology and analysis process included query of the Natural Resource Manager Special Uses Database, Land Status Atlas, Forest Service records and case files, and Washington state census data to review population trends.

Spatial and Temporal Context for Effects Analysis

This analysis is completed for all lands within the administrative boundaries of the Colville National Forest. It is assumed that the effective life of the plan would be 15 years, and this analysis discusses the effects to lands and special uses over this time period.

Incomplete and Unavailable Information

Special use proposals and applications are submitted by Federal, State and local agencies, commercial interests, and private individuals throughout the year. On average, approximately 35 new proposals and applications are submitted annually. This trend is expected to continue.

Summary of Effects

Under all alternatives, the issuance and administration of land special use authorizations would continue to the level allowed by staffing; and directed by law, regulations, and policy. Special use proposals shall be evaluated in part on the suitability of the proposed use within the land management allocation, and the first- and second-level screening process defined in 36 CFR 251.54.

It is expected that land-use and property access proposals will increase over the life of the plan as county populations increase, as recreational properties are converted to permanent residences, and as larger private parcels are subdivided. As property use conversions occur, additional requests for legal access will occur, and utilities to serve those properties are often extended through the Forest, requiring new or amended authorizations.

The Forest Service would continue to cooperate with the FERC and hydropower licensees on implementation of license conditions and settlement agreements. Special use authorizations would be issued on NFS lands outside the license boundaries to support license condition implementation.

Boundary line survey and maintenance would continue to support Forest program areas and defend Forest boundaries, as allowed by funding and staffing. Land realty actions would continue to support national and regional policy and objectives. The Forest would continue to aggressively pursue the acquisition of permanent and temporary access across non-NFS lands to meet resource management objectives and public access needs.

New applications for and extensions of existing withdrawals will continue to support Forest resources and programs. Requests for revocation of withdrawals that are no longer needed for administrative and other reasons will be made to the Secretary of the Interior as staffing and budget allow. See additional discussion of withdrawal in the Minerals and Geologic Resources sections in this FEIS.

Cumulative Effects

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The area for considering cumulative effects includes the lands within the Colville National Forest administrative boundary. In consideration of all past, present, and foreseeable actions, no cumulative effects to special uses are anticipated.

Tribal Resources

The United States and federally recognized American Indian Tribes have a special and unique government-to-government relationship of one sovereign nation to another. The Federal Government has a trust responsibility (duty) to each Tribal government based on the U.S. Constitution, treaties and statutes. The Federal trust duty imposes fiduciary standards on the conduct of executive agencies. Therefore, the Forest Service has certain legal responsibilities to American Indian Tribes. These legal responsibilities are clarified in statutes, executive orders, and case law enacted and interpreted for the protection and benefit of federally recognized American Indian Tribes. In meeting these responsibilities, the Forest Service must administer their programs in a manner that does not interfere with Tribal rights and resources. When American Indian Tribes ceded lands to the U.S. Government, rights and privileges to off-reservation lands (including the lands of the Colville National Forest) were reserved for their Tribal members.

Forest managers are required to consult the Tribes when proposed policies or management actions may affect their interests. The following American Indian Tribes and communities are known to have cultural ties with the lands of the Colville National Forest, based on current and past consultation: Colville Confederated Tribe, Kalispel Tribe of Indians, and Spokane Tribe of Indians. Each Tribe has its own history, traditions, and relationship to the land and other groups. The Forest shares a common boundary of 29 miles with the Colville Confederated Tribe and 14.7 miles with the Kalispel Tribe of Indians. The lands and resources of the Forest have been used and continue to be used by many of the Tribes for a variety of traditional cultural and religious activities. Consultations with each Tribe can identify the Tribe's historic and present day traditional use areas and sacred sites. This section summarizes effects to Tribes from the related specialist report (Beat 2017).

Affected Environment

Fourteen American Indian Tribes represented by three Tribal governments have cultural ties to lands within the Forest. Forest Service consultations with appropriate members of each Tribe can identify the Tribe's historic and present day traditional uses and sacred sites of the area. The lands, resources, and the archaeological sites within the Forests are considered traditionally significant to all affiliated Tribes and in some cases certain resources or areas are considered sacred to one or more. These traditional cultural properties may be eligible to the National Register of Historic Places because of their association with cultural practices and beliefs rooted in history and their importance in maintaining the cultural identity of ongoing American Indian communities. Consultations about these uses and sites are governed and/or mandated by the NHPA, as amended in 1992, (U.S.C. 470 et seq.), the American Indian Religious Freedom Act 1978 (42 U.S.C. 1996), the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.), E.O. 13007, E.O. 13175, Consultation and Coordination with Indian Tribal Governments.

Colville Confederated Tribes

During the past 6,000 years, the region has been utilized by diverse groups of people for a variety of activities. The project area lies within the traditional use area of the Colville Confederated Tribe. The Colville is a sub-group of the Salishan speaking groups that include the following cultural traditions: Wenatchee, Columbia, Chelan, Methow, Okanogan, Nespelem, Sanpoil, Spokane, Coeur D'Alene, Lakes and Kalispel. Ethnographic accounts indicate that the Colville practiced wintertime deer drives and maintained resident fisheries along the Columbia, Kettle, and San Poil Rivers. In addition to hunting deer and fishing, the Colville harvested camas and other root crops (Camassia species) (Holstine 1987).

A presidential executive order established the Colville Indian Reservation in 1872 (Colville Confederated Tribe 2004). The reservation originally extended across the entirety of present day Ferry County. The Colville Reservation, as established in July 1872, comprised about 2,900,000 acres. Except for certain 80-acre allotments to individual Indian's, the so-called "North Half" of the Reservation was ceded to the United States by an Agreement made with the Indians of the Reservation on May 9, 1891. The United States agreed to pay $1,500,000 for the Lands of the North Half. The Agreement provided that it was to go into effect after its ratification by Congress. However, by the Act of July 1, 1892 (27 Stat.b2), Congress opened the North Half to settlement without ratifying the Agreement and without providing for the payment of the $1,500,000. Subsequently, by the Act of June 21, 1906 (34 Stat. 525, 377-378), for the purpose of carrying into effect the 1891 Agreement, Congress directed that $1,500,000 be set aside in the Treasury for the use and benefit of the Indians of the Colville Reservation in full payment for the ceded North Half. Thereafter, pursuant to the Act of June 21, 1906, and by way of ratifying the 1891 Agreement, Congress appropriated $1,500,000 in five successive installments of $300,000 each under each of five Acts of Congress, namely Act of March 1, 1907 (34 Stat. 1015, 1050), Act of April 30, 1908 (35 Stat. 70, 96), Act of March 3, 1909 (39 Stat. 781, 8131), Act of April 4, 1910 (36 Stat. 269, 286), and Act of March 3, 1911 (36 Stat. 1058, 1075).

Kalispel Tribe of Indians

The Lower Bands of Kalispel typically wintered in the Pend Oreille Basin and were an Interior Salish-speaking population bounded on the south by the Spokane and Coeur dAlene people; on the north by the Northern Okanogan, Lakes, Colville, and Kootenai; and on the east by the Flathead and Pend Oreille. Many of the languages were mutually intelligible and the communities were conversant in more than one language. The commonalities in language, the practice of marrying outside ones own c ommunity, the right of mutual seasonal use of resources in neighboring watersheds, and a high degree of social mobility to gather resources all contributed to creating a porous social matrix that de-emphasized rigid territoriality.

Since 1855, the Lower Kalispels remained in their aboriginal territory and opposed any attempt to remove them. Over the next 50 years, the U.S. Government attempted to move them to other reservations; some of the members did move the Flathead Reservation in Montana. However, a small group remained and stayed in the valley near Cusick and Usk (Lahren 1998). The Kalispel Indian Reservation was established by President Woodrow Wilson by Executive Order No. 1904 on March 23, 1914. The executive order reserved approximately 4,629 acres for the Kalispel Tribe. The Pend Oreille River forms the western boundary of the reservation.

Spokane Tribe of Indians

The Spokane Tribe was comprised of three bands: the Lower Spokane had a principal settlement near Little Falls, the Middle Spokane settled near Hangman or Latah Creek, and the Upper Spokane settled along the Little Spokane River up from the junction of Hangman Creek (Ross 1998). Each of the bands had the potential to utilize the portion of the area now managed by the Colville National Forest. Generally

speaking, the portion of the Forest that is near/surrounding Chewelah, across Flowery Trail, and South of the Pend Oreille River were within the traditional use areas of the Spokane Tribe.

In the past, the Spokane occupied approximately 3 million acres in northeastern Washington. The Spokane Reservation was created by executive order in January 1881, by President Hayes. This order moved the Spokane Tribe of Indians from their ancestral homelands to the Spokane Indian Reservation.

Tribal Rights

In addition to laws listed in the Regulatory Framework, the following apply specifically to Tribal resources. The executive orders that established the three Tribal reservations in the area are:

- Confederated Tribes of the Colville Reservation: Executive Order of 1872; North-Half Agreement of 1891 (27 Stat. 62)
- Kalispel Tribe of Indians: Executive Order Number 1904 (1914)
- Spokane Tribe of Indians: Executive Order of 1881

Environmental Consequences

The revised forest plan provides a programmatic framework that guides site-specific actions, but does not authorize, fund, or carry out any project or activity. Because the revised forest plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. However, there may be implications, or longer term environmental consequences, of managing the forests under this programmatic framework.

Under the provisions of the National Historic Preservation Act (NHPA 1966, as amended; 16 U.S.C. §470), adverse effects to cultural resources include a variety of criteria affecting the potential eligibility of cultural resources for inclusion on the National Register of Historic Places (36 CFR §800.9b). Specifically, effects may be deemed adverse according to the following (36 CFR §800.5[1]):

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.*

Tribal consultation for specific actions would be conducted prior to approving site-specific projects in compliance with Federal law and Forest Service policy. Prior to the forests making a decision on a site-specific action that is subject to NHPA, the forests would consult the Tribes to identify TCPs and sacred sites, evaluate TCPs for the NRHP and analyze the effects of the proposed use or activity in compliance with the programmatic agreement and/or the Memorandum of Understanding with the Tribes. Following the identification and recording of TCPs, mitigation measures appropriate to the proposed undertaking would be implemented. Measures would be determined through consultation. For example, they might include avoidance by redesigning the project boundaries, or changing the time/season of when the project is implemented. In cases where specific activities would constitute an adverse effect and avoidance could not be accomplished, the adverse effects would be resolved in accordance with 36 CFR 800.

Some sacred sites may not meet the definition and criteria for a TCP and would not be subject to the NHPA. Executive Order 13007 states that the Federal Government should avoid adversely affecting the physical integrity of sacred sites. Tribal consultation for specific actions would be conducted prior to approving site-specific projects. Consultation with the appropriate Tribe/s could determine if the proposed action would affect the physical integrity of the sacred site. The physical integrity of a sacred site can be adversely affected by non-ground-disturbing activities, such as but not limited to using treated sewage water on the sacred site for making snow or irrigation; using the location for touch and go landings of aircraft; pumping ground water from a different location that affects the flow and water quality of sacred springs; mining or drilling underneath the sacred site; building facilities and/or permitting land use activities that change the visual, vegetative, and sound qualities of an area, which are attributes of the sacred site. At times, the only mitigation measure to not adversely affect a sacred site is avoidance. Other measures may be identified through consultation with the affected Tribes.

The American Indian Religious Freedom Act provides for the protection and preservation of the inherent rights of American Indians' freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, and use, and the freedom to worship through ceremonials and traditional rites. Some actions may not affect the access, but may temporarily and/or permanently alter or destroy the use of a site or religious ceremony by impacting the physical integrity of the location, setting or resources, and/or defiling the primary attributes that make the location a holy place. Certain resources or ceremonies may only be collected and/or conducted on a specific location by specific individuals at a specific time. Approved activities that limit or change the use and access of traditionally used resources or TCP/sacred sites may have permanent adverse effects by altering or removing a specific traditionally used resource, or impacts the process and/or continuation of the ceremonial rite.

The Federal trust duty requires the Forest Service to administer their programs in a manner that does not interfere with tribal rights and resources. Actions that may affect Tribal rights and resources include but are not limited to special use permits that allow pumping or diverting water resources, vegetation management treatments that could potentially reduce the risk of wildfires crossing jurisdictions or improve the quality of wildlife habitat along reservation boundaries, grazing and range improvements that prevent trespass issues, and transportation management that provides necessary access and discourages illegal access to reservation lands.

Methodology and Analysis Process

The analysis includes a review of the current conditions, alternatives and an assessment of the potential impacts each alternative could have on Tribal access and use of the Forest. The American Indian Rights and Interests area of potential effect includes the lands and resources of the Forest and the potential effect to Tribal resources and/or rights within lands adjacent to the Forest. Limited information exists on TCPs (TCPs) and Sacred Sites on the Forest. An ethnographic overview of the Forest has not been conducted. The existing condition was determined by reviewing the National Register of Historic Places, reviewing the Forest's heritage site and inventory files, cultural resource management overviews, ethnographic inventory overviews, articles, books, and the heritage Geographic Information System (GIS) database, and prior Tribal responses from consultation.

The American Indian Religious Freedom Act declares that the policies of the United States shall preserve and protect the American Indians' freedom to practice their religion. This includes the right to have access to religious sites, to use and retain sacred objects, and to conduct ceremonies and practice traditional rites on the forests. The Religious Freedom Restoration Act states that the government shall not substantially burden a person's exercise of religion even if the burden results from a rule of general applicability, except when the government demonstrates that application of the burden to the person is in furtherance of

a compelling governmental interest. To determine how the alternatives would affect the use and access to religious sites (1) an inventory of the known TCPs), or sacred sites were identified through known and accessible ethnographic reports, archaeological reports, and Tribal consultation responses; and (2) a review of the past and current accommodations to Tribes to access and use TCPs, sacred sites, and resources for ceremonial purposes was completed.

Sacred sites are defined in E.O. 13007 as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian Tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the Tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." The E.O. directs the Forest Service and other Federal land management agencies, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions: to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners; to avoid adversely affecting the physical integrity of such sacred sites; and to maintain the confidentiality of sacred sites where appropriate.

TCPs are defined in National Register Bulletin 38 as properties associated with "cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." For example, TCPs might be structures, mountains and other landforms, plant-gathering locations, communities, or other types of properties. These areas are considered historic properties that may be eligible to the National Register of Historic Places.

Section 106 of NHPA requires that Federal agencies take into consideration the effects of their undertakings on historic properties, which are defined in 36 CFR 800.16(l) as any district, site, building, structure, or object that is included in or eligible for inclusion in the NRHP. The "Section 106 review process," entails five steps: (1) determining whether the proposed action is an undertaking that has the potential to affect historic properties); (2) identifying historic properties; (3) evaluating the significance of historic properties; (4) assessing effects; and (5) consulting with interested parties (including Native People), the State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP). Section 110 (Federal Agencies' Responsibility to Preserve and Use Historic Properties) of the NHPA provides direction to Federal agencies to establish programs and activities to identify and nominate historic properties to the NRHP and to consult with Tribes. The Pacific Northwest Region has a programmatic agreement with the ACHP and Washington SHPO that stipulates the Forest Service's responsibilities for complying with the NHPA.

Under Section 106 regulations, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. Specific examples of adverse effects cited in statute include (36 CFR 800.5):

- Physical destruction of or damage to all or part of the property.
- Removal of the property from its historic location.
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance.

- Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.

A review of Tribal rights (hunting, fishing, and gathering rights) was conducted to determine how the alternatives would potentially affect Tribal rights. There are no known reserved hunting and gathering rights stated in treaties that involve lands of the Forest; however, executive order Tribes may have won certain rights and privileges under State law and regulation (*Colville Confederated Tribes—Antoine* v. *Washington*, 420 U.S. 1994 [1975]). For members of the Kalispel Tribe, "Waterfowl bag limits and hunting seasons on the Kalispel Indian Reservation are determined annually to concur with limits and seasons set forth through the U.S. Fish and Wildlife Service (USFWS) Migratory Bird Program (Kalispel Tribe of Indians Hunting and Fishing Regulations 2014)." The Kalispel Tribe regulates and enforces their hunting and fishing rights through their own Tribal law and order code. The Kalispel Tribe also have Memoranda of Understandings with the Washington Department of Wildlife concerning fisheries resources (WDFW 1993, 1994). The Forest Service is not party to these understandings as they effect only Kalispel reserved lands.

Consultation letters were sent to the three Tribal Governments (Colville Confederated Tribes, Kalispel Tribe of Indians, and Spokane Tribe of Indians) regarding the plan revision.

Assumptions

In the analysis for this resource, the following assumptions have been made:

- The revised forest plan provides a programmatic framework for future site-specific actions.
- The plan decisions (desired conditions, objectives, standards, guidelines, areas with special designations, suitability, monitoring) would be followed when planning or implementing site-specific projects and activities.
- Analysis and impacts to American Indian Rights and Interests from site-specific actions would be addressed at the time site-specific decisions are made.
- Members of American Indian Tribes would continue to access, use, and/or conduct religious pilgrimages and ceremonies at known TCPs and sacred sites; and collect forest and botanical resources.
- Generally, the lands and resources of the Colville National Forest used by American Indian Tribes for traditional cultural purposes and traditional use are for personal and community use.
- Law, policy, and regulations would be followed when planning or implementing site-specific projects and activities.
- The agency has the capacity (e.g., funding, personnel, other resources) to accomplish the minimum planned objectives.
- Burning could occur across all NFS lands.
- Unplanned ignitions are analyzed at the time of the fire's start and documented in the Wildland Fire Decision Support System (WFDSS). Management response to a wildfire is based on objectives appropriate to conditions of the fire, fuels, weather, and topography to accomplish specific objectives for the area where the fire is burning. Affects to cultural resources are considered when determining the objectives and management response to a wildfire
- The kinds of resource management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives of the forest plan. The specific location, design, and the extent of such activities are generally not known. The effects analysis is intended to

be useful for comparing and evaluating alternatives on a forestwide basis. It is not intended to be applied directly to specific locations on the Forest.

- Prior to making a project-level decision that is subject to the NHPA, the Forest would consult Tribes to identify TCPs and sacred sites, evaluate TCPs for the NRHP, and analyze the effects of the proposed use or activity in compliance with the *Programmatic Agreement Among the United States Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Officer Regarding Cultural Resources Management on National Forests in the State of Washington* (USDA Forest Service 1997), and/or memorandum of understandings with Tribes. Following the identification and recording of TCPs, mitigation measures appropriate to the proposed undertaking would be implemented. Measures would be determined through consultation and might include avoidance by redesigning the project boundaries and/or changing the time/season of when the project is implemented. In cases where specific activities would constitute an adverse effect and avoidance cannot be accomplished, the adverse effects would be resolved in accordance with 36 CFR 800.

Revision Topics Addressed in this Analysis

American Indian rights and interests may be affected by the issues addressed in the revision topics: maintenance and improvement of ecosystems and community forest interaction. This analysis would address two issues identified by the Tribes that are related to the American Indian Religious Freedom Act, Religious Freedom Restoration Act, E.O 13007, and the Federal trust responsibility.

The three Tribes affiliated with the Colville National Forest have identified three main issues regarding forest land management in consultation and collaboration efforts conducted by the Forest (various Tribal Communications 2014):

- The effects of management practices on resources used in traditional activities

  Indicator: Qualitative discussion of potential effects to TCPs, sacred sites, and Tribal rights from ecosystem restoration treatments, recreation, and special uses (Meeting Notes from November 4, 2014, and November 12, 2014).

- The accommodation of traditional use activities such as visiting offering places, medicinal plant gathering, visitation of sites identified in oral histories, pilgrimages, and other such cultural activities (Meeting Notes from November 4, 2014, and November 12, 2014)

  Indicator: Qualitative assessment of the potential effects on the access and use of those resources for traditional and religious purposes.

- The effects of vegetation management on fire behavior and its potential to affect Tribal lands adjacent to the Forest (refer to the following: *Colville Confederated Tribes Integrated Resource Management Plan*, June 3, 2014, Congressional Testimony of DeSautel April 10, 2014, Colville Confederated Tribes Comment letter dated April 13, 2009, and Meeting Notes from January 23, 2004).

  Indicator: Assessment and monitoring of future ecosystem restoration treatments.

Effects Common to All Alternatives

The Forest consults with three different Tribal governments that have a cultural affiliation to the area. At present, Tribes have not identified concerns or issues that the proposed plan and alternatives would result in adverse impacts to known and unidentified TCPs and sacred sites or the use of those locations. The Tribes have expressed interest in the effects to wildlife (caribou and native fish species), the effects of vegetation management (forest health and wildfire spread to adjacent Tribal lands), and the need to

prevent additional adverse impacts from activities to TCPs and sacred sites. It should be noted that some Tribes may not reveal specific locations of traditional use or sacred sites to non-practitioners because of cultural restrictions and/or religious beliefs unless that location is at risk of being adversely impacted by project activities. Government-to-government consultation would continue between the Forest and the Tribes. If Tribal consultation results in identification of additional, currently unidentified, traditional uses and traditional cultural properties, impacts to those areas would be considered during project-specific environmental assessments.

Traditional Cultural Properties and Sacred Sites

The 1988 forest plan (no action alternative) has not been amended to reflect the 1992 requirements and amendments to the NHPA. The 1992 amendment Section 101 (d)(6) states that properties of traditional religious and cultural importance to an Indian Tribe or native Hawaiian organization may be determined eligible for inclusion on the National Register. It also states that a Federal agency shall consult with any Indian Tribe that attaches religious and cultural significance to these properties. The forest plan also does not address the requirements of the Native American Graves Protection and Repatriation Act of 1990, E.O. 13007 Indian Sacred Sites, and E.O. 13175 Consultation and Coordination with Indian Tribal Governments. The focus of management and guidelines for forest resources within the 1988 forest plan were developed prior to the passage or issuance of these statutes, which lead to more impacts to TCPs. Emphasis was on use of timber and multiple-use activities that incorporate the location of TCPs and sacred sites that may not be compatible with those uses. In the action alternatives, the proposed plan would incorporate the passage of these statues and issuance of executive orders providing for increased consideration and management to avoid or minimize the impacts to TCPs and sacred sites, to allow access, and preserve their cultural value and use.

Tribal Interests

The Forest's proposed treatments in all of the alternatives provide for sustainability and improvement of wildlife habitat. The alternatives are not expected to reduce or limit the long-term availability and use of traditionally used wildlife. The Tribes have not identified any concerns that the proposed treatments would affect their access and use of traditionally used forest products and minerals. Road access and access in general are vitally important for Tribal members, particularly elder Tribal members, to continue to utilize culturally significant resources, TCPs, and sacred sites.

Relationship of Short-term Uses and Long-term Productivity

Traditional cultural areas used for hunting wildlife and collecting forest resources could be affected by the temporary closure of areas from wildland fires and treatments. Many of the traditionally used plants respond to fire by increasing productivity. The alternatives allow approximately the same number of acres to be treated by fire, and fuels treatments would potentially increase the long-term productivity of traditionally used forest resources and availability of those resources across the landscape. Access to visit TCPs and sacred sites could be affected in the short term during implementation of prescribed burn treatments or during management of wildfires. Conducting prescribed burns has the potential to restore the natural and cultural landscape, and the natural fire regime, reducing the potential for permanent adverse effects from high-intensity, high-severity fires. Mechanized treatments have similar benefits to TCPs by reducing the potential for permanent adverse effects from fire, but these treatments have the highest potential for long-term indirect effects from erosion caused from intensive ground disturbance near sites. Also, slash from mechanized treatments is often piled and burned resulting in more locations with hydrophobic soils, thus increasing erosion to sites if the piles were located near TCPs.

Unavoidable Adverse Impacts

The forest plan provides a programmatic framework that guides site-specific actions, but does not authorize, fund, or carry out any project or activity. Before actions take place, they must be authorized in a subsequent site-specific environmental analysis. Therefore, none of the alternatives cause unavoidable adverse impacts. Mechanisms are in place to monitor and use adaptive management principles to help alleviate any unanticipated impacts that need to be addressed singularly or cumulatively.

Irreversible and Irretrievable Commitment of Resources

The forest plan provides a programmatic framework that guides site-specific actions, but does not authorize, fund, or carry out any project or activity. Because the forest plan does not authorize or mandate any site-specific project or activity (including ground-disturbing actions), none of the alternatives cause an irreversible or irretrievable commitment of resources.

Adaptive Management

All alternatives assume the use of adaptive management principles. Forest Service decisions are made as part of an ongoing process, including planning, implementing projects, and monitoring and evaluation. The forest plan identifies a monitoring program. Monitoring the results of actions would provide a flow of information that may indicate the need to change a course of action or the forest plan. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

Consistency with Law, Regulation, and Policy

All alternatives are designed to guide Colville National Forest's management activities in meeting Federal law, regulations, and policy.

Other Planning Efforts

There are no conflicts between the alternatives and the adjacent tribal land use plans.

Cumulative Environmental Consequences

American Indian rights and interests may be affected by the issues addressed in the revisions, which increase maintenance and improvement of ecosystems and community forest interaction. Current and previous Forest Service management activities, public resource procurement and recreational use and natural processes have impacted TCPs and sacred sites. The analysis area consists of lands that include American Indian TCPs and sacred sites within the state of Washington associated with Tribes culturally affiliated with the lands of the Forest. Tribes view sacred sites and TCPs that are part of their traditions as interconnected places/features of the religious and traditional landscape. Effects to these places or features may directly or indirectly affect the access and use by the Tribes to conduct ceremonial and/or traditional practices of other sacred sites or TCPs that are part of their traditions. There are several known activities, projects or planned projects and/or plans located on lands that have or would adversely affect TCPs and sacred sites.

This page intentionally left blank

Chapter 4. Consultation and Coordination

Preparers and Contributors

The following individuals and Forest Service staff groups contributed to the development of this environmental impact statement. This list of preparers is limited to those people who were members of the interdisciplinary team working on these documents. Their preparation could not have been completed without the support and assistance of employees of the Colville and Okanogan-Wenatchee National Forests and our colleagues in the regional office and Pacific Northwest Research Station. We also recognize the forest leadership teams as providing guidance during this process.

Responsible Official

James Peña, Regional Forester for the Pacific Northwest Region

Official Responsible for Preparing the FEIS

Rodney Smoldon, Colville National Forest Supervisor

Interdisciplinary Team Members

Name	Contribution	Education and Experience
Kathleen Ahlenslager	Botany, Research Natural Areas	B.A. Geography; B.A. Environmental Studies, University of California, Santa Barbara; M.A. Botany, University of Montana. Botanist for 26 years with the Forest Service.
Alicia Beat	Heritage, Tribal	B.A. Sociology/Criminology (physical anthropology), University of Northern Colorado; M.A. Anthropology (sub-field Physical Anthropology), University of Oklahoma; 13 years of experience in Federal cultural resource management; 16 years of experience as a physical anthropologist specializing in Forensic Archaeology and Skeletal Biology.
Mary Jo Bendickson	Geographical Information System Analyst	B.S. Horticulture, Washington State University; 27 years with the Forest Service—Tree Improvement, Reforestation, and GIS
Terry L. Craigg	Soils	M.S. Soil Science, University of California Davis; M.F. (Forestry) Oregon State University; 29 years of experience with Federal Government (USDA Natural Resources Conservation Service and Forest Service).
Ben Curtis	Fire, Fuels Management	20 years experience with the Forest Service in fire and fuels management.
Jonathan Day	Silviculture, Timber Management	M.S. Physical Geography, University of Oregon; National Advanced Silviculture Program (Continuing Education). Forest Service certified silviculturist with 14 years of experience with natural resource management in the public sector.
Kate Day	Hydrology, Aquatics	B.S. in Environmental Science, William Smith College, M.S. in Physical Geography, University of

Name	Contribution	Education and Experience
		Oregon; 12 years of experience as a Forest Service hydrologist.
Amy Dillon	Planner	B.S. Forest Management, University of Missouri Columbia; 35 years natural resource management experience with the Forest Service.
Cara Farr	Soil	B.S. and M.S. Soil Science, West Virginia University; 13 years of experience with the Forest Service in soil and watershed resources.
Travis Fletcher	Range, Invasive Plants	B.S. Natural Resource Management (Wildlife, Range), Washington State University; 17 years of experience as professional rangeland management specialist with Bureau of Land Management and Forest Service.
William Gaines	Wildlife Biology Ecologist	PhD Wildlife Science, University of Washington; 28 years of experience in wildlife research and management
Elisabeth Grinspoon	Social analysis	B.A. East Asian Studies, Middlebury College, M.F., Yale University; Ph.D., University of California, Berkeley.
Holly Hutchinson	Planner	M.S. Fisheries and Wildlife, Michigan State University; 4 years experience in fisheries biology, 7 years experience as a NEPA specialist with the Forest Service.
Barbara L. Jackson	Scenery	B.S. Landscape Architecture, University of Oregon; 27 years of experience as Landscape Architect and Scenery Specialist with the Forest Service.
Delilah R. Jaworski	Social Scientist	M.S. in Environment and Development, The London School of Economics; 8 years of experience in social and economic analysis for natural resource management with Forest Service and BLM.
Jason Jimenez	Climate Change	B.S. Environmental Science, University of California Davis; M.S. Soil Science, University of Idaho; 10 years of experience in soil science with the Forest Service.
Deborah Kelly	Public Affairs	B.A. in Public Relations and Business Communications, Central Washington University; 26 years with the Forest Service Public Affairs, information, education, collaboration and facilitation
Kenneth MacDonald	Aquatic/Fisheries	B.S. degree in Fisheries Science and Forest Management, Oregon State University. Served 30+ years as a Forest Service fish biologist, including 15 years as the Fisheries Program Manager on the Okanogan-Wenatchee National Forest and supported the Interior Columbia Basin Ecosystem Management aquatic assessment.
Eric McQuay	Recreation	B.S. in Outdoor Recreation and Tourism, University of Idaho; 25 years of experience working for the Forest Service in recreation, wilderness, trail, and

Name	Contribution	Education and Experience
		special uses management; over ten years as a District and Zone Recreation Program Manager
Karen Nooney	Lands/Special Uses and Minerals	B.S. Wildland Recreation Management, Washington State University; 27 years of experience with the Forest Service in Wilderness Management and planning, Recreation and Lands Special Uses, and Minerals Administration. Colville Forest Special Uses and Minerals Program Manager.
Marcy Rumelhart	Writer-Editor	Associate degree in Forest Technology, Centralia College; 31 years experience with the Forest Service in fire, reforestation, planning, and writing and editing NEPA documents.

Support to Interdisciplinary Team

Name	Contribution	Education and Experience
Mike Borysewicz	Wildlife Biology	B.S. in Wildlife Resources, University of Idaho; 28 years' experience as a wildlife biologist with the Forest Service.
John Chatel	Threatened and Endangered Species	B.S. in Environmental Biology, Humboldt State University; M.S. in Environmental Studies, University of Montana; 25 years experience with the Forest Service including 6 years as the Regional Threatened and Endangered Species Program Manager.
Rodrick Clausnitzer	Botanist/Plant Ecologist	B.S. in Forest Management, M.S. in Forest and Range Ecology, Washington State University; 35 years of natural resource management experience in teaching, extension, research, forest and range ecology, botany, and silviculture. Plant ecologist and botanist for 25 years with the Forest Service
Patricia Goude	Writer-Editor	B.A. in Technical Journalism, Colorado State University; 9 years' experience as writer-editor with Forest Service Enterprise Program
Lisa Green	Writer-Editor	B.A. in English, Wayne State University; 18 years' experience with the Forest Service in fire, fuels management, recreation, planning, and writing and editing NEPA documents.
Margaret Hartzell	Planner	B.S. in Forest Management, University of Washington; M.S. in Forest Planning, University of Washington; 32 years of natural resource management experience in the public sector, with the Army Corps of Engineers and the Forest Service
Amanda Hendrix	Botany	B.S. in Plant Science, Montana State University; 14 years' experience in wildlife and botany with the US Fish and Wildlife Service and Forest Service.

Name	Contribution	Education and Experience
Paul Hessburg, Sr.	Research Landscape Ecologist-PNW Research	B.S. Forestry, University of Minnesota, St. Paul, Ecosystem Analysis and Silviculture, Ph.D. Oregon State University, Corvallis, OR, Botany and Plant Pathology, 37 years in research and natural resource management, specializing in ecological forestry, landscape and disturbance ecology, pathology, entomology, and fire ecology R&D
Karen Honeycutt	Fisheries	B.S. degree in Forestry and Wildlife with an emphasis in Fisheries Science. Fish Biologist for 28 years with the Forest Service.
Mark Loewen	Silviculturist	B.S., Forest Management, Oregon State University. Continuing Education in Forest Ecology and Silviculture: University of Montana, Univ. of Idaho, Washington State University. Forest Service Certified Silviculturist; 40 years' experience in western forest, shrub, and woodland ecosystems
Chris Loggers	Wildlife Biology	B.S. Wildlife Biology, Life Science Education, University of Minnesota; M.S. Wildlife Biology, University of Montana; 32 years of experience in wildlife management and research.
Richard Phillips	Economics	B.S. Forest Management, Colorado State University, Graduate Studies; Colorado State University; 28 years of experience as an economist for the Forest Service providing direction and social and economic analysis in support of forest planning, projects and programs
Mark Skinner	Botanist	Ph.D. in Biology, Harvard University; 29 years' experience in botany with California Native Plant Society and the Forest Service.
Brian Staab	Hydrologist	B.S. in Civil and Environmental Engineering, Pennsylvania State University; M.S. in Hydrology, Stanford University; 17 years' experience as a Hydrologist with the Forest Service.
Max Wahlberg	Analyst	B.S. in Environmental Studies, Prescott College; 15 years' experience with the Forest Service as an ecologist and analyst.
Doug Young	Planner	B.S. in Fishery Biology, Colorado State University; M.S. in Fisheries Humboldt State University; 20 years' experience as fish biologist Bureau of Reclamation and US Fish and Wildlife Service; 6 years' experience as Energy Program Manager with US Fish and Wildlife Service; 2 years' experience as Forest Service Regional Planner.

Consultation and Coordination

The Forest Service consulted the following Tribes, Federal, State and local agencies, groups, and individuals during the development of this environmental impact statement.

Tribes

The following three Tribes were consulted: Kalispel Tribe of Indians, Confederated Tribes of the Colville Reservation, and Spokane Tribe of Indians.

Federal, State and Local Agencies

Numerous Federal, State and local agencies were consulted in the development of the proposed plan and this FEIS. Complete mailing lists for the scoping and comment periods are available in the "Plan Set of Documents." Some of the agencies consulted include:

U.S. Fish and Wildlife Service

Washington Department of Fish and Wildlife

Ferry County Board of Commissioners

Pend Oreille County Board of Commissioners

Stevens County Board of Commissioners

Others

Numerous groups and individuals participated in the process through written comments and by attending public meetings. Complete mailing lists are available in the "Plan Set of Documents."

Agencies, Organizations and Persons to Whom Copies of the FEIS were sent

Notice of the availability of this FEIS was mailed to the public, Forest employees, Tribal governments, Federal and State agencies, and local governments. These mailing lists can be found in the planning record.

This page left blank intentionally

Literature Cited

Abe, K., and R. R. Ziemer. 1991. Effect of tree roots on shallow-seated landslides. USDA Forest Service General Technical Report PSQ-GTR-130: 11-20.

Adams, H. D., C. H. Luce, D. D. Breshears, C. D. Allen, M. Weiler, V. C. Hale, A. M. S. Smith, and T.E. Huxman. 2012. Ecohydrological consequences of drought- and infestation-triggered tree die-off: insights and hypotheses. Ecohydrology 5: 145-159.

Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. (Washington D.C.: Island Press). 493 p.

Agee, J. K. 2000. Disturbance ecology of North American boreal forests and associated northern mixed/subalpine forests. Pages 39-82 in: Ruggiero, L.F., K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. Ecology and Conservation of Lynx in the United States. University Press of Colorado, Denver, CO.

Ager, A.A., M. A. Finney, B. K. Kerns, and H. Maffei. 2007. Modeling wildfire risk to northern spotted owl (*Strix occidentalis caurina*) habitat in central Oregon, USA. Forest Ecology and Management 246: 45-56.

Al-Chokhachy, R., B. Roper, and E. K. Archer. 2010. Evaluating the status and trends of physical stream habitat in headwater streams within the interior Columbia River and upper Missouri River basins using an index approach. Transactions of the American Fisheries Society 139.4 (2010): 1041–1059.

Al-Chokhachy, R., B. Roper, E. K. Archer, and S. Miller. 2011. Quantifying the Extent of and Factors Associated with the Temporal Variability of Physical Stream Habitat in Headwater Streams in the Interior Columbia River Basin, Transactions of the American Fisheries Society, 140: 2, 399 – 414.

Allen, S. D., D. A. Wickwar, F. P. Clark, R. R. Dow, R. Potts, and S. A. Snyder. 2009. Values, Beliefs, and Attitudes Technical Guide for Forest Service Land and Resource Management, Planning, and Decision making. USDA Forest Service General Technical Report, PNW-GTR-788. Portland, OR. 120 p.

Almack, J.A. 1998. Mountain caribou recovery in the southern Selkirk Mountains of Washington, Idaho, and British Columbia. Progress report, October 1995-September 1998. Washington Department of Fish and Wildlife, Olympia, WA. 45 p.

Alverson, E. and J. Arnett. 1986. From the steppe to the alpine: a botanical reconnaissance of the Lake Chelan-Sawtooth Ridge Area, Washington. In: Plant life of the North Cascades. Douglasia Occasional Papers, Washington Native Plant Society, Seattle, WA 2:1-63.

Alward, G., R. Hokans, R. Marshall, M. Niccolucci, C. Redmond, D. Smith, and S. Winter. 2010. Economic Impact Technical Guide. U.S. Department of Agriculture, Forest Service: Fort Collins, CO. 138 p.

Amundson, R. and H. Jenny. 1997. On a State Factor Model of Ecosystems. BioScience 47: 536–543. doi:10.2307/1313122.

Andelman, S.J., S. Beissinger, J. F. Cochrane (and others). 2001. Scientific standards for conducting viability assessments under the National Forest Management Act: report and recommendations of the NCEAS Working Group. National Center for Ecological Analysis and Synthesis, University of California, CA.

Angert, A., S. Biraud, C. Bonfils, C. C. Henning, W. Buermann, J. Pinzon, C. J. Tucker, and I. Fung. 2005. Drier summers cancel out the CO_2 uptake enhancement induced by warmer springs. Proceedings of the National Academy of Sciences 102: 10823-10827.

Aplet, G. H. and W.S. Keeton. 1999. Application of historical range of variability concepts to biodiversity conservation. Pages 71-86 in: R. Baydack, H. Campa, and J. Haufler (eds.). Practical Approaches to the Conservation of Biological Diversity. Island Press, Washington D.C. 313 p.

Apps, C. D., J. L. Weaver, P. C. Paquet, B. Bateman, and B. N. McLellan. 2007. Carnivores in the southern Canadian Rockies: core areas and connectivity across the Crowsnest Highway. Wildlife Conservation Society Canada Conservation Report No. 3, Toronto, Ontario, Canada.

Araujo, M. B., M. Cabeza, W. Thuiller, L. Hannah, and P. H. Williams. 2004. Would climate change drive species out of reserves? An assessment of existing reserve selection methods. Global Change Biology 10: 1618-1626.

Archer, E., R. Al-Chokhachy, J. Heitke, P. Ebertowski, R. Leary, T. Romano and B. B. Roper. 2009. PACFISH INFISH biological opinion effectiveness monitoring program for streams and riparian areas 2009 Annual Summary Report. Logan, Utah, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fish and Aquatic Ecology Unit: 48 p.

Archer, E. 2014. Understanding the relationship between livestock disturbance, the protocols used to measure that disturbance and stream conditions. Presentation by Eric Archer, PacFish/InFish Biological opinion Monitoring Program (PIBI) to the Colville National Forest plan revision interdisciplinary team. January 28, 2014. PowerPoint presentation available from the Colville National Forest.

Archer, E.A. 2015. Habitat condition in the Colville National Forest. Unpublished Report. USDA Forest Service, Rocky Mountain Research Station, Fish and Aquatic Ecology. On file at: Colville National Forest Supervisor's Office. Colville, WA.

Archer, E., J.V. Ojala, and A.Van Wagenan. 2016. Stream habitat condition for sites in the Colville National Forest. PacFish/InFish Biological Opinion Monitoring Program. USDA Forest Service, Logan, Utah. July 28, 2016. 92 p. Available at Colville National Forest Headquarters, Colville, WA.

Arienti, M. C., S. G. Cumming, and S. Boutin. 2006. Empirical models of forest fire initial attack success probabilities: the effects of fuels, anthropogenic linear features, fire weather, and management. Canadian Journal of Forest Research, 36(12), 3155-3166.

Asner, G., J. Elmore, L. Olander, R. Martin, and T. Harris. 2004. Grazing Systems, Ecosystem Responses, and Global Change. Annual Review of Environment and Resources 2004.29: 261-299.

Astrup Felde, V., J. Kapfer, and J.A. Grytnes. 2012. Upward shift in elevational plant species ranges in Sikkilsdalen, central Norway, Ecography 35: 922–932.

Aubry, K. B., K. S. McKelvey, and J. P. Copeland. 2007. Distribution and broad-scale habitat relations of the wolverine in the contiguous United States. Journal of Wildlife Management 71: 2147-2159.

Aukema, J. E. and A. B. Carey. 2008. Effects of variable-density thinning on understory diversity and heterogeneity in young Douglas-fir forests. Research Paper PNW-RP-575. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 20 p.

Bailey, R. G. 1995. Description of the ecoregions of the United States (2nd edition). Misc. Pub. No. 1391, Map scale 1:7,500,000. USDA Forest Service. 124 p.

Baldwin, K. 2005. Colville River watershed fecal coliform bacteria total maximum daily load (water cleanup plan): Detailed implementation plan. Washington State Department of Ecology water quality program. Available online at: https://fortress.wa.gov/ecy/publications/publications/0510045.pdf

Baldwin, K. 2006. Colville National Forest temperature and bacteria total maximum daily load. Water quality implementation plan. Water Quality Program. Washington State Department of Ecology, Olympia, WA. Publication number 06-10-059. October 2006.

Bamonte, T. and S. Schaffer Bamonte. 1996. History of Pend Oreille County. Spokane, WA: Tornado Creek Publications.

Barrett, S., D. Havlina, J. Jones, W. Hann, C. Frame, D. Hamilton, K. Schon, T. Demeo, L. Hutter, and J. Menakis. 2010. Interagency Fire Regime Condition Class Guidebook. Version 3.0 (Homepage of the Interagency Fire Regime Condition Class website, USDA Forest Service, US Department of the Interior, and The Nature Conservancy). Available online at: https://www.frames.gov/frcc

Bate, L. J., M. J. Wisdom, and B. C. Wales. 2007. Snag densities in relation to human access and associated management factors in forests of northeastern Oregon, USA. Landscape and Urban Planning 80: 278-291.

Batjes, N.H. 1996. Total carbon and nitrogen in the soils of the world. Eur. J. Soil Sci. 47: 151–163.

Beat, A. 2017a. Heritage report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Beat, A. 2017b. Tribal resources report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Beck, J. L. and L. H. Suring. 2009. Wildlife Habitat – Relationships Models: Description and Evaluation of Existing Frameworks. Chapter 10 Habitat Modeling Frameworks. Pages 251-285

Beckley, T., J. Parkins, and R. Stedman. 2002. Indicators of forest-dependent community sustainability: the evolution of research. The Forestry Chronicle. 78(5): 626-636.

Bedford, B. and K. Godwin. 2003. Fens of the United States: Distribution, Characteristics and Scientific Connection versus Legal Isolation. Wetlands 23(3): 608-629.

Beebe, J., R. Everett, G. Scherer, and C. Davis. 2002. Effect of fertilization applications and grazing exclusion on species composition and biomass in wet meadow restoration in eastern Washington. USDA Forest Service, Gen. Tech. Rep. PNW-RP-542.

Beechie, T.J., D.A. Sear, J.D. Olden, G.R. Pess, J.M. Buffington, H. Moir, P. Roni, and M.M. Pollock. 2010. Process-based principles for restoring river ecosystems. BioScience, 60(3): 209-222.

Behnke, R. 2002. Trout and salmon of North America. The Free Press. New York, New York. 359 p.

Beissinger, S. R. and D. R. McCullough. 2002. Population viability analysis. The University of Chicago Press, Chicago, Ill.

Benda, L., D. Miller, P. Bigelow, and K. Andras. 2003. Effects of post-wildfire on channel environments, Boise River, Idaho. Forest Ecology and Management 178: 105-119.

Benda, L., N.L. Poff, D. Miller, T. Dunne, G. Reeves, G. Pess, and M. Pollock. 2004. The network dynamics hypothesis: How channel networks structure riverine habitats. Bioscience, 54(5): 413–427.

Benda, L.E., S.E. Litschert, G. Reeves, and R. Pabst. 2015. Thinning and in-stream wood recruitment in riparian second growth forests in coastal Oregon and the use of buffers and tree tipping as mitigation. Journal of Forestry Research, 27(4): 1-16.

Bengeyfield, P. 2006. Managing cows with streams in mind. Rangelands: February 2006. 28: 3-6.

Benjamin, J. R. and C.V. Baxter. 2010. Do nonnative salmonines exhibit greater density and production than the natives they replace? A comparison of nonnative brook trout with native cutthroat trout. Transactions of the American Fisheries Society 139:641-651.

Berger, J., P. B. Stacey, L. Bellis, and M. P. Johnson. 2001. A Mammalian Predator-Prey Imbalance: Grizzly Bear and Wolf Extinction Affect Avian Neotropical Migrants. Ecological Applications, 11(4): 947-960.

Berryman, E.M., H.R. Barnard, H.R. Adams, M.A. Burns, E. Gallo, and P.D. Brooks. 2015. Complex terrain alters temperature and moisture limitations of forest soil respiration across a semiarid to subalpine gradient. Journal Geophysical Research Biogeoscience. 120: 707-723.

Beschta, R.L., D.L. Donahue, D.A. DellaSala, J.J. Rhodes, J.R. Karr, M.H. O'Brien, T.L. Fleischner, and C.D. Williams. 2013. Adapting to climate change on western public lands: addressing the ecological effects of domestic, wild, and feral ungulates. Environ Manag 51(2):474–491.

Bilby R.E., K. Sullivan, and S. H. Duncan. 1989. The generation and fate of road-surface sediment in forested watersheds in southwest Washington. Forest Science. 35(2): 453-468.

Binder, L. C.W., J. K. Barcelos, D. B. Booth et al. 2009. Preparing for climate change in Washington State. In: Elsner, M.M., Littel, J., Binder, L.W. (eds.) The Washington Climate Change Impacts Assessment. Seattle, WA: Center for Science in the Earth System, University of Washington: 373–407.

Binkley, D. 1991. Connecting soils with forest productivity. Pages 66–69 in: Proc. On Management and productivity of western-montane forest soils, Harvey, A.E., and L.F. Neuenschwander (compilers). US Forest Service Gen Tech Rep. INT-280.

Binkley, D. and T. Brown. 1993. Forest practices as nonpoint sources of pollution in North America. Water resources bulletin 29(5): 729-740.

Birdsey, R., K. Pregitzer, and A. Lucier. 2007. Forest carbon management in the United States: 1600-2100. Journal of Environmental Quality 35: 1461-1469.

Bjornn, T. C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 In W.R. Meehan, ed. Influences of forest and rangeland management on salmonid fishes and their habitats, American Fisheries Society Special Publication 19.

Blackford, D. 2004. Management Guide for Western Spruce Budworm. Forest Health Protection. USDA Forest Service.

Blankenship, K., L. Frid, and J. L. Smith. 2015. A state-and-transition simulation modeling approach for estimating the historical range of variability. AIMS Environmental Science, 2(2): 253–268.

BLM/RS/ST-96/004+1730. 1996, Rev. 1997 and 1999. Utilization studies and residual measurements. Interagency technical reference. 174 p.

Boisvenue, C. and S.W. Running. 2006. Impacts of climate change on natural forest productivity – evidence since the middle of the 20th century. Global Change Biology 12: 1-12.

Booth, D. B., K. G. Troost, J. J. Clague, and R. B.Waitt. 2003. The Cordilleran Ice Sheet, in: A.R. Gillespie, S.C.P., and B. F. Atwater (Ed.), Developments in Quaternary Sciences, The Quaternary Period in the United States. Elsevier, 17–43.

Bormann, B.T., R.W. Haynes, and J.R. Martin. 2007. Adaptive management of forest ecosystems: Did some rubber hit the road? Bioscience 57(2): 186-191.

Bosch J. M. and J. L Hewlett. 1982. A review of catchment experiments to determine the effects of vegetation changes on water yield and evapotranspiration. Journal of Hydrology, 55: 3-23.

Bosch, D., K. Stephenson, G. Groover, and B. Hutchins. 2008. Farm returns to carbon credit creation with intensive rotational grazing. 11 October 2008. Available online at: http://www.jswconline.org/content/63/2/91.

Bradley, B. A., M. Oppenheimer, and D. S. Wilcove. 2009. Climate change and plant invasions: restoration opportunities ahead? Global Change Biology 15: 1511-1521.

Brown, R. T., J. K. Agee, and J. F. Franklin. 2004. Forest restoration and fire: principles in the context of place. Conserv. Biol., 18 p.

Brown A. E., L. Zhang, T. A. McMahon, A. W. Western, and R. A. Vertessy. 2005. A review of paired catchment studies for determining changes in water yield resulting from alterations in vegetation. Journal of Hydrology, 310(1-4): 28-61.

Brown, J. and J. Thorpe. 2008. Climate Change and Rangelands: Responding Rationally to Uncertainty. Rangelands June 2008: 3-6.

Brown, T. C. and P. Froemke. 2009. Estimating mean annual contribution to water supply from units of the National Forest System (NFS) of the U.S. Forest Service. In Water Supply from National Forests. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 5 p.

Bunting, S. C., J. L. Kingery, M. A. Hemstrom, M. A. Schroeder, R. A. Gravenmier, and W. J. Hann. 2002. Altered rangeland ecosystems on the interior Columbia Basin. USDA Forest Service, Pacific Northwest Research Station, Gen. Tech. Rep. PNW-GTR-553. Portland, OR. 82 p.

Burger, J.A. and D. L. Kelting. 1999. Using soil quality indicators to assess forest stand management. For. Ecol. Manag. 122: 155–166.

Burnett, K.M. and D.J. Miller. 2007. Streamside policies for headwater channels: An example considering debris flows in the Oregon Coastal Province. Forest Science, 53(2): 239-253.

Burroughs, E. R. Jr. and J. G. King. 1989. Reductions of soil erosion on forest roads. General Technical Report INT-264. USDA Forest Service, Intermountain Research Station, Ogden Utah. 21 p.

Burton, T.A. 1997. Effects of basin-scale timber harvest on water yield and peak streamflow. Journal of the American Water Resources Association, 33(6): 1187-1196.

Burton, T. A., S. J. Smith, and E. R. Cowley. 2011. Riparian area management: Multiple indicator monitoring (MIM) of stream channels and streamside vegetation. MIM Technical Reference 1737-23. BLM/OC/ST-10/003+1737+REV. U.S. Department of the Interior Bureau of Land Management, National Operations Center, Denver, CO. 168 p.

Butler, E., K. Stockmann, N. Anderson, K. Skog, S. Healey, D. Loeffler, J. G. Jones, J. Morrison, and J. Young. 2014. Estimates of carbon stored in harvested wood products from United States Forest Service Pacific Northwest Region 1909-2012. USDA Forest Service Publication.

Cambi, M., G. Certini, F. Neri, and E. Marchi. 2015. The impact of heavy traffic on forest soils: a review. Forest Ecology and Management. 338: 124-138.

Camp, P. and J. Gamon. 2011. Field Guide to the Rare Plants of Washington, University of Washington Press. 404 p.

Campbell, E. M., R. E. Keane, E. R. Larson, M. P. Murray, A. W. Schoettle, and C. Wong. 2011. Disturbance ecology of high-elevation five-needle pine ecosystems in western North America. In: Keane, R. E., D. F. Tomback, M. P. Murray, and C. M. Smith, eds. The future of high-elevation, five-needle white pines in Western North America: Proceedings of the High Five Symposium. 28-30 June 2010; Missoula, MT. Proceedings RMRS-P-63. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 154-163.

Canadell, J. G., D. E. Pataki, R. Gifford, R. A. Houghton, Y. Luo, M. R. Raupach, P. Smith, and W. Stefen. 2007. Saturation of the Terrestrial Carbon Cycle. Pages 59-78 in: Terrestrial Ecosystems in a Changing World (Canadell, J.G., D. Pataki, and L. Pitelka (eds.). Springer-Verlag, Berlin Heidelberg, Germany.

Cannell, M. G. R., R. Milne, K. J. Hargreaves, T. A. W. Brown, M. M. Cruickshank, R. I. Bradley, T. Spencer, D. Hope, M. F. Billett, W. N. Adger, and S. Subak. 1999. National inventories of terrestrial carbon sources and sinks: The UK experience. Climatic Change, 42: 505–530.

Cannon, S. H., J. E. Gartner, M. G. Rupert, J. A. Michael, A. H. Rea, and C. Parrett. 2010. Predicting the probability and volume of post wildfire debris flows in the intermountain western United States. GSA Bulletin January/February 122(1/2): 127-144.

Carim, K., M. Young, K. McKelvey, and M. Schwartz. 2016. Project: Environmental DNA Sampling for Detection of Salmonid Fish by the United States Forest Service. February 29, 2016. 15 p.

Carpenter, T. E., V. L. Coggins, C. McCarthy, C. S. O'Brien, J. M. O'Brien, and T. J. Schommer. 2014. A spatial risk assessment of bighorn sheep extirpation by grazing domestic sheep on public lands. USDA Forest Service. University of Nebraska-Lincoln Faculty Publications. Paper 265. 10 p.

Carroll, C., J. R. Dunk, and A. Moilanens. 2009. Optimizing resiliency of reserve networks to climate change: multispecies conservation planning in the Pacific Northwest, USA. Global Change Biology 16: 891-904.

Carroll, C., R. F. Noss, and P. C. Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain region. Ecological Applications 11: 961-980.

Carroll, C., J. R. Dunk, and A. Moilanen. 2010. Optimizing resiliency of reserve networks to climate change: multispecies conservation planning in the Pacific Northwest, USA. Global Change Biology 16: 891-904.

Case, M., C. B. Halpern, and S. A. Levin. 2013. Contributions of gopher mound and casting disturbances to plant community structure in a Cascade Range meadow complex. Botany. 91: 555-561.

Catlin, T., S. Rawlings, and T. Contreras. 2005. Forest Health Assessment: Colville National Forest. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington. 44 p.

Chamberlin, T.W., R. D. Harr, and F. H. Everest. 1991. Timber harvest, silviculture, and watershed processes. American Fisheries Society Special Publication 19: 181-205.

Chance, D. H. 1973. Influences of the Hudson's Bay Company on the Native Cultures of the Colville District. Northwest Anthropological Research Notes Memoir. Vol. 7, No. 1, Part 2. Moscow, ID: University of Idaho.

Chapin III, F. S., G. M. Woodwell, J. T. Randerson, E. B. Rastetter, G. M. Lovett, D. D. Baldocchi, D. A. Clark, M. E. Harmon, D. S. Schimel, R.Valentini, C. Wirth, J. D. Aber, J. J. Cole, M. L. Goulden, J.W. Harden, M. Heimann, R.W. Howarth, P. A. Matson, A.D. McGuire, J. M. Melillo, H. A. Mooney, J. C. Neff, R. A. Houghton, M. L. Pace, M. G. Ryan, S.W. Running, O. E. Sala, W. H. Schlesinger, and E.D. Schulze. 2006. Reconciling carbon-cycle concepts, terminology, and methods. Ecosystems 9: 1041-1050.

Chatters, J. C. and D. L. Pokotylo. 1998. Prehistory: Introduction. In: Sturtevant, W.C. ed. Handbook of North American Indians. Vol. 12. Washington D.C.: Smithsonian Institute.

Chen, S., G. Lin, J. Huang, and M. He. 2008. Responses to soil respiration to stimulated precipitation pulses in semiarid steppe under different grazing regimes. Journal of Plant Ecology September 2008: 1-10.

Choromanska, U. and T.H. DeLuca. 2002. Microbial activity and nitrogen mineralization following heating: evaluation of post-fire effects. Soil Biology Biochemistry. 34: 263-271.

Cissel, R., T. Black, N. Nelson, C. H. Luce, and B. Staab. 2014. Monitoring the hydrologic and geomorphic effects of forest road decommissioning and road improvements. Poster presentation at International Union of Forest Research Organizations conference.

City of Seattle, Washington, 142 FERC ¶ 62,231.

Clary, W. P. and B.F. Webster 1989. Managing grazing of riparian areas in the intermountain region. USDA Forest Service General Technical Report INT-263. Intermountain research station, Ogden, UT. 11 p.

Clary, W. P. and B. F. Webster. 1990. Riparian grazing guidelines for the Intermountain Region. Rangelands. 12(4): 209-212.

Clary, W. P. and W. Leininger. 2000. Stubble height as a tool for management of riparian areas. Journal of Range Management. 53(6): 562-573.

Clausnitzer, R., and M. Skinner. 2018. Botany report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Clayton, J. L. 1990. Soil disturbance resulting from skidding logs on granitic soils in central Idaho. Research Paper INT-436. Ogden, UT: USDA Forest Service, Intermountain Research Station. 9 p.

Climate Change Impacts Group. 2004. Overview of climate change impacts in the U.S. Pacific Northwest. Seattle, WA: Western Governor's Climate Change Initiative.

Climate Change Sensitivity Database (CCSD). 2013. Climate change sensitivity database. University of Washington.

Climate Impacts Group. 2009. The Washington Climate Change Impacts Assessment, M. McGuire Elsner, J. Little, and L. Whitely Binder (eds.) Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Oceans, University of Washington, Seattle, WA. Available online at: http://www.cses.washington.edu/db/pdf/wacciareport681.pdf (accessed 7/29/2009)

Coe, P. K., B. K. Johnson, J. W. Kern, S. L. Findholt, J. G. Kie, and M. J. Wisdom. 2001. Responses of elk and mule deer to cattle in summer. Journal of Range Management 54: A51-A76.

Coe, P. K., B. K. Johnson, K. M. Stewart, and J. G. Kie. 2005. Spatial and temporal interactions of elk, mule deer, and cattle. Pages 150-158 in: Wisdom, M.J. (tech. ed.) The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Group Communications, Lawrence, Kansas, USA. 5 p.

Colville Confederated Tribes. 2000. Colville Indian Reservation Record of Decision and Plan for Integrated Resource Management Plan 2000 – 2014. Final Environmental Impact Statement, July 2001. Nespelem, Washington.

Colville Confederated Tribes. 2015. Confederated Tribes of the Colville Reservation Draft Integrated Resource Management Plan. January 6, 2017. Nespelem, Washington. Available online at: https://www.colvilletribes.com/irmp/ (accessed July 2017)

Conant, R. and K. Paustian. 2000. The Effects of Grazing Management on Soil Carbon (Carbon Sequestration). Natural Resource Ecology Laboratory, Colorado State University.

Confederated Tribes of the Colville Reservation. 2012. Wetland Program Plan. Nespelem, WA. Available online at: http://colville.whydevelop.com/media/files/Wetland%20Program%20Plan.pdf (Accessed July 2017).

Confederated Tribes of the Colville Reservation. 2015. Draft Comprehensive Plan. Nespelem, WA.

Cook, J. G. 2002. Chapter 5. Nutrition and Food. Pages 259-350 in North American Elk: Ecology and Management. Toweill, D.E., Thomas, J.W. (eds.) Smithsonian Institution Press, Washington D.C.

Cook, J. G., L. L. Irwin, L. D. Bryant, R. A. Riggs, and J. W. Thomas. 1998. Relations of forest cover and condition of elk: a test of the thermal cover hypothesis in summer and winter. Wildlife Monograph. 141. 61 p.

Cook, J. G., L. L. Irwin, L. D. Bryant, R. A. Riggs, and J. W. Thomas. 2005. Thermal cover needs of large ungulates: a review of hypothesis tests. Pages 185-196 in: Wisdom, M.J. (tech. ed.) The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Group Communications, Lawrence, Kansas, USA.

Cook, J. G., B. J. Johnson, R. A. Cook, R. A. Riggs, L. D. Bryant, and L. L. Irwin. 2004. Effects of summer-autumn nutrition and parturition date on reproduction and survival of elk. Wildlife Monograph. 155. 61 p.

Cook, R. C., J. G. Cook, D. J. Vales, B. K. Johnson, S. M. McCorquodale, L. A. Shipley, R. A. Riggs, L. Irwin, S. Murphie, B. Murphie, K. A. Schoenecker, and F. Geyer. 2013. Regional and seasonal patterns of nutritional condition and reproduction in elk. Wildlife Monographs 184(1): 1-45.

Coots, R. 2002. Colville River fecal coliform total maximum daily load study. Washington State Department of Ecology environmental assessment program. Available online at: https://fortress.wa.gov/ecy/publications/SummaryPages/0203036.html

Copeland, J. P. 1996. Biology of the wolverine in central Idaho. M.S. Thesis, University of Idaho, Moscow, ID.

Copeland, J. P., J. M. Peek, C. R. Groves, W. E. Melquist, K. S. McKelvey, G. W. McDaniel, C. D. Long, and C. E. Harris. 2007. Seasonal habitat associations of the wolverine in central Idaho. Journal of Wildlife Management 71: 2201-2212.

Copeland, J. P., K. S. McKelvey, K. B. Aubry, L. Landa, J. Persson, R. M. Inman, J. Krebs, E. Lofroth, H. Golden, J. R. Squires, A. Magoun, M. K. Schwartz, J. Wilmot, C. L. Copelan, R. E. Yates, I. Kojola, and R. May. 2010. The bioclimatic envelope of the wolverine (*Gulo gulo*): do climatic constraints limit its geographic distribution? Canadian Journal of Zoology 88: 233-246.

Cordell, H. K., G. Green, C. Betz, M. Fly, and B. Stephens. 2004. USDA Forest Service, Southern Research Station, Recreation Statistics Update Report Numbers 1-3.

Cordell, H. K., C. J. Betz, G. Green, and M. Owens. 2005. USDA Forest Service, Southern Research Station Off-highway vehicle recreation in the United States, regions, and states: a national report from the national survey on recreation and the environment (NSRE).

Cordell, H. K., C. J. Betz, B. J. Butler, and J. C. Bergstrom. 2008. Trends in Forest-Based Recreation: Reports for the 2010 Montreal Process Indicators for the U.S. http://warnell.forestry.uga.edu/nrrt/nsre/IRISRec/IRISRec8rpt.pdf.

Cordell, H. K., G. T. Green, and C. J. Betz. 2009. Long-term National Trends in Outdoor Recreation Activity Participation---1980 to Now. http://warnell.forestry.uga.edu/nrrt/nsre/IRISRec/IRISRec12rpt.pdf.

Council on Environmental Quality (CEQ). 1997. "Environmental Justice: Guidance Under the National Environmental Policy Act." Executive Office of the President.

Cover, M., C. L. May, V. H. Resh, and W. E. Dietrich. 2006. Quantitative linkages between sediment supply, streambed fine sediment, and benthic macroinvertebrates in streams of the Klamath Mountains. Journal of the North American Benthological Society 27(1): 135-149.

Covington, W. W., P. Z. Fule, M. A. Moore, S. C. Hart, C. Kolb, J. M. Mast, S. S. Sackett, and M. R. Wagner. 1997. Restoring ecosystem health in ponderosa pine forests of the Southwest. Journal of Forestry 95(4): 23-29.

Cox, G. W. 1999. Alien Invasion in North America and Hawaii: Impacts on Natural Ecosystems. Island Press.

Craigg, T. L., P. W. Adams, and K. A. Bennett. 2015. Soil matters: improving forest landscape planning and management for diverse objectives with soils information and expertise. Journal of Forestry. 113(3): 343-353.

Croke, J., S. Mockler, P. Fogarty, and I. Takken. 2005. Sediment concentration changes in runoff pathways for a forest road network and the resultant spatial pattern of catchment connectivity. Geomorphology 68 (3-4): 257-268.

Curtis, B. and M. Wynecoop. 2017. Fire ecology report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Daniels, Jean M. 2004. Assessing socioeconomic resiliency in Washington counties. Gen. Tech. Rep. PNW-GTR-607. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 35 p.

Daubenmire, R. 1970. Steppe vegetation of Washington. Tech. Bull. 62. Wash. Agric. Exp. Stn., College of Agriculture, Washington State University, Pullman, WA. 131 p.

Davidson, E.A. and P. A. Lefebvre. 1993. Estimating regional carbon stocks and spatially covarying edaphic factors using soil maps at three scales. Biogeochemistry 22: 107–131.

Davidson, E. A., E. Belk, and R. D. Boone. 1998. Soil water content and temperature as independent or confounded factors controlling soil respiration in a temperate mixed hardwood forest. Global Change Biology. 4: 217-227.

Davis, C., M. Karrer, B. Kovalchik, T. Lillybridge, and C. Narsico. 2004. Landtype associations of north central Washington: Wenatchee, Okanogan, and Colville National Forests. USDA Forest Service, Wenatchee, WA. 118 p.

Davis, R. J., K. M. Dugger, S. Mohoric, L. Evers, and W. Aney. 2011. Northwest Forest Plan-the first 15 years (1994-2008): Status and trends of northern spotted owl populations and habitats. PNW-GTR-850. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 147 p.

Davis, R.J., J.L. Ohmann, R.E. Kennedy, W.B. Cohen, M.J. Gregory, Z. Yang, H.M. Roberts, A.N. Gray, and T.A. Spies. 2015. Northwest Forest Plan-The first 20 years (1994-2013): Status and trends of Late-Successional and Old-Growth Forests. PNW-GTR-911. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

Day, J. 2015. Personal communication between Cara Farr, Soil Scientist, R6 Regional Office and Jon Day, Colville National Forest Silviculturist.

Day, J. 2017. Forest vegetation report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Day, K. 2018. Hydrology report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

DeBano, L. F., D. G. Neary, and P. F. Ffolliott. 1998. Fire's effects on ecosystems. John Wiley and Sons: USA.

DeLuca, T. H. and G. H. Aplet. 2008. Charcoal and carbon storage in forests of the Rocky Mountain West. Front. Ecol. Environ. 6(1): 18-24.

Derner, J., G. Schuman, M. Jawson, S. Shafer, J. Morgan, H. Polley, G. Runion, S. Prior, H. Torbert, H. Rogers, J. Bunce, L. Ziska, J. White, A. Franzleubbers, J. Reeder, R. Venterea, and L. Harper. 2005. USDA-ARS Global Change Research on Rangelands and Pasturelands. Rangelands October 2005: 36-42.

Derner, J., T. Boutton, and D. Briske. 2006. Grazing and ecosystem carbon storage in the North American Great Plains. Plant and Soil Journal 280: 77-90.

DeRose, R. J. and J. N. Long. 2014. Resistance and resilience: A conceptual framework for silviculture. Forest Science. Available online at: doi: http://dx.doi.org/10.5849/forsci.13-507.

Deser, C., A. Phillips, V. Bourdette, and H. Teng. 2012. Uncertainty in climate change projections: The role of internal variability. Climate Dynamics, 38: 527-546.

de Steiguer, J., J. Brown, and J. Thorpe. 2008. Contributing to the Mitigation of Climate Change Using Rangeland Management. Rangelands June 2008: 7-11.

Devine, W., C. Aubry, A. Bower, J. Miller, and N. Maggiulli Ahr. 2012. Climate change and forest trees in the Pacific Northwest: a vulnerability assessment and recommended actions for national forests. Olympia, WA: USDA Forest Service, Pacific Northwest Region. 982 p.

Dilling, L., S. C. Doney, and J. Edmonds. 2003. The role of carbon cycle observations and knowledge in carbon management. Annual Review of Environment and Resources. 28: 521-558.

Dodson, E. K., D. W. Peterson, and R. J. Harrod. 2008. Understory vegetation response to thinning and burning restoration treatments in dry conifer forests of the eastern Cascades, USA. Forest Ecology and Management. 255: 3130-3140.

Doerr, S. H., R. A. Shakesby, W. H. Blake, C. J. Chafer, G. S. Humphreys, and P. J. Wallbrink. 2006. Effects of differing wildfire severities on soil wettability and implications for hydrological response. Journal of Hydrology. 319(1): 295-311.

Dukes, J. S. and H. A. Mooney. 1999. Does global change increase the success of biological invaders? TREE 14(4): 135-139.

Dunne, T. and L. B. Leopold. 1978. Water in environmental planning. W.H. Freeman & Co., San Francisco, CA. 818 p.

ECCP-Working group on forest sinks. 2003. Conclusions and recommendations regarding forest related sinks and climate change mitigation. In: European Climate Change Programme. Available at: http://ec.europa.eu/environment/climat/pdf/forest_sinks_final_report.pdf.

EcoAdapt.org. 2015. Meadows, Riparian, and Fen Sensitivity Assessment. Available online at: http://ecoadapt.org/data/documents/Meadowsriparianandfen_packetforworkshopcopy.pdf (accessed September 29, 2015)

ECOMAP. 1993. National hierarchical framework of ecological units. Unpublished administrative paper. Washington D.C. USDA Forest Service. 20 p.

Egan, D. and Howell, E. A. 2001. The historical ecology handbook: a restorationist's guide to reference ecosystems. Island Press, Washington D.C. 457 p.

Egerton-Warburton, L. M., J. Podbielski, J. Sickel, R. C. Graham, P. F. Hendrix, and P. D. Sternberg. 2005. Soil Ecosystem Indicators of Post-Fire Recovery in the California Chaparral. Final Report to the National Commission on Science for Sustainable Forestry. NCSSF Research Project C4.1. 36 p.

Ehinger, P. 2008. Data request for Eastern Oregon timber industry statistics. Eugene, OR. Paul F. Ehinger and Associates.

Elliot, W. E, D. E. Hall, and S. R. Graves. 1998. Predicting sedimentation from forest roads. Journal of Forestry. 97(8): 23-29.

Elliot, W. J. 2010. Effects of forest biomass use on watershed processes in the western United States. Western Journal of Applied Forestry 25(1): 12-17.

Elsner, M. M., L. Cuo, N. Voisin, J. S. Deems, A. F. Hamlet, J. A. Vano, K. E. B. Mickelson, S. Lee, and D. P. Lettenmeir. 2010. Implications of 21st century climate change for the hydrology of Washington State. In: Elsner, M. M., J. Littel, and L. W. Binder (eds.) 2009. The Washington Climate Change Impacts Assessment. Seattle, WA: Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Oceans, University of Washington: 69–106.

Erickson, H. E. and R. White. 2008. Soils under fire: soils research and the Joint Fire Science Program. Gen. Tech. Rep. PNW-GTR-759. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 17 p.

Evans, K. 2006. Plant community response to grazing in four Washington meadow exclosures. M.S. Thesis, Central Washington University, Ellensburg, WA.

Everest, F. H. and G. H. Reeves. 2007. Riparian and aquatic habitats of the Pacific Northwest and southeast Alaska: Ecology, management history, and potential management strategies. USDA Forest Service PNW-GTR-692. 148 p.

Everett, R., P. Hessburg, J. Lehmkuhl, M. Jensen, and P. Bourgeron. 1994. Old Forests in Dynamic Landscapes, Dry-site forests of eastern Oregon and Washington. Journal of Forestry: 22-25.

Everett, R., D. Baumgartner, P. Ohlson, R. Schellhaas, and R. Harrod. 2007. Development of current stand structure in dry fir-pine forests of eastern Washington. Journal of the Torrey Botanical Society. Vol. 134, no. 2 (Apr.-June 2007): 199-214.

Fandrich, B. 2002. Pend Oreille River: An Evaluation of 23 Historic Sites Located Between Albeni Falls Dam and Box Canyon Dam. Bellevue, WA: EES Consulting Inc.

Farr, C., T. Craigg, and K. Bennett. 2017. Soil resource report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Federal Energy Regulatory Commission. 2011. Final environmental impact statement for the relicensing of the boundary hydroelectric project No 2144-038 and the surrender of the Sullivan Creek project no. 2225-015 (FERC). September 9, 2011.

Federal Energy Regulatory Commission. 2014. FERC Licensing processes. Available online at: http://www.ferc.gov/industries/hydropower/gen-info/licensing.asp.

Federal Highway Administration. 2011. About FHWA. U.S. Department of Transportation. Federal Highway Administration (FHWA). http://www.fhwa.dot.gov/about/.

Fellin, D. G. and J. E. Dewey. 1982. Western Spruce Budworm. Forest Insect & Disease Leaflet 53. Missoula, MT: U.S. Dept. of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Fellman, J., E. Franz, C. Crenshaw, and D. Elston. 2008. Global estimates of soil carbon sequestration via livestock waste: a STELLA simulation. Environmental Development and Sustainability DOI 10.1007/s10668-008-9157-0.

FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest ecosystem management: an ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Government Printing Office 1993-793-071. U.S. Government Printing Office for the USDA Forest Service, USDI Fish and Wildlife Service, Bureau of Land Management, and National Park Service, U.S. Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service, and the U.S. Environmental Protection Agency.

Ferrell, G. T. 1986. Fir Engraver. Forest Insect and Disease Leaflet 13. USDA Forest Service. 8 p.

Ferry County. 2006. Ferry County Washington Community Wildfire Protection Plan (CWPP) Volume I, December 8, 2006. Ferry County Community Wildfire Protection Plan Core Team in cooperation with Northwest Management, Inc., 233 E. Palouse River Dr., P.O. Box 9748, Moscow, ID, 83843, Tel: 208-883-4488, www.Consulting-Foresters.com (Updated 2015).

Ferry County. 2013. Ferry County Comprehensive Plan. Republic, WA. Available online at: http://www.ferry-county.com/Planning/PDF_Files/Ordinances/2013-ComprehensivePlanUpdatedWithMaps-Final.pdf (Updated 2016)

FGDC. 2005. Federal Standards for Delineation of Hydrologic Unit Boundaries. Federal Geographic Data Committee. FGDC Proposal. Version 1.0. Available online at: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/hydro-unit-boundaries/.

Findholt, S. L., B. K. Johnson, D. Damiran, T. DelCurto, and J. G. Kie. 2005. Diet composition, dry matter intake, and diet overlap of mule deer, elk, and cattle. Pages 159-169 in: Wisdom, M. J. (tech. ed.) The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Group Communications, Lawrence, Kansas, USA.

Finney, M. A. 2001. Design of regular landscape fuel treatment patterns for modifying fire growth and behavior. Forest Science 47: 219-228.

Finney, M. A., R. C. Seli, C. W. McHugh, A. A. Ager, B. Bahro, and J. K. Agee. 2006. Simulation of long-term landscape-level fuel treatment effects on large wildfire. International Journal of Wildland Fire 16: 712-727.

Fisher, R. F. and D. Binkley. 2000. Ecology and Management of Forest Soils, John Wiley & Sons. N.Y.

Flanagan, S. A., M. J. Furniss, T. S. Ledwith, S. Thiesen, M. Love, K. Moore, and J. Ory. 1998. Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings. USDA Forest Service, San Dimas Technology and Development Center, San Dimas CA. 56 p.

Fletcher, T. 2017a. Invasive plants report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Fletcher, T. 2017b. Range report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Florida, R. 2002. The Rise of the Creative Class. New York: Basic Books.

Foltz, S. 2008a. Species fact sheet – delicate emerald. October 2008. 19 pp. Available at: https://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml. Accessed February 22, 2017.

Foltz, S. 2008b. Species fact sheet – Whitehouse's emerald. October 2008. 19 pp. Available at: https://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml. Accessed February 22, 2017.

Foltz, S. 2010. Species fact sheet-Zigzag darner. August 2010. 20 pp. Available at: https://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml. Accessed February 22, 2017

Foltz S. 2011a. Species fact sheet – subarctic bluet. December 2011. 16 pp. Available at: https://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml. Accessed February 22, 2017.

Foltz S. 2011b. Species fact sheet – subarctic darner. December 2011. 24 pp. Available at: https://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml. Accessed February 22, 2017.

Franklin, J. F. and C. T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Oregon State 2015 University Press. Corvallis, OR. 452 p.

Franklin, J. F., R. J. Mitchell, and B. J. Palik. 2007. Natural disturbance and stand development principles for ecological forestry. General Technical Report NRS-GTR-19. USDA Forest Service, Northern Research Station, Newtown Square, PA. 44 p.

Franklin, J. F., M. A. Hemstrom, R. Van Pelt, J. B. Buchanan, and S. Hull. 2008. The case for active management of dry forest types in eastern Washington: perpetuating and creating old forest structures and functions. In: Washington Department of Natural Resources, Olympia, Washington. 105 p.

Franklin, J. F. and K. N. Johnson. 2012. A restoration framework for federal forests in the Pacific Northwest. Journal of Forestry. Vol. 110, Is. 8: 429-439.

Franzmeier, D.P., G. D. Lemme, and R. J. Miles. 1985. Organic carbon in soils of north central United States. Soil Sci. Soc. Am. J. 49: 702–708.

Furniss, M. J., T. D. Roelofs, and C. S. Yee. 1991. Road construction and maintenance. In: Influence of Forest and Rangeland management on Salmonid Fishes and Their Habitats. W. R. Meehan, ed. Bethesda, Maryland. American Fisheries Society. Special Publication 19: 297-323.

Furniss, M. J., T. S. Ledwith, M. A. Love, B. C. McFadin and S. A. Flanagan. 1998. Response of road-stream crossings to large flood events in Washington, Oregon, and northern California. San Dimas, California, USDA Forest Service, San Dimas Technology and Development Center. 14 p.

Gaines, B. 2018. Wildlife report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Gaines, D., and S. A. Laymon. 1984. Decline, status, and preservation of the yellow-billed cuckoo in California. Western Birds 15: 49-80.

Gaines, W. L. 2013. Habitat Connectivity and the Northeast Washington Forest Plan Revisions. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington. (updated 2015).

Gaines, W. L., B. C. Wales, L. H. Suring, J. S. Begley, K. Mellen-McLean, and S. Mohoric. 2017. Terrestrial species viability assessments for the National Forests in northeastern Washington. USDA Forest Service, Gen. Tech. Rep. PNW-GTR-907.

Gaines, W. L., D. W. Peterson, C. A. Thomas, and R. J. Harrod. 2012. Adaptations to climate change: Colville and Okanogan-Wenatchee National Forests. General Technical Report PNW-GTR-862. USDA Forest Service, Pacific Northwest Research Station. Portland, OR. 40 p.

Gaines, W. L., M. Haggard, J. Begley, J. Lehmkuhl, and A. Lyons. 2010. Short-term effects of thinning and burning restoration treatments on avian community composition, density, and nest survival in the eastern Cascades dry forests, Washington. Forest Science 56(1): 88-99.

Gaines, W. L., M. Haggard, J. F. Lehmkuhl, A. L. Lyons, and R. J. Harrod. 2007. Short-term response of land birds to ponderosa pine restoration. Restoration Ecology 15(4): 670-678.

Gaines, W. L., P. H. Singleton, and R. C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. USDA Forest Service, Gen. Tech. Rep. PNW-GTR-586. 89 p.

Ganjegunte, G., G. Vance, C. Preston. G. Schuman, L. Ingram, P. Stahl, and J. Welker. 2005. Soil Organic Carbon Composition in a Northern Mixed-Grass Prairie: Effects of Grazing. Soil Science Society of America 69: 1746-1756.

Gelbard, J. and S. Harrison. 2003. Roadless Habitats as refuges for Native Grasslands: Interactions with Soil, Aspect and Grazing. Ecological Applications 13:2: 404-415.

Geomorphic Road Analysis and Inventory Package unpublished data. 2014. Road sediment delivery output graph from roads in four watersheds in the Pacific Northwest (GRAIP).

Gibson, K., S. Kegley, and B. Bentz. 2009. Mountain Pine Beetle. Forest Insect and Disease Leaflet 2. USDA Forest Service. 12 p.

GNN – Gradient Nearest Neighbor. 2012. Available online at: http://lemma.forestry.oregonstate.edu/data/structure-maps (accessed November 14, 2014).

Goetz, S.J., A.G. Bunn, G.J. Fiske, and R.A. Houghton. 2005. Satellite observed photosynthetic trends across boreal North America associated with climate and fire disturbance. Proceedings of the National Academy of Sciences 102: 13521-13525.

Gomez, A., R. F. Powers, M. J. Singer, and W. R. Horwath. 2002. Soil compaction effects on growth of young ponderosa pine following litter removal in Californias Sierra Nevada. Soil Science Society of America Journal. 66(4): 1334-1343.

Goodell, B.C. 1965. Watershed treatment effects on evapotranspiration. In International symposium of Forest Hydrology. National Science Foundation Advanced Science Seminar Proceedings, Penn State University, University Park, PA. Pergamon Press, New York: 477-482.

Gough, C.M., C.S. Vogel, K.H. Harrold, K. George, and P.S. Curtis. 2007. The legacy of harvest and fire on ecosystem carbon storage in a north temperate forest. Global Change Biology 13: 1935-1949. 15 p.

Government Performance and Results Act (GPRA) of 1993. Public Law 103-62.

Government Performance and Results Modernization Act (GPRAMA) of 2010.

Graham, G. and K. Nooney. 2017. Mineral and geologic resources report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Graham, R. T., A. E. Harvey, M. F. Jurgensen, T. B. Jain, J. R. Tonn, and D. S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Research Paper INT-RP-477. Ogden, UT: US Department of Agriculture, Forest Service, Intermountain Research Station. 16 p.

Graham, R. T., A. E. Harvey, T. B. Jain, and J. R. Tonn. 1999. Effects of thinning and similar stand treatments on fire behavior in western forests. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-463. 37 p.

Graham, R. T., T. B. Jain, and J. Sandquist. 2007. Free selection: a silvicultural option. In: Powers, Robert F., tech. editor. Restoring fire-adapted ecosystems: proceedings of the 2005 national silviculture workshop. Gen. Tech. Rep. PSW-GTR-203, Albany, CA: USDA Forest Service, Pacific Southwest Research Station: 121-156.

Grant, G. E., S. L. Lewis, F. J. Swanson, J. H. Cissel, and J. J. McDonnell. 2008. Effects of forest practices on peak flows and consequent channel response: A state-of-science report for western Oregon and Washington. USDA Forest Service PNW-GTR-760. 84 p.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old growth forest types of the Northern Region. Missoula, MT. USDA Forest Service, Northern Region. 36 p.

Gregory, S.V., F. J. Swanson, W. A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. Bioscience 41: 540-551.

Grier, C. C., K. M. Lee, N. M. Nadkarni, G. O. Klock, and P. J. Edgerton. 1989. Productivity of forests of the United States and its relation to soil and site factors and management practices: a review. Gen. Tech. Rep. PNW-GTR-222. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 51 p.

Griffis, K. L., J. Crawford, M. Wagner, and W. H. Moir. 2001. Understory response to management treatments in northern Arizona ponderosa pine forests. Forest Ecology and Management. 146:1: 239-245.

Grigal, D. F. and E. D. Vance. 2000. Influence of soil organic matter on forest productivity, in: New Zealand Journal of Forestry Science. New Zealand Forest Research Institute: 169–205.

Grinspoon, E. and D. Phillips. 2007. "Economic and Social Evaluation." Pacific Northwest Region. June 12, 2007.

Groisman, P. Y., R. W. Knight, T. R. Karl, D. R. Easterling, B. Sun, and J. H. Lawrimore. 2004. Contemporary changes of the hydrological cycle over the contiguous United States: Trends derived from in situ observations. Journal of Hydrometeorology, 5: 64-85.

Gucinski, H., M .J. Furniss, R. R. Ziemer, and M. H. Brookes. 2001. Forest roads: a synthesis of scientific information. Gen. Tech. Rep. PNW-GTR-509. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 120 p.

Gude, P. H., R. Rasker, and J. van den Noort. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4): 198-205. Available online at: http://www.headwaterseconomics.org/tools/eps-hdt (accessed June 4, 2012).

Gurnell, A. M.1998. The hydrogeomorphological effects of beaver dam building activity. Progress in Physical Geography 22: 167-189.

Haak, A. L. and J. E. Williams. 2012. Spreading the risk; native trout management in a warmer and less-certain future. North American Journal of Fisheries Management 32: 387-401.

Haferkamp, M. and M. MacNeil. 2004. Grazing Effects on Carbon Dynamics in the Northern Mixed-Grass Prairie. Environmental Management 33(1): S462-474.

Hájek, M., M. Horsák, P. Hájková, and D. Dítě. 2006. Habitat diversity of central European fens in relation to environmental gradients and an effort to standardize fen terminology in ecological studies. Perspectives in Plant Ecology, Evolution and Systematics 8 (2006): 97-114.

Hall, T. E. 2005. Likely Trends in National Forest Recreation in Region Six (Draft), University of Idaho.

Hall, T. E., H. Heaton, and L. Kruger. 2004. Understanding Recreation Trends in the Pacific Northwest: State of Knowledge and Manager's Needs (Draft).

Halofsky, J. E. and D. E. Hibbs. 2009. Controls on early post-fire woody plant colonization in riparian areas. Forest Ecology and Management. 258: 1350-1358.

Hamlet, A. F. and D. P. Lettenmaier. 1999. Effects of climate change on hydrology and water resources in the Columbia River basin. Journal of the American Water Resources Association. 35: 1597–1623.

Hamlet, A. F., P. W. Mote, M. P. Clark, and D. P. Lettenmaier. 2005. Effects of temperature and precipitation variability on snowpack trends in the western U.S. Journal of Climate. 18: 4545–4561.

Hamlet, A. F., P. W. Mote, M. P. Clark, and D. P. Lettenmaier. 2007. Trends in runoff, evapotranspiration, and soil moisture in the western United States. Journal of Climate. 20: 1468–1481.

Hammond, C., D. Hall, S. Miller, and P. Swetik. 1992. Level I Stability Analysis (LISA) Documentation for Version 2.0. General Technical Report INT-285. Ogden, UT: USDA Forest Service Intermountain Research Station. 190 p.

Han, S., H. Han, D. S. Page-Dumroese, and L. R. Johnson. 2009. Soil compaction associated with cut-to-length and whole-tree harvesting of a coniferous forest. Can. J. For. Res. 39: 976-989.

Hann, W. J., and D. L. Bunnell. 2001. Fire and land management planning and implementation across multiple scales. International Journal of Wildland Fire, 2001, 10, 389–403.

Hann, W. J., A. Shlisky, D. Havlina, K. Schon, S. W. Barrett, T. E. DeMeo, K. Pohl, J. P. Menakis, D. Hamilton, J. Jones, M. Levesque, and C. K. Frame. 2008. Interagency Fire Regime Condition Class (FRCC) guidebook. Version 1.3.0. 119 p. (Homepage of the Interagency and The Nature Conservancy Fire Regime Condition Class website, USDA Forest Service, U.S. Department of the Interior, The Nature Conservancy, and Systems for Environmental Management). Available online at: www.frcc.gov.

Hanski, I. 2002. Metapopulations of animals in highly fragmented landscapes and population viability analysis. In: Beissinger, S.R. and D. R. McCullough. Population Viability Analysis. University of Chicago Press, Chicago, Il: 86-108.

Hardy, C. C. 2005. Wildland fire hazard and risk: Problems, definitions, and context. USDA Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory, Missoula MT. Forest Ecology and Management 211: 73-82.

Hardy, C. C., K. M. Schmidt, J. P. Menakis, and R. N. Sampson. 2001. Spatial data for national fire planning and fuel management. International Journal of Wildland Fire, 2001, 10: 353-372.

Harmon, M. E. and B. Marks. 2002. Effects of silvicultural practices on carbon stores in Douglas-fir – western hemlock forests in the Pacific Northwest, U.S.A.: Results from a simulation model. Canadian Journal of Forest Research, 32: 863–877.

Harr, R. D. 1979. Effects of streamflow in the rain-dominated portion of the Pacific Northwest. In Proceedings of Workshop on Scheduling Timber Harvest for Hydrologic Concerns. USDA Forest Service, PNW Forest and Range Experimental Station. 45 p.

Harrod, R. J., W. L. Gaines, W. E. Hartl, and A. Camp. 1998. Estimating historical snag density in dry forests east of the Cascade Range. USDA Forest Service, Gen.Tech.Rep. PNW-GTR-428. 24 p.

Hart, S. C., T. H. DeLuca, G. S. Newman, M. D. MacKenzie, and S. Boyle. 2005. Post-fire vegetative dynamics as drivers of microbial community structure and function in forest soils. For. Ecol. Man. 230: 166-184.

Hartford, R. A. and W. H. Frandsen. 1992. When its hot, its hot... or maybe its not! (Surface flaming may not portend extensive soil heating). International Journal of Wildland Fire. 2(3): 139-144.

Harvey, A. E., M. F. Jurgensen, M. J. Larsen, and R. T. Graham. 1987. Decaying organic materials and soil quality in the inland northwest: a management opportunity. Gen. Tech. Rep. INT-225. Ogden, UT: USDA Forest Service, Intermountain Research Station. 15 p.

Hassett, J. E. and D. R. Zak. 2005. Aspen Harvest Intensity Decreases Microbial Biomass, Extracellular Enzyme Activity, and Soil Nitrogen Cycling. Soil Science Society of America Journal, 69: 227-235.

Haugo, R., C. Zanger, T. DeMeo, C. Ringo, A. Shlisky, K. Blankenship, M. Simpson, K. Mellen-McLean, J. Kertis, and M. Stern. 2015. A new approach to evaluate forest structure restoration needs across Oregon and Washington, USA. Forest Ecology and Management, Volume 335.

Haynes, R.W., B. T. Bormann, D. C. Lee, J. R. Martin, tech. eds. 2006. Northwest Forest Plan-the first 10 years (1994-2003): Synthesis of monitoring and research results. Gen Tech. Rep. PNW-GTR-651. Portland, OR: USDA Forest Service, PNW Research Station. 292 p.

Healey, S. P., W. B. Cohen, T. A. Spies, M. Moeur, D. Pflugmacher, M. G. Whitley, and M. Lefsky. 2008. The relative impact of harvest and fire upon landscape-level dynamics of older forests: lessons from the Northwest Forest Plan. Ecosystems 11: 1106-1119.

Healey, S. P., C. L. Raymond, I. B. Lockman, A. J. Hernandez, C. Garrard, and C. Huang. 2016. Root disease can rival fire and harvest in reducing forest carbon storage. Ecosphere 7(11):e01569. 10.1002/ecs2.1569.

Hebel, C. L., J. E. Smith, and K. Cromack. 2009. Invasive plant species and soil microbial response to wildfire burn severity in the Cascade Range of Oregon. Applied Soil Ecology. 42(2): 150-159.

Heitschmidt, R. K. and J.W. Stuth. 1991. Grazing management: An ecological perspective. Timber Press: Portland, OR. 259 p.

Hellmann, J. J., J. E. Byers, B. G. Bierwagen, and J. S. Dukes. 2008. Five potential consequences of climate change for invasive species. Conservation Biology 22(3): 534-543.

Heller, D. 2004. A paradigm shift in watershed restoration. Streamline Watershed Management Bulletin, 8(1): 21-24. Forest Research Extension Partnership. Kamloops, B.C., Canada.

Heller, D. and B. McCammon. 2003. Aquatic strategies in Region 6—are they working? Unpublished report, on file with: USDA Forest Service, PNW Region, Portland, OR. 6 p.

Heller, N. E. and E. S. Zavaleta. 2009. Biodiversity management in the face of climate change: a review of 22 years of recommendations. Biological Conservation 142: 14-32.

Hellquist, C., E.W. Hamilton III, M. Thorne, and D. Frank. 2007. The influence of simulated grazing on carbon exchange processes and microbial communities in Yellowstone National Park grasslands. Poster presented as part of the Ecological Restoration Association / Society of Ecological Restoration Joint Meeting, San Jose, California, 5-10 August 2007.

Helms, J.A. (editor). 1998. The dictionary of forestry. Society of American Foresters, Bethesda, MD. 210 p. Available online at: www.dictionaryofforestry.org.

Helvey, J. D. 1980. Effects of a north-central Washington wildfire on runoff and sediment production. Water Resources Bulletin. 16(4): 627-634.

Helvey, J. D., A. R. Tiedmann, and T. D. Anderson. 1985. Plant nutrient losses by soil erosion and mass movement after wildfire. Journal of Soil and Water Conservation 40(1): 168-173.

Helvey, J. D. and W. B. Fowler. 1995. Effects of timber harvest on the hydrology and climate of four small watersheds: From the Umatilla National Forest watershed program.

Henderson, D., B. Ellert, and M. A. Naeth. 2004. Grazing and soil carbon along a gradient of Alberta rangelands. Journal of Range Management 57(4): 402-410.

Henderson, J. 2012. Final Report for Contract AG-05H7-P-10-0029: Revise and update the PAG map and model for the Okanogan, Wenatchee and Colville National Forests.

Hessburg, P. F. and B.G. Smith. 1999. Management implications of recent changes in spatial patterns of interior northwest forests, USA. North American Wildlife and Natural Resources Conference: 55-78.

Hessburg, P. F., B. G. Smith, and R. B. Salter. 1999. Using estimates of natural variation to detect ecologically important change in forest spatial patterns: a case study, Cascade Range, eastern Washington. USDA Forest Service, Pacific Northwest Research Station, Res. Paper PNW-RP-514. Portland, OR. 72 p.

Hessburg, P. F., B. G. Smith, S. D. Kreiter, C. A. Miller, R. B. Salter, C. H. McNicoll, and W. J. Hann. 1999. Historical and current forest and range landscapes in the Interior Columbia River Basin and portions of the Klamath and Great Basins. Part 1: Linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. General Technical Report PNW-GTR-458. USDA Forest Service, Pacific Northwest Research Station, USDI Bureau of Land Management, Portland, OR. 388 p.

Hessburg, P. F., D. J. Churchill, A. J. Larson, R. D. Haugo, C. Miller, T. A. Spies, M. P. North, N. A. Povak, R. T. Belote, P. H. Singleton, W. L. Gaines, R. E. Keane, G. H. Aplet, S. L. Stephens, P. Morgan, P. A. Bisson, B. E. Rieman, R. B. Salter, and G. H. Reeves. 2015. Restoring fire-prone Inland Pacific landscapes: seven core principles. Landscape Ecology. 30: 1805-1835.

Hessburg, P. F. and J. K. Agee. 2003. An environmental narrative of Inland Northwest United States forests, 1800–2000. Forest Ecology and Management, Volume 178, Issues 1–2, 3 June 2003: 23-59.

Hessburg, P. F., J. K. Agee, and J. F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: contrasting the landscape ecology of the pre-settlement and modern eras. For. Ecol. Manage. 211 p.

Hessburg, P. F., K. M. Reynolds, R. B. Salter, J. D. Dickinson, W. L. Gaines, and R. J. Harrod. 2013. Landscape evaluation for restoration planning on the Okanogan-Wenatchee National Forest, USA. Sustainability 5: 805-840.

Hessburg, P. F., R. B. Salter, and K. M. James. 2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecology. 20 p.

Hessburg, P. F., R. B. Salter, M. B. Richmond, and B. G. Smith. 2000. Ecological subregions in the Interior Columbia Basin, USA. Applied Vegetation Science. Vol. 3 (2000): 163-180.

Hessburg, P. F., R. G. Mitchell, and G. M. Filip. 1994. Historical and current roles of insects and pathogens in eastern Oregon and Washington forested landscapes. General Technical Report PNW-GTR-327. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 72 p.

Heyerdahl, E. K., D. McKenzie, L. D. Daniels, A. E. Hessl, J. S. Littell, and N. J. Mantua. 2008. Climate drivers of regionally synchronous fires in the inland northwest (1651-1900). International Journal of Wildland Fire. 17: 40-49.

Hibbert, A. R. 1967. Forest treatment effects on water yield. In: Sopper W. E. and H. W. Lull, (eds.), International Symposium for Hydrology, Pergamon Osxford. 813 p.

Hicke, J. A., G. P. Asner, J. T. Randerson, C. Tucker, S. Los, R. Birdsey, J. C. Jenkins, C. Field, and E. Holland. 2002. Satellite-derived increases in net primary production across North America, 1982-1988. Geophysical Research Letters 29: 69-1 to 69-4.

Hickenbottom, J. A. S., T. Shuhda, and N. Glines. 2009. Le Clerc Creek watershed action plan. USDA Forest Service, Colville National Forest, Sullivan Lake and Newport Ranger Districts, Newport, WA. 116 p.

Hidalgo, H. G., T. Das, M. D. Dettinger, D. R. Cayan, D. W. Pierce, T. P. Barnett, G. Bala, A. Mirin, A. W. Wood, C. Bonfils, B. D. Santer, and T. Nozawa. 2009. Detection and attribution of streamflow timing changes to climate change in the western United States. Journal of Climate, 22: 3838-3855.

Hilty, J.A., W. Z. Lidicker Jr., and A. M. Merenlander. 2006. Corridor Ecology: The science and practice of linking landscapes for biodiversity conservation. Island Press, Washington, DC.

Hirsch, K., V. Kafka, C. Tymstra, R. McAlpine, B. Hawkes, H. Stegehuis, S. Quintilio, S. Gauthier, and K. Peck. 2001. Fire-smart forest management: A pragmatic approach to sustainable forest management in fire-dominated ecosystems. The Forestry Chronicle 77(2): 1-7.

Hodkinson, D. J. and K. Thompson. 1997. Plant Dispersal: The Role of Man. Journal of Applied Ecology. 34: 1484-96.

Hollenbeck, J. P., L. J. Bate, V. A. Saab, and J. F. Lehmkuhl. 2013. Snag distributions in relation to human access in ponderosa pine forests. Wildlife Society Bulletin 37(2): 256-266.

Holling, C. S. and G. K. Meffe. 1996. Command and control and the pathology of natural resource management. Conservation Biology. 10(2): 328-337.

Holstine, C. E. 1987. Forgotten corner: A history of the Colville National Forest, Washington. Colville Statesman Examiner. Colville, WA.

Honeycutt, K. 2014. Viability Assessment for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Horne, A. and R. Haynes. 1999. Developing Measures of Socioeconomic Resiliency in the Interior Columbia Basin. USDA Forest Service General Technical Report, PNW-GTR-453. April 1999.

Hubbart, J. A. 2007. Measuring and modeling hydrologic responses to timber harvest in a continental/maritime mountainous environment. PhD dissertation, University of Idaho, Moscow, ID. 170 p.

Huff, D. D, B. Hargrove, M. L. Tharp, and R. Graham. 2000. Managing forests for water yield: The importance of scale. Journal of Forestry: 98(12): 15-19.

Hurt, G.W., P. M. Whited, and R. F. Pringle. 1996. Field indicators of hydric soils in the United States: A guide for identifying and delineating hydric soils.

Hurteau, M., G. W. Koch, and B. A. Hungate. 2008. Carbon protection and fire risk reduction: toward a full accounting of forest carbon offsets. Frontiers of Ecology and the Environment. 6: 127-136.

Hurteau, M. and M. North. 2009. Fuel treatment effects on tree-based forest carbon storage and emissions under modeled wildfire scenarios. Frontiers in Ecology and the Environment. 7: 34-48.

Hyde, K., S. Peckham, T. Holmes, and B. Ewers. 2016. Bark beetle-induced forest mortality in the North American Rocky Mountains. In: Biological and Environmental Hazards, Risks, and Disasters, Ramesh Sivanpillai, Editor. New York: Elsevier. 119-135. 17 p.

Hyvönen, R., B. A. Olsson, H. Lundkvist, and H. Staaf. 2000. Decomposition and nutrient release from Picea abies (L.) Karst. and Pinus sylvestris L. logging residues. For. Ecol. Manag. 126: 97–112.

Hyvönen, R., G. I. Ågren, S. Linder, T. Persson, M. Francesca Cotrufo, A. Ekblad, M. Freeman, A. Grelle, I. A. Janssens, P. G. Jarvis, S. Kellomäki, A. Lindroth, D. Loustau, T. Lundmark, R. J. Norby, R. Oren, K. Pilegaard, M. G. Ryan, B. D. Sigurdsson, M. Strömgren, M. van Oijen, and G. Wallin. 2007. The likely impact of elevated CO_2, nitrogen deposition, increased temperature and management on carbon sequestration in temperate and boreal forest ecosystems: A literature review. New Phytologist, 173: 463–480.

Independent Scientific Advisory Board (ISAB). 2007. Climate change impacts on Columbia Basin fish and wildlife. ISAB Climate Change Report ISAB 2007-2 to for the Northwest Power and Conservation Council. Portland, Oregon May 11, 2007. Available online at: http://www.nwcouncil.org/media/31247/isab2007_2.pdf. (Accessed March 6, 2014).

Ingalsbee, T. 2015. Ecological fire use for ecological fire management: Managing large wildfires by design. In: Keane, R. E., M. Jolly, R. Parsons, and K. Riley. Proceedings of the large wildland fires conference; May 19-23, 2014; Missoula, MT. Proc. RMRS-P-73. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station: 120-127.

Ingram, L., P. Stahl, G. Schuman, J. Buyer, G. Vance, G. Ganjegunte, J. Welker, and J. Derner. 2008. Grazing Impacts on Soil Carbon and Microbial Communities in a Mixed-Grass Ecosystem. Soil Science Society of America Journal 72(4): 939-948.

Inman, R. M., M. L. Packila, K. H. Inman, A. J. McCue, G. C. White, J. Persson, B. C. Aber, M. L. Orme, K. L. Alt, S. L. Cain, J. A. Fredrick, B. J. Oakleaf, and S. S. Sartorious. 2012. Spatial ecology of wolverines at the southern periphery of distribution. Journal of Wildlife Management 76: 778-792.

Integrated Landscape Assessment Project (ILAP). 2013. Available online at: http://oregonstate.edu/inr/node/228 (accessed November 14, 2014).

Interagency Grizzly Bear Committee (IGBC). 1986. Interagency grizzly bear guidelines. Missoula, Montana. 100 p.

Interagency Grizzly Bear Committee. 1998. Interagency Grizzly Bear Committee access management task force report. Interagency Grizzly Bear Committee, Denver, CO. 6 p.

Interagency Lynx Biology Team (ILBT). 2013. Canada Lynx Conservation Assessment and Strategy. Third Edition. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication R1-13-19, Missoula, MT. 128 p.

Intergovernmental Panel on Climate Change (IPCC). 2014. Summary for Policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Field, C. B., V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, and L. L. White (eds.)). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA: 1-32.

Interior Columbia Basin Interagency Deputy Regional Executive Team. 2014. Updated Interior Columbia Basin strategy: A strategy for applying the knowledge gained by the Interior Columbia Basin Ecosystem Management Project to the revision of Forest and Resource Management plans and project implementation. USDA Forest Service. 11 p.

Interior Redband Conservation Team (IRCT). 2016. A conservation strategy for interior redband (*Oncorhynchus mykiss* subsp.) in the states of California, Idaho, Montana, Nevada, Oregon, and Washington.

Isaak, D. J., C.H. Luce, B. E. Rieman, D. E. Nagel, E. E. Peterson, D. L. Horan, S. Parkes, and G. Chandler. 2010. Effects of climate change and wildfire on stream temperatures and salmonid thermal habitat in a mountain river network. Ecological Applications 20: 1350-1371.

Isaak, D. J., S. J. Wenger, E. E. Peterson, J. M. Ver Hoef, S. Hostetler, C. H. Luce, J. B. Dunham, J. Kershner, B. B. Roper, D. Nagel, D. Horan, G. Chandler, S. Parkes, and S. Wollrab. 2011. NorWeST: An interagency stream temperature database and model for the Northwest United States. U.S. Fish and Wildlife Service, Great Northern Landscape Conservation Cooperative Grant.

Iten, C., T. A. O'Neil, K. A. Bettinger, and D. H. Johnson. 2001. Extirpated species of Oregon and Washington. Pages 452-473 in D.H. Johnson and T.A. O'Neil (eds.) Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, Oregon.

Jackson, B. 2017. Scenic resources report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Jain, T. B. and R. T. Graham. 2005. Restoring dry and moist forests of the inland northwestern U.S. (Chapter 30). In: Stranhauf, J. A., P. Madsen (eds.) Restoration of boreal and temperate forests. New York: CRC Press: 463-480.

James Kent Associates (JKA). 2010. Community Field Reports in Support of the Upcoming Land Use Planning for the Spokane District Office of the Bureau of Land Management. Ashland, OR: JKA Group.

Jandl, R., M. Lindner, L. Vesterdal, B. Bauwens, R. Baritz, F. Hagedorn, D. W. Johnson, K. Minkkinen, and K. A. Byrne. 2007. How strongly can forest management influence soil carbon sequestration? Geoderma, 137: 253–268.

Jaworski, D. and E. Grinspoon. 2017. Social report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Jaworski, D., E. Grinspoon, and R. Phillips. 2017. Economic impacts report for the Colville National Forest Plan Revision, Draft Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Jenny, H. 1941. Factors of Soil Formation: A System of Quantative Pedology. McGraw-Hill, New York.

Jiménez Esquilín, A. E., M. E. Stromberger, and W. D. Shepperd. 2008. Soil scarification and wildfire interactions and effects on microbial communities and carbon. Soil Sci. Soc. Am. J. 72: 111-118.

Jimenez, J. 2014a. Post Timber Harvest Monitoring - Soils: Currant Creek Timber Sale. Report on-file.

Jimenez, J. 2014b. Post Timber Harvest Monitoring - Soils: Flowery Trail Timber Sale. Report on-file.

Jimenez, J. 2014c. Post Timber Harvest Monitoring - Soils: Summit Pierre Timber Sale. Report on-file.

Jimenez, J. 2015a. Post-Harvest Soil Monitoring: Kettle Face North. Report on-file.

Jimenez, J. 2015b. Post-Harvest Soil Monitoring: Sand Creek Units 70 & 80. Report on-file.

Jimenez, J. 2015c. Post-Harvest Soil Monitoring: Sand Creek Unit 84. Report on-file.

Jimenez, J. 2015d. Post-Harvest Soil Monitoring: Sand Creek Units 86 & 89. Report on-file.

Jimenez, J. 2016. Post Timber Harvest Monitoring - Soils: Flowery Trail. Report on-file.

Jimenez, J. 2017. Climate change report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Johansson, M-B. 1994. The influence of soil scarification on the turn-over rate of slash needles and nutrient release. Scandinavian Journal of Forest Research, 9: 170–179.

Johnson, D. W. 1992. Effects of forest management on soil carbon storage. Water, Air, and Soil Pollution, 64: 83–120.

Johnson, D.W. and P. S. Curtis. 2001. Effects of forest management on soil C and N storage: meta-analysis. For. Ecol. Manag. 140: 227–238. doi:10.1016/S0378-1127(00)00282-6.

Johnson, D. W., R. B. Susfalk, T. G. Caldwell, J. R. Murphy, W. W. Mille, and R. F. Walker. 2004. Fire effects on carbon and nitrogen budgets in forests. Water, Air, and Soil Pollution: Focus, 4: 263–275.

Johnson, K.L. 1992. Management of water quality on rangelands through best management practices: The Idaho approach. Pages 415-441 In: R.J. Naiman (ed.) Watershed Management: Balancing Sustainability and Environmental Change. Springer-Verlag. New York.

Jones, C. C., C. B. Halpern, and J. Niederer. 2008. Plant succession on gopher mounds in Western Cascade meadows: consequences for species diversity and heterogeneity. American Midland Naturalist. 159: 275-286.

Jones, F., D. Embody, and W. Peterson. 1961. Landslides along the Columbia River Valley, Northeastern Washington (US Geological Survey Professional Paper No. 367).

Joyce, L. A., G. M. Blate, J. S. Littell, S. G. McNulty, C. I. Millar, S. C. Moser, R. P. Neilson, K. O'Halloran, and D. L. Peterson. 2008. National Forests. In: Preliminary review of adaptation options for climate-sensitive ecosystems and resources. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (Authors)). U.S. Environmental Protection Agency, Washington D.C., USA: 3-1 to 3-127.

Jurgensen, M. F., A. E. Harvey, R. T. Graham, D. S. Page-Dumroese, J. R. Tonn, M. J. Larsen, and T. B. Jain. 1997. Review article: Impacts of timber harvesting on soil organic matter, nitrogen, productivity, and health of inland northwest forests. Forest Science 43(2): 234-251.

Kalispel Tribe of Indians. 2002. Fish and Wildlife Management Plan. Kalispel Natural Resource Department. Usk, WA.

Kalispel Tribe of Indians. http://www.kalispeltribe.com/ (accessed August 2015)

Kalispel Tribe of Indians. 2014. Hunting and Fishing Regulations. Available online at: http://kalispeltribe.com/kalispel-natural-resources-department/hunting-and-fishing (accessed November 25, 2014).

Kapnick, S. and A. Hall. 2012. Causes of recent changes in western North America snowpack. Climate Dynamics, 38(9): 1885-1899.

Karr, J. R. 1991. Biological integrity: a long-neglected aspect of water resource management. Ecological Applications, 1(1): 66-84.

Karr, J. R., K. D. Fausch, P. L. Angermeier, P. R. Yant, and I. J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. Illinois Natural History Survey Special Publication 5. 28 p.

Karr, J. R. and L.W. Chu. 1999. Restoring life in running waters. Better biological monitoring. Island Press. Washington D.C. 206 p.

Kasworm, W. F., H. Carriles, T. G. Radandt, J. E. Teisberg, M. Proctor, and C. Servheen. 2012. Cabinet-Yaak grizzly bear recovery area 2011 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 90 p.

Kasworm, W. 2016. Cabinet-Yaak and Selkirk Mountains grizzly bear ecosystems update. USDI Fish and Wildlife Service, Libby, Montana. 7 p.

Kattelman, R. C., N. H. Berg, and J. Rector. 1987. Water yields from high elevation basins in California. Proceedings of the California Watershed Management Conference, November 18-20, 1986, West Sacramento, California.

Kaufmann, M. R., R. T. Graham, D. A. Boyce, Jr., W. H. Moir, L. Perry, R. T. Reynolds, R. L. Bassett, P. Mehlhop, C. B. Edminster, W. M. Block, and P. S. Corn. 1994. An ecological basis for ecosystem management. GTR RM-246. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 24 p.

Keane, R. E., P. F. Hessburg, P. B. Landres, and F. J. Swanson. 2009. The use of historical range and variability (HRV) in landscape management. Forest Ecology and Management, 258(7): 1025-1037.

Keddy, P. A. 2010. Wetland Ecology: Principles and conservation. Cambridge University Press: New York. 497 p.

Kennedy, M. C., E. D. Ford, P. Singleton, M. Finney, and J. K. Agee. 2008. Informed multi-objective decision-making in environmental management using pareto optimality. Journal of Applied Ecology 45: 181-192.

Keppeler, E. T. and R. R. Ziemer. 1990. Logging effects on streamflow: Water yield and summer low flows at Caspar Creek in northwestern California. Water Resources Research. 26(7): 1669-1697.

Kern, J. S. 1994. Spatial patterns of soil organic carbon in the contiguous United States. Soil Sci. Soc. Am. J. 58: 439–455.

Kershner, J. L. and B. B. Roper. 2010. An Evaluation of Management Objectives Used to Assess Stream Habitat Conditions on Federal Lands within the Interior Columbia Basin. Fisheries Vol 35, No 6. 9 p.

Kershner, J. L., E. K. Archer, M. Coles-Ritchie, E. R. Cowley, R. C. Henderson, K. Kratz, C. M. Quimby, D. L. Turner, L. C. Ulmer, and M. R. Vinson. 2004. Guide to effectiveness monitoring of aquatic and riparian resources. Gen, Tech. Rep. RMRS-GTR-121. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 57 p.

Keyser, C. E., compiler. 2008. Northern Idaho/Inland Empire (NI/IE) variants overview: Forest Vegetation Simulator. USDA Forest Service, Forest Management Service Center, Fort Collins, CO. (last revised 2011).

Kim, J. 2005. A projection of effects of the climate change induced by increase CO_2 on extreme hydrologic events in the western U.S. Climatic Change. 68: 153-168.

King, A.Q., L. Dilling, G. P. Zimmerman, D. M. Fairman, R. A. Houghton, G. Marland, A. Z. Rose, and T. J. Wilbanks. 2007. Executive Summary. Pages 1-14 in: The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon

Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (King, A.W., L. Dilling, G. P. Zimmerman, D. M. Fairman,, R. A. Houghton, G. Marland, A. Z. Rose, and T. J. Wilbanks (eds.)). National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC, USA.

Kirchner, J. W., R. C. Finkel, C. S. Riebe, D. E. Granger, J. L. Clayton, J. G. King, and W. F. Megahan. 2001. Mountain erosion over 10 yr, 10 ky, and 10 my time scales. Geology. 29(7): 591-594.

Klock, G.O. 1975. Impact of five postfire salvage logging systems on soils and vegetation. J. soil and water conservation. March-April: 78-81.

Koehler, G. M., B. T. Maletzke, J. A. von Kienast, K. B. Aubry, R. B. Wielgus, and R. H. Naney. 2008. Habitat fragmentation and persistence of lynx populations in Washington State. Journal of Wildlife Management. 72: 1518-1524.

Kondolf, G. M. 1993. Lag in stream channel adjustment to livestock exclosure, White Mountains, California. Restoration Ecology, 1: 226-230.

Korhonen, L., K. T., Korhonen, M. Rautiainen, and P. Stenberg. 2006. Estimation of Forest Canopy Cover: a Comparison of Field Measurement Techniques. Silva Fennica 40(4): 577-588.

Kovalchik, B. L. and R. R. Clausnitzer. 2004. Classification and management of aquatic, riparian, and wetland sites on the national forests of eastern Washington: series description. General Technical Report PNW-GTR-593. USDA Forest Service, Pacific Northwest Research Station. 354 p. In cooperation with: Pacific Northwest Region, Colville, Okanogan, and Wenatchee National Forests.

Kramer, B. 2014. Teck American Reopening Pend Oreille Mine. Spokesman Review newspaper, Spokane, WA. April 24, 2014.

Kramer, M. and Snook. 2014. Using historical snowpack change in the Pacific Northwest to understand future vulnerability to climate change. Manuscript submitted to Regional Environmental Change.

Krebs, J. A., E. C. Lofroth, and I. Parfitt. 2007. Multiscale habitat use by wolverines in British Columbia, Canada. Journal of Wildlife Management 71: 2180-2192.

Krist, Jr., F.J., J.R. Ellenwood, M.E. Woods, A.J. McMahan, J.P. Cowardin, D.E. Ryerson, F.J. Sapio, M.O. Zweifler, and S.A. Romero. 2014. 2013–2027 National Insect and Disease Forest Risk Assessment. FHTET-14-01. U.S. Department of Agriculture, Forest Service, Forest Health Technology Enterprise Team.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K. T. Redmond, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. Climate of the Northwest U.S. NOAA Technical Report NESDIS 142-6. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington D.C. 83 p.

Lackey, R. T. 2001. Values, policy and ecosystem health. Bioscience 51: 437-443.

Lahren, S. L. 1998. Reservations and Reserves. In: Sturtevant, W.C. ed. Handbook of North American Indians. Vol. 12. Washington D.C.: Smithsonian Institute.

Laiho, R. and C. E. Prescott. 1999. The contribution of coarse woody debris to carbon, nitrogen, and phosphorus cycles in three Rocky Mountain coniferous forests. Canadian Journal of Forest Research. 29: 1592-1603.

Lambeck, R. J. 1997. Focal species: a multi-species umbrella for nature conservation. Conservation Biology. 11: 849-856.

LANDFIRE: LANDFIRE National Vegetation Dynamics Models. (2007, January - last update). (Homepage of the LANDFIRE Project, USDA Forest Service; U.S. Department of Interior). Available online at: http://www.landfire.gov/index.php (February 8, 2007).

Landres, P. B., J. Verner, and J. W. Thomas. 1988. Ecological uses of vertebrate indicator species: a critique. Conservation Biology. 2: 316-328.

Landres, P. B., P. Morgan, and F. J. Swanson. 1999. Overview of the use of natural variability concepts in managing ecological systems. Ecological Applications. 9(4): 1179-1188.

Lanigan, S. H., S. N. Gordon, P. Eldred, M. Isley, S. Wilcox, C. Moyer, and H. Andersen. 2012. Northwest Forest Plan—the first 15 years (1994–2008): watershed condition status and trend. Gen. Tech. Rep. PNW-GTR-856. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 155 p.

Larsen, I. J., L. H. MacDonald, E. Brown, D. Rough, M. J. Welsh, J. H. Pietraszek, Z. Libohova, J. de Dios Benavides-Solorio, and K. Schaffrath. 2009. Causes of post-fire runoff and erosion: water repellency, cover, or soil sealing? Soil Science Society of America. 73(4): 1393-1407.

Lasmanis, R. 1991. The geology of Washington. Rocks and minerals, Vol. 66 (4): 262-277.

Lawler, J. J. and M. Mathias. 2007. Climate change and the future of biodiversity in Washington. Report prepared for the Washington Biodiversity Council. College of Forest Resources, Seattle, WA: University of Washington. 42 p.

Lawler, J. J., C. L. Raymond, M. E. Ryan, M. J. Case, and R. M. Rochefort. 2014. Climate change, wildlife, and wildlife habitat in the North Cascade Range. Pages 191-260 in Raymond, C.L., D. L. Peterson, and R. M. Rochefort (eds.) Climate change vulnerability and adaptation in the North Cascades Region, Washington. USDA Forest Service, Gen. Tech. Rep. PNW-GTR-892.

Laymon, S. A. and M. D. Halterman. 1987. Can the western subspecies of the yellow-billed cuckoo be saved from extinction? Western Birds 18: 19-25.

LeCain, D., J. Morgan, G. Schuman, J. Reeder, and R. Hart. 2001. Carbon exchange and species composition of grazed pastures and exclosures in the shortgrass steppe of Colorado. Agriculture, Ecosystems and Environment 93: 421-435.

Lee, D. C., J. R. Sedell, B. E. Rieman, R. F. Thurow, J. E. Williams, D. Burns, J. Clayton, L. Decker, R. Gresswell, R. House, P. Howell, K. M. Lee, K. MacDonald, J. McIntyre, S. McKinney, T. Noel, J. E. OConnor, C. K. Overton, D. Perkinson, K. Tu and P. Van Eimeren. 1997. Broadscale assessment of aquatic species and habitats, Chapter 4. In: An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins. T. M. Quigley and S. J. Arbelbide (eds.) Portland, OR. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-405, Volume III: 1057-1496.

Lehmkuhl, J. F., A. L. Lyons, E. Bracken, J. Leingang, W. L. Gaines, E. K. Dodson, and P. H. Singleton. 2013. Forage composition, productivity, and utilization in the eastern Washington Cascade Range. Northwest Science 87(3): 207-231.

Lehmkuhl, J. F., M. G. Raphael, R. S. Holthausen, (and others).1997. Historical and current status of terrestrial species and the effects of proposed alternatives. In: Quigley, T.M., K. M. Lee, and S. J. Arbelbide (tech. eds.) Evaluation of EIS alternatives by the Science Integration Team. USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-406.

Lehmkuhl, J. F., M. Kennedy, E. D. Ford, P. H. Singleton, W. L. Gaines, and R. L. Lind. 2007. Seeing the forest for the fuels: integrating ecological values and fuel management. Forest Ecology and Management 246: 73-80.

Lenz, M. 1997. Winter habitat use by mule deer in Chelan County, WA. M.S. Thesis, University of Washington, Seattle, WA.

Leopold, L. 1994. A view of the river. Harvard University Press, Cambridge, MA. 298 p.

Lestelle, L. C., L. E. Mobrand, and W. E. McConnaha. 2004. Information Structure of Ecosystem Diagnosis and Treatment (EDT) and Habitat Rating Rules for Chinook Salmon, Coho Salmon, and Steelhead Trout. Mobrand Biometrics, Inc. 106 p.

Lewis, J. C. 2016. Periodic status review for the lynx in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 24 p.

Li, Z., S. Liu, and Z. Tan. 2007. Spatially Explicit Modeling of Grazing Effects on Soil Organic Carbon Change in the Green River Basin, Wyoming. American Geophysical Union, Fall Meeting 2007, abstract #B23C-1508.

Liski, J., A. Pussinen, K. Pingoud, R. Mäkipää, and T. Karjalainen. 2001. Which rotation length is favourable to carbon sequestration? Canadian Journal of Forest Research, 31: 2004–2013.

Lisle, T.E., J.M. Buffington, P.R. Wilcock, and K. Bunte. 2015. Can Rapid Assessment Protocols Be Used to Judge Sediment Impairment in Gravel-Bed Streams? A Commentary. Journal of the American Water Resources Association, 51(2): 373-387.

Littell, J. S., D. McKenzie, (and others). 2009. Climate, wildfire area burned in western US ecoprovinces, 1916-2003. Ecological Applications. 19: 1003-1021.

Littell, J. S., D. McKenzie, B. K. Kerns, S. Cushman, and C. G. Shaw. 2011. Managing uncertainty in climate driven ecological models to inform adaptation to climate change. Ecosphere 2(9): 102. doi:10.1890/ES11-00114.1 19 p.

Littell, J. S., E. E. Oneil, D. McKenzie, J. A. Hicke, J. A. Lutz, R. A. Norheim, and M. M. Elsner. 2010. Forest ecosystems, disturbance, and climatic change in Washington State, USA. Climatic Change 102(1-2) (Sept. 2010): 129-158.

Lloyd, R. A., K. A. Lohse, and T.P.A Ferré. 2013. Influence of road reclamation techniques on forest ecosystem recovery. Frontiers in Ecology and the Environment. 11(2): 75-81.

Loewen, M. 2014. Personal communication between Delilah Jaworski, Social Scientist, USDA Forest Service R6 Regional Office and Mark Loewen, Silviculturist (retired). 2014.

Lockman, I. B. and H.S.J. Kearns, eds. 2016. Forest root diseases across the United States. Gen. Tech. Rep. RMRS-GTR-342. Ogden, UT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 55 p.

Lofroth, E. C. and J. Krebs. 2007. The abundance and distribution of wolverines in British Columbia, Canada. Journal of Wildlife Management 71: 2159-2169.

Lofroth, E. C., C. M. Raley, J. M. Higley, R. L. Truex, J. S. Yaeger, J. C. Lewis, P. J. Happe, L. L. Finley, R. H. Naney, L. J. Hale, A. L. Krause, S. A. Livingston, A. M. Myers, and R. N. Brown. 2010. Conservation of Fishers (*Martes pennanti*) in South-Central British Columbia, Western Washington, Western Oregon, and California-Volume I: Conservation Assessment. USDI Bureau of Land Management, Denver, Colorado, USA.

Luce, C. H., B. E. Rieman, J. B. Dunham, J. L. Clayton, J. G. King, and T. A. Black. 2001. Incorporating aquatic ecology into decisions on prioritization of road decommissioning. Water Resources Impact 3(3): 8-14.

Luce, C. H. and T. A. Black. 2001. Effects of traffic and ditch maintenance on forest road sediment production. In: proceedings of the seventh federal interagency sedimentation conference, March 25-29, 2001, Reno, NV: V67-V74.

Luce, C., B. Staab, M. Kramer, S. Wenger, D. Isaak, and C. McConnell. 2014. Sensitivity of summer stream temperatures to climate variability in the Pacific Northwest. Water Resour. Res., 50: 3428–3443. doi:10.1002/2013WR014329.

MacDonald, K. 2014a. Personal communication between Eric Archer, Fisheries Biologist, and Ken MacDonald, fisheries biologist consultant. March 20, 2014.

MacDonald, K. 2014b. Personal communication (email) between Eric Archer, Fisheries Biologist, and Ken MacDonald, fisheries biologist consultant (Preliminary Colville Results). March 21, 2014.

MacDonald, K. 2014c. Personal communication (email) between Eric Archer, Fisheries Biologist, and Ken MacDonald, fisheries biologist consultant (Results). March 21, 2014.

MacDonald, K. 2014d. Personal communication (phone) between Eric Archer, Fisheries Biologist, and Ken MacDonald, fisheries biologist consultant. March 25, 2014.

MacDonald, K. 2014e. Personal Communication between Kate Day, Hydrologist, Colville National Forest and Ken MacDonald, fisheries biologist consultant. October 16, 2014.

MacDonald, K. 2015. Personal communication (email) between Eric Archer, Fisheries Biologist, and Ken MacDonald, fisheries biologist consultant. Revised report: Habitat Conditions in the Colville National Forest. January 31, 2015.

MacDonald, K., K. Day, and K. Honeycutt. 2018. Fisheries report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

MacDonald, L. H. 2000. Evaluating and managing cumulative effects: Process and constraint. Environmental Management, 26(3): 299-315.

Madej, M. A. 2001. Erosion and sediment delivery following removal of forest roads. Earth Surface Processes and Landforms 26(2): 175-190.

Mälkönen, E. 1976. Effect of whole-tree harvesting on soil fertility.

Manley, J. G., J. R. Schuman, and R. Hart. 1995. Rangeland soil carbon and nitrogen responses to grazing. Journal of Soil & Water Conservation 50: 294-297.

Mann, L. K., D. W. Johnson, D. C. West, D. W. Cole, J. W. Hornbeck, C. W. Martin, and D. H. Van Lear. 1988. Effects of whole-tree and stem-only clearcutting on postharvest hydrologic losses, nutrient capital, and regrowth. Forest Science, 34(2): 412-428.

Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. Climatic Change. 102: 187–223.

Marcot, B. G., R. S. Holthausen, M. G. Raphael, M. M. Rowland, and M. J. Wisdom. 2001. Using Bayesian belief networks to evaluate fish and wildlife population viability under land management alternatives from an environmental impact statement. Forest Ecology and Management. 153: 29-42.

Marston, R.A. 1994. River entrenchment in small mountain valleys of the western USA: Influence of beaver, grazing, and clear-cut logging. Revue de Geographie de Lyon 69(1/94): 11-15.

Masters, R. E., R. L. Lochmiller, and D. M. Engle. 1993. Effects of Timber Harvest and Prescribed Fire on White-tailed Deer Forage Production. Wildlife Society Bulletin. 21: 411-414.

May, B. 2009. Westslope cutthroat trout status update summary 2009. Wild trout Enterprises, LLC. Bozeman, MT. 33 p.

May, B., B. J. Writer, and S. Albeke. 2012. Redband trout status update summary 2012. Wild Trout Enterprises, LLC. Bozeman, MT. 36 p.

McCaffery, M., T. A. Switalski, and L. Eby. 2007. Effects of road decommissioning on stream habitat characteristics in the South Fork Flathead River, Montana. Transactions of the American Fisheries Society 136(3): 553-561. DOI: 10.1577/T06-134.1

McCashion J. D. and R. M. Rice. 1983. Erosion on logging roads in northwestern California: How much is avoidable. Journal of Forestry 81(1): 23-26.

McCaughey, W. and P. Farnes. 2001. Snowpack comparison between an opening and a lodgepole stand. 69th Annual Meeting of the Western Snow Conference. Sun Valley, Idaho.

McDowell, P. F. and F. J. Magilligan. 1997. Response of stream channels to removal of cattle grazing disturbance: Overview of western US exclosure studies. Pages 469-475 in: S. S. Wang, E. J. Langendoen, and F. D. Shields, Jr. (eds.) Proceedings—Conference on Management of Landscapes Disturbed by Channel Incision. University of Mississippi Press, Oxford.

McKelvey, K. S., Y. K. Ortega, G. M. Koehler, (and others). 2000. Canada lynx habitat and topographic use patterns in north central Washington: a reanalysis. USDA Forest Service, Rocky Mountain Research Station, RMRS-GTR-30WWW.

McKenzie, D., Z. E. Gedalof, D. L. Peterson, and P. Mote. 2004. Climatic change, wildfire, and conservation. Conservation Biology 18: 890-902.

McLain, R. J., and R. G. Lee. 1996. Adaptive Management: Promises and Pitfalls. Environmental Management, 20(4): 437-438.

McMahon, T. E., A.V. Zale, F. T. Barrows, J. H. Selong, and R. J. Danehy. 2007. Temperature and competition between bull trout and brook trout: a test of the elevation refuge hypothesis. Transactions of the American Fisheries Society 136: 1313-1326.

McNab W. H. and P. E. Avers, compilers. 1994. Ecological subregions of the United States: Section descriptions. Administrative Publication WO-WSA-5. Washington D.C.: USDA Forest Service. 267 p.

McQuay, E. 2017. Recreation report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

Medin, D. E. and W. P. Clary. 1991. Breeding Bird Populations in a Grazed and Ungrazed Riparian Habitat in Nevada. RP-INT-441. USDA Forest Service, Intermountain Research Station. 14 p.

Medina, A. L. and S. C. Martin. 1988. Stream channel and vegetation changes in section of McKnight Creek, New Mexico. Great Basin Naturalist 48: 373-381.

Meehan, W. R. 1991. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19: 1-15.

Megahan, W. F. 1983. Hydrologic effects of clearcutting and wildfire on steep granitic slopes in Idaho. Water Resources Research, Vol 19(3): 811-819.

Megahan, W. F., J. G. King, and K.A. Seyedbagheri. 1995. Hydrological and erosion responses of a granitic watershed to helicopter logging and broadcast burning. Forestry Science, 41: 777-795.

Mellen-McLean, K., B. Wales, and B. Bresson. 2013. A conservation assessment for the white-headed woodpecker. USDA Forest Service and USDI Bureau of Land Management. Portland, OR. 41 p.

Meredith, C., E. K. Archer, R. Scully, A. Van Wagenen, J. V. Ojala, R. Lokteff, and B. Roper. 2012. PIBO effectiveness monitoring program for streams and riparian areas. USDA Forest Service 2012 Annual Summary report. Available online at: http://www.fs.fed.us/biology/resources/pubs/feu/pibo/2012_PIBOEM_AnnualReport9_12_2013update.pdf (accessed March 20, 2014).

Meredith, C., B. Roper, and E. Archer. 2014. Reductions in instream wood in streams near roads in the Interior Columbia River Basin. North American Journal of Fisheries Management, 34:3: 493-506.

Miles, E. L., A. K. Snover, A. F. Hamlet, B. M. Callahan, and D. L. Fluharty. 2000. Pacific Northwest regional assessment: the impacts of climate variability and climate change on the water resources of the Columbia River basin. Journal of the American Water Resources Association. 36: 399–420.

Millar, C.I., N.L. Stephenson, and S.L. Stephens. 2007. Climate change and forests of the future: Managing in the face of uncertainty. Ecol. Appl. 17(8):2145–2151.

Miller, C. and D. L. Urban. 1999. Forest pattern, fire, and climatic change in the Sierra Nevada. Ecosystems. 2: 76-87.

Miller, D., C. Luce, and L. Benda. 2003. Time, space, and episodicity of physical disturbance in streams. Forest Ecology and Management. 178(1): 121-140.

Miller, J. D., H. D. Safford, M. Crimmins, and A. E. Thode. 2008. Quantitative evidence for increasing forest fire severity in the Sierra Nevada and Southern Cascade Mountains, California and Nevada, USA. Ecosystems.

Miller, N. L., K. E. Bashford, and E. Strem. 2003. Potential impacts of climate change on California hydrology. Journal of American Water Resources Association. 39(4): 771-784.

Miller-Struttmann, N. E., J. C. Geib, (and others). 2015. Functional mismatch in a bumblebee pollination mutualism under climate change. Science 349: 1541-1544.

Minnesota IMPLAN Group (IMPLAN). 2010. IMPLAN Professional Version 3.0, 2010 Data.

Minnesota IMPLAN Group (MIG). 2012. Data and models for 2010. Hudson, WI.

Mitchell, S. and D. Hamilton. 2007. Snowmobiling and Mountain caribou: a literature review of stewardship practices. Version 4.0. Nanuq Consulting Ltd. Nelson, BC.

Mitchell, S. R., M. E. Harmon, and K. E. B. OConnell. 2009. Forest fuel reduction alt ers fire severity and long-term carbon storage in three Pacific Northwest ecosystems. Ecological Applications 19(3): 643-655.

Mitton, J.B. and S.M. Ferrenberg. 2014. Field Studies Demonstrate Bivoltinism in the Mountain Pine Beetle (A Reply to Bentz and Powell). The American Naturalist. Vol. 184, No. 6. (2014).

Moeur, M. and D. Vandendriesche. 2009. Calibration of state and transition models with FVS, pgs. 275-288. In: Jain, T. B., R. T. Graham, and J. Sandquist (tech. eds.) 2009. Integrated management of carbon sequestration and biomass utilization opportunities in a changing climate: Proceedings of the 2009 National Silviculture Workshop; 2009 June 15-18; Boise, ID. Proceedings RMRS-P-61. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 351 p.

Montgomery, D. R. and J. M Buffington. 1997. Channel reach morphology in mountain drainage basins. Geological Society of America Bulletin 109(5): 596-611.

Montgomery, D. R. and J. M. Buffington. 1998. Channel processes, classification and response. Pages 13-42 in: R. J. Naiman and R. E. Bilby (eds.) River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer. New York, New York.

Montgomery, D.R. and L. H. MacDonald. 2002. Diagnostic approach to stream channel assessment and monitoring. Journal of the American Water Resources Association, 38(1): 1-16.

Moore, M. M. and D. A. Deiter. 1992. Stand density index as a predictor of herbage production in northern Arizona pine forests. Journal of Range Management, 45: 267-271.

Moore, R. D., D. L. Spittlehouse, and A. Story. 2005. Riparian Microclimate and Stream Temperature Response to Forest Harvesting: A Review. Journal of the American Water Resources Association, 41(4): 813-834.

Morgan, P., E. K. Heyerdahl, and C.E. Gibson. 2008. Multi-season climate synchronized forest fires throughout the 20th century, northern Rockies, USA. Ecology. 89(3): 717-728.

Mosconi, S. L. and R. L. Hutto. 1982. The effect of grazing on the land birds of a western Montana riparian habitat. Pages 221-233 in L. Nelson, J.M. Peek, and P.D. Dalke, editors. Proceedings of the wildlife-livestock relationships symposium. Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, Idaho.

Mote, P. 2003a. Trends in snow water equivalent in the Pacific Northwest and their climatic causes. Geophysical Research Letters. 30: 1601–1604.

Mote, P. 2003b. Trends in temperature and precipitation in the Pacific Northwest during the twentieth century. Northwest Science. 77: 271–282.

Mote, P. 2006. Climate-driven variability and trends in mountain snowpack in western North America. Journal of Climate, 19: 6209-6220.

Mote, P. W., A. F. Hamlet, M. P. Clark, and D.P. Lettenmaier. 2005. Declining mountain snowpack in western North America. American Meteorological Society: 39-49.

Mote, P. W., A. Hamlet, and E. Salathé. 2008. Has spring snowpack declined in the Washington Cascades? Hydrology and Earth System Sciences, 12: 193-206.

Mote, P. W. and E. P. Salathé. 2010. Future climate in the Pacific Northwest. Climatic Change, 102: 29-50.

Mountain Caribou Science Team. 2005. Mountain caribou in British Columbia: a situation analysis. May 19, 2005.

Muhlfield, C. C., T. E. McMahon, M. C. Boyer, and R. E. Gresswell. 2009. Local habitat, watershed, and biotic factors influencing the spread of hybridization between native westslope cutthroat trout and introduced rainbow trout. Transactions of the American Fisheries Society 138: 1036-1051.

Mulloy, W. 1958. A Preliminary Historical Outline for the Northwestern Plains. Laramie, WY: University of Wyoming Publications 22 (1).

Munson, S. M. and A. A. Sher. 2015. Long-term shifts in the phenology of rare and endemic rocky mountain plants. American Journal of Botany 102 (8): 1268–1276.

Murray, D. and R. Coots. 2003. Colville River watershed bacteria total maximum daily load submittal report (amended). Washington State Department of Ecology water quality program. Available online at: https://fortress.wa.gov/ecy/publications/publications/0310030.pdf

Myneni, R. B., J. Dong, C. J. Tucker, R. K. Kaufmann, P. E. Kauppi, J. Liski, L. Zhou, V. Alexeyev, and M. K. Hughes. 2001. A large carbon sink in the woody biomass of northern forests. Proceedings of the National Academy of Sciences 98: 14784-14789.

Nabuurs, G. J., O. Masera, K. Andrasko, P. Benitez-Ponce, R. Boer, M. Dutschke, E. Elsiddig, J. Ford-Robertson, P. Frumhoff, T. Karjalainen, O. Krankina, W. A. Kurz, M. Matsumoto, W. Oyhantcabal, N. H. Ravindranath, M. J. Sanz Sanchez, and X. Zhang. 2007. Pages 541–584 in: Climate change 2007: Mitigation, (eds.) B. Metz, O. R. Davidson, P. R. Bosch, R. Dave, and L. A. Meyer. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY: Cambridge University Press.

Naiman, R. J., T. J. Beechie, L. E. Benda, D. R. Berg, P. A. Bisson, L. H. MacDonald, M. D. OConnor, P. L. Olson, and E. A. Steel. 1992. Fundamental elements of ecologically healthy watersheds in the Pacific Northwest coastal ecoregion. In: Watershed Management, Balancing Sustainability and Environmental Change. R. Naiman (ed.) New York. McGraw-Hill: 127-188.

Naiman, R. J., R. E. Bilby, and P. A. Bisson. 2000. Riparian ecology and management in the Pacific coastal rain forest. BioScience 50: 996-1011.

Narayanaraj, G. and M. C. Wimberly. 2011. Influences of forest roads on the spatial pattern of wildfire boundaries. International Journal of Wildland Fire, 2011, 20: 792-803.

National Commission on Science for Sustainable Forestry (NCSSF). 2005. Science, Biodiversity, and Sustainable Forestry: A findings report of the National Commission on Science for Sustainable Forestry. National Commission on Science for Sustainable Forestry (NCSSF). Washington D.C. 56 p.

National Marine Fisheries Service. 2008a. Endangered Species Act -Section 7 Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation: consultation on remand for operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program (Revised and reissued pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon)). NMFS, Portland, Oregon, 5/5/2008.

National Marine Fisheries Service. 2008b. Supplemental comprehensive analysis of the Federal Columbia River Power System and mainstem effects of the Upper Snake and other tributary actions. NMFS, Portland, Oregon, 5/5/2008.

National Marine Fisheries Service. 2010. Supplemental Consultation on Remand for Operation of the Federal Columbia River Power System (FCRPS), 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program, F/NWR/2010/02096, 5/20/2010.

National Marine Fisheries Service. 2014. Endangered Species Act -Section 7 Consultation Supplemental Biological Opinion Consultation on Remand for operation of the Federal Columbia River Power System (FCRPS), 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program (Revised and reissued pursuant to court order, *NWF* v. *NMFS*, Order issued August 2, 2011). NMFS, Portland, Oregon, 1/17/2014.

National Operational Hydrologic Remote Sensing Center. 2004. Snow Data Assimilation System (SNODAS) Data Products at NSIDC, (2003-2012). Boulder, Colorado USA: National Snow and Ice Data Center. Available online at: http://dx.doi.org/10.7265/N5TB14TC

National Research Council. 2002. Riparian Areas: Functions and Strategies for Management. National Academy Press, Washington, DC. 449 p.

National Research Council. 2002. Scientific research in education. Committee on Scientific Principles for Education Research. Shavelson, R.J., and L. Towne, Editors. Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press. Available online at: https://www.nap.edu/read/10236/chapter/1

National Wetlands Inventory descriptions. Available online at: http://www.fws.gov/wetlands/Data/Mapper-Wetlands-Legend.html.

NatureServe. 2017. Available at: http://explorer.natureserve.org/ranking.htm

Nave, L. E., E. D. Vance, C. W. Swanston, and P. S. Curtis. 2010. Harvest impacts on soil carbon storage in temperate forests. Forest Ecology and Management, 259: 857–866.

Neary, D. G., C. C. Klopatek, L. F. DeBano, and P. F. Folliott. 1999. Fire effects on belowground sustainability: a review and synthesis. Forest ecology and management. 122(1): 51-71.

Neary, D. G., K. C. Ryan, and L. F. DeBano, editors. 2005 (revised 2008). Wildland fire in ecosystems: effects of fire on soils and water. Gen. Tech. Rep. RMRS-GTR-42-Vol.4. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 250 p.

Neill, A. R. and K. J. Puettmann. 2013. Managing for adaptive capacity: thinning improves food availability for wildlife and insect pollinators under climate change conditions. Can. J. For. Res. 43: 428-440.

Nelson, N., T. Black, C. Luce, and R. Cissel. 2012. Legacy roads and trails monitoring project update 2012. USDA Forest Service, Rocky Mountain Research Station. 5 p.

Nemani, R., M. White, P. Thornton, K. Nishida, S. Reddy, J. Jenkins, and S. Running. 2002. Recent trends in hydrologic balance have enhanced the terrestrial sink in the United States. Geophysical Research Letters: 29: 106-1 to 106-4.

Nemani, R. R., C. D. Keeling, H. Hashimoto, W. M. Jolly, S. C. Piper, C. J. Tucker, R. B. Myneni, and S.W. Running. 2003. Climate-driven increases in global terrestrial net primary production from 1982 to 1999. Science 300: 1560-1563.

Nooney, K.. 2017. Land and special uses report for the Colville National Forest Plan Revision, Final Environmental Impact Statement. Unpublished report. USDA Forest Service, Colville National Forest, Colville, Washington.

North, M., P. Stine, K. O'Hara, W. Zielinski, and S. Stephens. 2009. An Ecosystem Management Strategy for Sierran Mixed Conifer Forests. USDA Forest Service, Pacific Southwest Research Station, Davis, CA. General Technical Report PSW-GTR-220.

Northwest Interagency Coordination Center (NWCC). 2012. Available online at: https://gacc.nifc.gov/nwcc/

Noss, R. F., J. F. Franklin, W. L. Baker, T. Schoennagel, and P. B. Moyle. 2006. Managing fire-prone forests in the western United States. Frontiers in Ecology and the Environment 4(9): 481-487.

Nunery, J. S. and W. S. Keeton. 2010. Forest carbon storage in the northeastern United States: Net effects of harvesting frequency, post-harvest retention, and wood products. Forest Ecology and Management, 259: 1363–1375.

O'Brien, J. M., C. S. O'Brien, C. McCarthy, and T. E. Carpenter. 2014. Incorporating Foray Behavior Into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep. Wildlife Society Bulletin. 38(2): 321-331.

Office of the Interagency Committee (IAC). 2002. Interagency Committee for Outdoor Recreation: An assessment of outdoor recreation on Washington state—a State Comprehensive Outdoor Recreation Planning Document (SCORP) 2002-2007.

Office of Interagency Committee. 2005. PO Box 40917, Olympia, WA. 98504-0917; Outdoor Industry Foundation, Outdoor Recreation Participation Study, Seventh Edition, for year 2004, 2005.

Office of the President. 1994. "Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Population and Low-income Populations." February 1994.

Ohmann, J. L. and M. J. Gregory. 2002. Predictive mapping of forest composition and structure with direct gradient analysis and nearest neighbor imputation in coastal Oregon, USA. Canadian Journal of Forest Research 32: 725-741.

Okanogan County. 2013. Okanogan County Washington Community Wildfire Protection Plan (CWPP), October 2013. Okanogan County Community Wildfire Protection Plan Committee in cooperation with Okanogan County Department of Emergency Management, Washington State Department of Natural Resources, and Northwest Management, Inc., 233 E. Palouse River Dr., P.O. Box 9748, Moscow, ID, 83843, Tel: 208-883-4488, www.Consulting-Foresters.com

Okanogan County. 2014. Okanogan County Comprehensive Plan. Okanogan, WA. Available online at: http://www.okanogancounty.org/planning/

Oliver, C. D. and B. C. Larson. 1996. Forest Stand Dynamics. Update edition. John Wiley and Sons Inc., New York, NY.

Olson, D. H., J. B. Leirness, P. G. Cunningham, and E. A. Steel. 2014. Riparian buffers and forest thinning: Effects on headwater vertebrates 10 years after thinning. Forest Ecology and Management, 321: 81-93.

Olson, D. H. and J. I. Burton. 2014. Near-Term Effects of Repeated-Thinning with Riparian Buffers on Headwater Stream Vertebrates and Habitats in Oregon, USA. Forests, 5(11): 2703-2729.

Opdam, P. and D. Wascher. 2004. Climate change meets habitat fragmentation: linking landscape and biogeographical scale levels in research and conservation. Biological Conservation 117: 285.

Örlander, G., G. Egnell, and A. Albrektsson. 1996. Long-term effects of site preparation on growth in Scots pine. Forest Ecology and Management, 86: 27–37.

Ouren, D. S., C. Hass, C. P. Melcher, S. C. Stewart, P. D. Ponds, N. R. Sexton, L. Burris, T. Fancher, and Z. H. Bowen. 2007. Environmental effects of off-highway vehicles on Bureau of Land Management lands: A literature synthesis, annotated bibliographies, extensive bibliographies, and internet resources: U.S. Geological Survey Open-File Report 2007-1353.

Owensby, C., J. Ham, and L. Auen. 2006. Fluxes of CO_2 From Grazed and Ungrazed Tallgrass Prairie. Rangeland Ecology and Management 59: 111-127.

Pacala, S., R. A. Birdsey, S. D. Bridgham, R. T. Conant, K. Davis, B. Hales, R. A. Houghton, J. C. Jenkins, M. Johnston, G. Marland, and K. Paustian. 2007. The North American Carbon Budget Past and Present. Pages 29-36 in: The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (King, A.W., L. Dilling, G. P. Zimmerman, D. M. Fairman, R. A. Houghton, G. Marland, A. Z. Rose, and T. J. Wilbanks (eds.)). National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC, USA.

Page, W. G., M. J. Jenkins, and J. B. Runyon. 2012. Mountain pine beetle attack alters the chemistry and flammability of lodgepole pine foliage. Canadian Journal of Forest Research. Vol. 42, No. 8 (2012): 1631-1647.

Page-Dumroese, D. S. and M. F. Jurgensen. 2006. Soil carbon and nitrogen pools in mid- to late-successional forest stands of the northwestern United States: potential impact of fire. Canadian Journal of Forest Research. 36(9): 2270-2284.

Page-Dumroese, D. S., M. F. Jurgensen, A. E. Tiarks, F. Ponder, Jr., F. G. Sanchez, R. L. Fleming, J. M. Kranabetter, R. F. Powers, D. M. Stone, J. D. Elioff, and D. A. Scott. 2006. Soil physical property changes at the North American Long-Term Soil Productivity study sites: 1 and 5 years after compaction. Can. J. For. Res. 36: 551–564.

Page-Dumroese, D. S., M. Jurgensen, and T. Terry. 2010. Maintaining soil productivity during forest or biomass-to-energy thinning harvest in the western United States. Western Journal of Applied Forestry. 25(1): 5-11.

Palmgren, K. 1984. Microbiological changes in soil following soil preparation and liming (in Finnish, English abstract). Folia Forestalia, 603: 1–27.

Parise, M. and S. H. Cannon. 2012. Wildfire impacts on the processes that generate debris flows in burned watersheds. Natural hazards. 61(1): 217-227.

Parker, B., G. Miller, and L. C. Burrill. 1998. Scotch Broom. Pacific Northwest Extension Publication. 4 p.

Parks, N. 2010. The future of spring bud burst: looking at the possibilities. Science Findings. Is. 128 (Dec. 2010). Pacific Northwest Research Station. Portland, OR.

Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. Annual Review of Ecology, Evolution, and Systematics 37: 637-669.

Peck, B. 2014. Personal communication (email) between Ken MacDonald, fisheries biologist consultant, and Brian Peck, fisheries biologist, Newport Ranger District, Colville National Forest. Project Operations Compliance Report submitted in FERC P-2144-000 by Seattle City Light, et al. March 21, 2014. Terms of Seattle City Light's license are available online at: http://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20140318-5216 (accessed March 25, 2014)

Pederson, G. T., S. T. Gray, C. A. Woodhouse, J. L. Betancourt, D. B. Fagre, J. S. Littell, E. Watson, B. H. Luckman, and L. J. Graumlich. 2011. The unusual nature of recent snowpack declines in the North American Cordillera. Science Vol. 33 No. 6040 (2011): 332-335.

Pelster, A.J., S. Evans, W.C. Leininger, M.J. Trlica, and W.R. Clary. 2004. Steer diets in a montane riparian community. Journal of Range Management. 57: 546-552.

Pend Oreille County. 2011. Pend Oreille County Washington, Community Wildfire Protection Plan (CWPP), November 21, 2005, updated March 2011. Pend Oreille County Interface Wildfire Mitigation Plan Committee in cooperation with Northwest Management, Inc., 233 E. Palouse River Dr., P.O. Box 9748, Moscow, ID, 83843, Tel: 208-883-4488, www.Consulting-Foresters.com

Pend Oreille County. 2013. Pend Oreille County Comprehensive Plan. Newport, WA. Available online at: http://www.pendoreilleco.org/county/planning.asp (Updated 2015)

Peterson, D. L., J. K. Agee, G. H. Aplet, D. P. Dykstra, R. T. Graham, J. F. Lehmkuhl, D. S. Pilliod, D. F. Potts, R. F. Powers, and J. D. Stuart. 2009. Effects of timber harvest following wildfire in western North America. Gen. Tech. Rep. PNW-GTR-776. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 51 p.

Peterson, D. P., K. D. Fausch, and G. C. White. 2004. Population ecology of an invasion: effects of brook trout on native cutthroat trout. Ecological Applications 14: 754-772.

Peterson, D. L., C. I. Millar, L. A. Joyce, M. J. Furniss, J. E. Halofsky, R. P. Neilson, and T. L. Morelli. 2011. Responding to climate change in national forests: a guidebook for developing adaptation options. General Technical Report PNW-GTR-855. USDA Forest Service, Pacific Northwest Research Station. Portland, OR. 109 p.

Peterson, D. W., B. K. Kerns, and E. K. Dodson. 2014. Climate change effects on vegetation in the Pacific Northwest: a review and synthesis of the scientific literature and simulation model projections. Gen. Tech. Rep. PNWGTR-900. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 183 p.

Phillips, E. L. and D. C. Durkee. 1972. Washington climate for these counties: Ferry, Pend Oreille, and Stevens. Cooperative extension services, College of Agriculture, Washington State University, Pullman, WA. 63 p.

Phillips, R. 2010. Impact area definition. Unpublished report. USDA Forest Service, Colville National Forest. On file at: Colville National Forest Supervisors Office, Colville, WA.

Piao, S., P. Ciais, P. Friedlingstein, P. Peylin, M. Reichstein, S. Luyssaert, H. Margolis, J. Fung, A. Barr, A. Chen, A. Grelle, D.Y. Hollinger, T. Laurila, A. Lindroth, A. D. Richardson, and T. Vesala. 2007. Net carbon dioxide losses of northern ecosystems in response to autumn warming. Nature 451: 49-52.

Pierce, D. W., T. P. Barnett, H. G. Hidalgo, T. Das, C. Bonfils, B. D. Santer, G. Bala, M. D. Dettinger, D. R. Cayan, A. Mirin, A. W. Wood, and T. Nozawa. 2008. Attribution of declining western US snowpack to human effects. Journal of Climate, 21: 6425-6444.

Platts, W. S. 1991. Livestock grazing. In: Meehan, ed., Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Soc., Bethesda, Maryland. 751 p. Special Publication 19: 389-424.

Platts, W. S., K. A. Gebhardt, and W. L. Jackson. 1985. The effects of large storm events on basin-range riparian stream habitats. Pages 30-34 in: Developing strategies for rangeland management: Reconciling conflicting uses. USDA Forest Service General Technical Report RM-120. Rocky Mountain Research Station. Fort Collins, CO.

Pollock, M. M. and P. M. Kennard. 1998. A low-risk strategy for preserving riparian buffers needed to protect and restore salmonid habitat in forested watersheds of Washington State. 10,000 Years Institute.

Pollock, M. M., M. Heim, and D. Werner. 2003. Hydrologic and geomorphic effects of beaver dams and their influence on fishes. American Fisheries Society Symposium 37: 1-21.

Post, E., J. Brodie, M. Hebblewhite, A. D. Anders, J. A. K. Maier, and C. C. Wilmers. 2009. Global Population Dynamics and Hot Spots of Response to Climate Change. BioScience 59(6): 489-497.

Potter, C. S. and S. A. Klooster. 1999. Detecting a terrestrial biosphere sink for carbon dioxide: interannual ecosystem modeling in the mid-1980s. Climatic Change. 42: 489-503.

Potter, C., S. Klooster, A. Huete, and V. Genovese. 2007. Terrestrial carbon sinks for the United States predicted from MODIS satellite data and ecosystem modeling. Earth Interactions 11 (Paper N. 13): 1-21.

Potter, C., S. Klooser, R. Myneni, V. Genovese, P-N. Tan, and V. Kumar. 2003. Continental-scale comparisons of terrestrial carbon sinks estimated from satellite data and ecosystem modeling 1982-1998. Global and Planetary Change 39: 201-213.

Potter, C., P. Gross, S. Klooster, M. Fladeland, and V. Genovese. 2008. Storage of carbon on U.S. forests predicted from satellite data, ecosystem modeling, and inventory summaries. Climatic Change 90: 269-282.

Potyondy, J. P. and T.W. Geier. 2010. Forest Service watershed condition classification technical guide (Updated 2011). Available at: http://www.fs.fed.us/biology/resources/pubs/watershed/maps/watershed_classification_guide2011FS978.pdf. (accessed October 4, 2016.)

Powers, R. F., D. Andrew Scott, F. G. Sanchez, R. A. Voldseth, D. Page-Dumroese, J. D. Elioff, and D. M. Stone. 2005. The North American long-term soil productivity experiment: Findings from the first decade of research. For. Ecol. Manag. 220: 31–50. doi:10.1016/j.foreco.2005.08.003.

Pregitzer, K. S. and E.S. Euskirchen. 2004. Carbon cycling and storage in world forests: biome patterns related to forest age. Global Change Biology 10: 2052-2077.

Price, J. T. 2002. Global warming and songbirds: Washington. The birdwatcher's guide to global warming. Available online at: www.abcbirds.org (April 2008).

Prichard, D., H. Barrett, J. Cagney, R. Clark, J. Fogg, K. Gebhardt, P. Hansen, B. Mitchell, and D. Tippy. 1993. Riparian area management: Process for assessing proper functioning condition. TR 1737-9. Bureau of Land Management, BLM/SC/ST-94/008+1737, Service Center, CO. 60 p.

Pritchett, W. L. 1979. Properties and management of forest soils. John Wiley & Sons.

Proctor, M., C. Servheen, W. Kasworm, and T. Radandt. 2007. Habitat security for grizzly bears in the Yahk Grizzly Bear Population Unit of the south Purcell Mts. of southeast British Columbia. The Trans-border Grizzly Bear Project. Kaslo, B.C. 44 p.

Proctor, M. F., D. Paetkau, B. N. McLellan, G. B. Stenhouse, K. C. Kendall, R. D. Mace, W. F. Kasworm, C. Servheen, C. L. Lausen, M. L. Gibeau, W. L. Wakkinen, M. A. Haroldson, G. Mowat, C. D. Apps, L. M. Ciarniello, R. M. R. Barclay, M. S. Boyce, C. C. Schwartz, and C. Strobeck. 2012. Population Fragmentation and Inter-Ecosystem Movements of Grizzly Bears in Western Canada and the Northern United States. Wildlife Monographs 180: 1-46.

Proctor, M. F., S. E. Nielson, W. F. Kasworm, C. Servheen, T. G. Radandt, A. G. MacHutchon, and M. S. Boyce. 2015. Grizzly bear connectivity mapping in the Canada-United States trans-border region. Journal of Wildlife Management.

Public Utility District No. 1 of Pend Oreille County, 112 FERC ¶ 61,055.

Puettmann, K. J., K. D. Coates, and C. Messier. 2009. A critique of silviculture: managing for complexity. Island Press, Washington D.C. 189 p.

Qualls, R.G., B. L. Haines, and W. T. Swank. 1991. Fluxes of dissolved organic nutrients and humic substances in a deciduous forest. Ecology: 254–266.

Quigley, T. M., R. W. Haynes, and R. T. Graham. 1996a. Disturbance and Forest Health In Oregon and Washington. Gen. Tech. Rep. PNW-GTR-382. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 310 p.

Quigley, T. M., R.W. Haynes, and R. T. Graham. 1996b. Integrated Scientific Assessment for Ecosystem Management in the Interior Colombia Basin and Portions of the Klamath and Great Basins. USDA Forest Service PNW-GTR-382. Portland, OR.

Quigley, T. M. and S. J. Arbelbide, technical editors. 1997. An assessment of ecosystem components in the Interior Columbia Basin and Portions of the Klamath and great basins: volume III. Gen. Tech. Rep. PNW-GTR-405. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 4 vol.

Raphael, M. G., M. J. Wisdom, M. M. Rowland, (and others). 2001. Status and trends of habitats of terrestrial vertebrates in relation to land management in the interior Columbia River basin. Forest Ecology and Management. 153: 63-87.

Rasmussen, C. 2006. Distribution of soil organic and inorganic carbon pools by biome and soil taxa in Arizona. Soil Science Society of America Journal. 70: 256-265.

Ray, D. G., R. S. Seymour, N. A. Scott, and W. S. Keeton. 2009. Mitigating climate change with managed forests: Balancing expectations, opportunity, and risk. Journal of Forestry, 107: 50–51.

Reeder, J., G. Schuman, J. Morgan, D. LeCain, and R. Hart. 2004. Impact of grazing management strategies on carbon sequestration in semi-arid rangeland, USA. Presented at the Proceedings of the XIX International Grassland Congress, 2001.

Reeves, D., D. Page-Dumroese, and M. Coleman. 2011. Detrimental soil disturbance associated with timber harvest systems on National Forests in the Northern Region. Res. Pap. RMRS-RP-89 Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p.

Reeves, G. H., B. R. Pickard, and K. N. Johnson. 2016. An initial evaluation of potential options for managing riparian reserves of the Aquatic Conservation Strategy of the Northwest Forest Plan. Portland, OR. USDA Forest Service, Pacific Northwest Research Station.

Reeves, G. H., D. H. Olson, S. M. Wondzell, S. A. Miller, J. W. Long, P. A. Bisson, and M. J. Furniss. 2016. The Aquatic Conservation Strategy of the Northwest Forest Plan—A Review of the Relevant Science After 22 Years. Chapter 7 in Spies, T., P. Stine, J. Long, and M. Reilly (Editors). Synthesis of Science to Inform Land Management Within the Northwest Forest Plan Area. Manuscript in review.

Reeves, G. H., J. E. Williams, K. M. Burnett, and K. Gallo. 2006a. The Aquatic Conservation Strategy of the Northwest Forest Plan. Conservation Biology, 20(2): 319-329.

Reeves, G. H., J. E. Williams, K. M. Burnett, and K. Gallo. 2006b. The Aquatic Conservation Strategy of the Northwest Forest Plan: An assessment after 10 Years. In: R.W. Haynes, B. T. Bormann, D. C. Lee, J. R. Martin (tech. eds.) 2006. Northwest Forest Plan-the first 10 years (1994-2003): Synthesis of monitoring and research results. Gen Tech. Rep. PNW-GTR_651. Portland, OR. USDA Forest Service, PNW Research Station. 292 p.

Reeves, G. H., L. E. Benda, K. M. Burnett, P. A. Bisson, and J. Sedell. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionary significant units of anadromous salmonids in the Pacific Northwest. American Fisheries Society Symposium 17: 334-349.

Regional Ecosystem Office. 1995. Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis (v 2.2). With supplementation by RIEC memorandum: Watershed analysis, direction for completion of a federal agency guide to watershed analysis. Portland, OR. 29 p.

Regional Interagency Executive Committee (RIEC). 2011. Framework to guide Forest Service and Bureau of Land Management land use plan revisions and amendments (Western Oregon, Western Washington, and Northern California).

Reid, L. M. and T. Dunne. 1984. Sediment production from forest road surfaces. Water Resources Research 20: 1753-1761.

Reidy Liermann, C. A., J. D. Olden, T. J. Beechie, M. J. Kennard, P. B. Skidmore, C. P. Konrad, and H. Imaki. 2012. Hydrogeomorphic classification of Washington state rivers to support emerging environmental flow management strategies. River Resource Applications 28: 1340-1358.

Reiss, K. Yuki, K. Gallo, P. Dawson, D. Konnoff, and L. Croft. 2008. Process for evaluating the contribution of national forest system lands to aquatic ecological sustainability. A regional pilot process conducted on the Okanogan-Wenatchee and Colville National Forests. USDA Forest Service, Pacific Northwest Region, Region 6. Portland, OR. August 2, 2008.

Reynolds, R. T., A. J. Sanchez Meador, J. A. Youtz, T. Nicolet, M. S. Matonis, P. L. Jackson, D. G. DeLorenzo, and A. D. Graves. 2013. Restoring Composition and Structure in Southwestern Frequent-Fire Forests: A science-based framework for improving ecosystem resiliency. General Technical Report RMRS-GTR-310. USDA Forest Service, Rocky Mountain Research Station. 86 p.

Richardson, J. S., R. J. Naiman, and P. A. Bisson. 2012. How did fixed-width buffers become standard practice for protecting freshwaters and their riparian areas from forest harvest practices? Freshwater Science, 31(1): 232-238.

Rieman, B., D. Lee, D. Burns, R. Gresswell, M. Young, R. Stowell, J. Rinne, and P. Howell. 2003. Status of native fishes in the western United States and issues for fire and fuels management. Forest Ecology and Management 178: 197-211.

Rieman, B., D. Lee, G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings-Fire Effects on Rare and Endangered Species and Habitat Conference. Coeur d'Alene, Idaho. November 13-16, 1995.

Rieman, B. E., C. L. Smith, R. J. Naiman, G. T. Ruggerone, C. C. Wood, N. Huntly, E. N. Merrill, J. R. Alldredge, P. A. Bisson, J. Congleton, K. D. Fausch, C. Levings, W. Pearcy, D. Scarnecchia, and

P. Smouse. 2015. A Comprehensive Approach for Habitat Restoration in the Columbia Basin. Fisheries, 40(3): 124-135.

Rieman, B. E., D. Isaak, S. Adams, D. Horan, D. Nagel, C. Luce, and D. Myers. 2007. Anticipated climate warming effects on bull trout habitats and populations across the interior Columbia basin. Transactions of the American Fisheries Society 136: 1552-1565.

Rieman, B. E. and J. D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302. Ogden, UT. USDA Forest Service, Intermountain Research Station. 38 p.

Rieman, B. E., J. T. Peterson, and D. L. Myers. 2006. Have brook trout (*Salvelinus fontinalis*) displaced bull trout (*Salvelinus confluentus*) along longitudinal gradients in central Idaho streams? Canadian Journal of Fisheries and Aquatic Sciences 63: 63–78.

Rinke, S. 2012. Personal communication between Dick Phillips, Economist (retired), Delilah Jaworski, Social Scientist, USDA Forest Service R6 Regional Office and Susan Rinke, Forest Contracting Officer (retired), Okanogan-Wenatchee National Forest. 2012.

Robichaud, P. R., C. H. Luce, and R. E. Brown. 1993. Variation between different surface conditions in timber harvest sites in the Southern Appalachians. In Proceedings from the Russia, U.S. and Ukraine international workshop on quantitative assessment of soil erosion. Moscow, Russia, Sept. 20-24, 1993.

Robichaud, P. R. and R. D. Hungerford. 2000. Water repellency by laboratory burning of four northern Rocky Mountain forest soils. Journal of Hydrology, 231-232: 207-219.

Robinson, D. C. E. and S. J. Beukema. 2012. Through a glass, darkly—comparing VDDT and FVS, p. 123. In: Kerns, B. K., A. J. Shlisky, and Daniel J. (tech. eds.) 2012. Proceedings of the first landscape state-and-transition simulation modeling conference, June 14-16, 2011, Portland, Oregon. General Technical Report PNW-GTR-869. USDA Forest Service, Pacific Northwest Research Station. Portland, OR. 215 p.

Rodtka, M. C. and J. P. Volpe. 2007. Effects of water temperature on interspecific competition between juvenile bull trout and brook trout in an artificial stream. Transactions of the American Fisheries Society 136: 1714-1727.

Rominger, E. M. 1995. Late winter foraging ecology of woodland caribou. Ph.D. Dissertation, Washington State University, Pullman, WA. 68 p.

Rominger, E. M., C. T. Robins, and M. A. Evans. 1996. Winter foraging ecology of woodland caribou in northeastern Washington. Journal of Wildlife Management 60: 719-728.

Rominger, E. M. and J. L. Oldemeyer. 1989. Early-winter habitat of woodland caribou, Selkirk Mountains, British Columbia. Journal of Wildlife Management 53: 238-243.

Roni, P., G. Pess, T. Beechie, and S. Morley. 2010. Estimating changes in coho salmon and steelhead abundance from watershed restoration: how much restoration is needed to measurably increase smolt production? North American Journal of fisheries Management 30: 1469-1484.

Roni, P., T. J. Beechie, R. E. Bilby, F. E. Leonetti, M. M. Pollock, and G. P. Pess. 2002. A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific Northwest Watersheds. North American Journal of Fisheries Management, 22: 1–20.

Root, T. L., J. T. Price, K. R. Hall, S. H. Schneider, C. Rosenzweig, and J. A. Pounds. 2003. Fingerprints of global warming on wild animals and plants. Nature 421: 57-60.

Roper, B., E. Archer, R. Al-Chokhachy, J. Kershner, and C. Meredith. 2016. Monitoring policy relevant stream habitat conditions: A thirteen year perspective from the Interior Columbia River Basin. Manuscript in preparation.

Rosenberger, R. S., L. A. Bell, P. A. Champ, and E. L. Smith. 2012. Nonmarket economic values of forest insect pests: an updated literature review. General Technical Report RMRS-GTR-275www. USDA Forest Service, Rocky Mountain Research Station. Fort Collins, CO. 46 p.

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO. 390 p.

Ross, J. A. 1998. Spokane. In: Sturtevant, W. C. ed. Handbook of North American Indians. Vol. 12. Washington D.C.: Smithsonian Institute.

Rothacher, J. 1970. Increases in water yield following clear-cut logging in the Pacific Northwest. Water Resources Research 6(2): 653-658.

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2005. Effects of roads on elk: Implications for management in forested ecosystems. Pages 42-52 in: Wisdom, M. J. (tech. ed.) The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Group Communications, Lawrence, Kansas, USA.

Rowland, M. M., M. J. Wisdom, D. H. Johnson, B. C. Wales, J. P. Copeland, and F. B. Edelmann. 2003. Evaluation of landscape models for wolverines in the interior Northwest, USA. Journal of Mammalogy 8: 92-105.

Ruediger, B., J. Claar, S. Gniadek, (and others). 2000 Canada lynx Conservation Assessment and Strategy. USDA Forest Service, Forest Service Publication, R1-00-53. Missoula, MT. 142 p.

Ruhl, J. B., S. E. Kraft, and C. L. Lant. 2007. The Law and Policy of Ecosystem Services. Island Press, Washington D.C. 360 p. Available online at: https://islandpress.org/book/the-law-and-policy-of-ecosystem-services

Running, S.W., R. R. Nemani, F. A. Heinsch, M. Zhao, M. Reeves, and H. Hashimoto. 2004. A continuous satellite-derived measure of global terrestrial primary production. BioScience 54: 547-560.

Ryan, M. G., M. E. Harmon, R. A. Birdsey, C. P. Christian, L. S. Heath, R. A. Houghton, R. B. Jackson, D. C. Duncan, J. F. Morrison, B. C. Murray, D. E. Pataki, and K. E. Skog. 2010. A synthesis of the science on forests and carbon for U.S. forests. Issues in Ecology, Report number 13. Ecological Society of America.

Safeeq, M., G. E. Grant, S. L. Lewis, and C. L. Tague. 2013. Coupling snowpack and groundwater dynamics to interpret historical streamflow trends in the western United States. Hydrological Processes. 27: 655-668.

Sanpoil Watershed Action Plan (SWAP). 2012. Upper Sanpoil River and West Fork Sanpoil River Watershed Action Plan. USDA Forest Service, Colville National Forest, Republic Ranger District. Republic, WA.

Schlesinger, W. H. 1977. Carbon balance in terrestrial detritus. Annual Review Of Ecology and Systematics. 8: 51–81.

Schmidt, K. M., J. P. Menakis, C. C. Hardy, W. J. Hann, and D. L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Schmidt, M. G., S. E. Macdonald, and R. L. Rothwell. 1996. Impacts of harvesting and mechanical site preparation on soil chemical properties of mixed-wood boreal forest sites in Alberta. Canadian Journal of Soil Science, 76: 531–540.

Schmidt, M. W. I., M. S. Torn, S. Abiven, T. Dittmar, G. Guggenberger, I. A. Janssens, M. Kleber, I. Kögel-Knabner, J. Lehmann, D. A. C. Manning, P. Nannipieri, D. P. Rasse, S. Weiner, and S. E. Trumbore. 2011. Persistence of soil organic matter as an ecosystem property. Nature, 478: 49–56.

Schmidt, W. 1989. Plant Dispersal by motor cars. Vegetation 80: 147-52.

Schmitz, R. F. and K. E. Gibson. 1996. Douglas-fir Beetle. Forest Insect and Disease Leaflet 5. USDA Forest Service.

Schreiber, S. G, A. R. Bearlin, S. J. Nicol, and C. R. Todd. 2004. Adaptive management: A synthesis of current understanding and effective application. Ecological Management and Restoration, 5(3): 177-182.

Schulze, E. D., J. Lloyd, F. M. Kelliher, C. Wirth, C. Rebmann, B. Luhker, M. Mund, A. Knohl, I. M. Milyukova, W. Schulze, W. Ziegler, A. B. Varlagin, A. F. Sogachev, R. Valentini, S. Dore, S. Grigoriev, O. Kolle, M. I. Panfyorov, N. Tchebakova, and N. N. Vygodskaya. 1999. Productivity of forests in the Eurosiberian boreal region and their potential to act as a carbon sink – a synthesis. Global Change Biology, 5: 703–722.

Schuman, G., H. Janzen, and J. Herrick. 2002. Soil carbon dynamics and potential carbon sequestration by rangelands. Environmental Pollution 116: 391-396.

Schwilk, D.W., J. E. Keeley, E. E. Knapp, J. McIver, J. D. Bailey, C. Fettig, C. E. Fiedler, R. J. Harrod, J. J. Moghaddas, K.W. Outcalt, C. N. Skinner, S. L. Stephens, T. H. Waldrop, D. A. Yaussy, and A. Youngblood. 2009. The national fire and fire surrogate study: effects of alternative fuel reduction methods on forest vegetation structure and fuels. Ecological Applications. 19: 285–304. Available online at: http://dx.doi.org/10.1890/07-1747.1

Seattle City Light. 2014a. Boundary Dam facts. Available online at: http://www.seattle.gov/light/generation/boundary/

Seattle City Light. 2014b. Millpond dam removal. Available online at: http://www.seattle.gov/light/generation/boundary/millponddam.asp

Sedell, J., M. Sharpe, D. D. Apple, M. Copenhagen, and M. Furniss. 2000. Water and the Forest Service. USDA Forest Service, Washington Office, FS-660. 26 p. http://www.fs.fed.us/publications/policyanalysis/water.pdf

Seeds, J. and G. Foster. 2010. Sediment policy revisions to reduce nonpoint sources of toxic pollutants to Oregon waters. Oregon Department of Environmental Quality.

Servheen, C. and M. Cross. 2010. Climate change impacts on grizzly bears and wolverines in the Northern U.S. and Transboundary Rockies: Strategies for conservation. Report on a workshop held Sept. 13-15, 2010 in Fernie, British Columbia. 23 p.

Sestrich, C. M., T. E. McMahon, and M. K. Young. 2011. Influence of fire on native and nonnative salmonid populations and habitat in a Western Montana basin. Transactions of the American Fisheries Society 140: 136-146.

Sharma, R. and R. Hilborn. 2001. Empirical relationships between watershed characteristics and coho salmon (*Oncorhynchus kisutch*) smolt abundance in 14 western Washington streams. Canadian Journal of Fisheries and Aquatic Sciences 58(7): 1453-1463.

Sharrow, S. 2008. Trading Carbon Sequestration and Carbon Credits. Department of Rangeland Ecology and Management. Oregon State University, Corvallis, OR. The Grazier, December 2008: 2-7.

Sheley, R. L., B. H. Mullin, and P. K. Fay. 1995. Managing Riparian Weeds. Rangelands 17(5): 154-7.

Shiflet, T. N., ed. 1974. Rangeland cover types of the United States. Misc. Pub. 1974-13. Society for Range Management. Denver, CO. 152 p.

Shrestha, G. and P. Stahl. 2008. Carbon accumulation and storage in semi-arid sagebrush steppe: Effects of long-term grazing exclusion. Agriculture, Ecosystems, and Environment 125(2008): 173-181.

Simpson, K. and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou. Management Concerns, Interim Management Guidelines and Research Needs. Wildlife Working Report No. WR-99. British Columbia Ministry of Environment, Lands, and Parks, Wildlife Branch. Victoria, BC. 11 p.

Singleton, P. H., W. L. Gaines, and J. F. Lehmkuhl. 2002. Landscape permeability for large carnivores in Washington: a geographic information system weighted-distance and least-cost corridor assessment. USDA Forest Service, Pacific Northwest Research Station, PNW-GTR-549.

Skidmore, P., K. Hansen, and W. Quimby. 1994. Snow accumulation and ablation under fire-altered lodgepole pine forest canopies. Annual Meeting of the Western Snow Conference.

Skog, K. E. 2008. Sequestration of carbon in harvested wood products for the United States. Forest Product Journal 58: 56-72.

Slayback, D. A., J. E. Pinzon, S. O. Los, and C. Tucker. 2003. Northern hemisphere photosynthetic trends 1982-1999. Global Change Biology 9: 1-15.

Smith, J. E. and L. S. Heath. 2004. Carbon stocks and projections on public forestlands in the United States, 1952-2040. Environmental Management 33: 433-442.

Smith, J. E., L. S. Heath, K. E. Skog, and R. A. Birdsey. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States.

Snover, A. K., A. F. Hamlet, and D. P. Lettenmaier. 2003. Climate-change scenarios for water planning studies: pilot applications in the Pacific Northwest. Bulletin of the American Meteorological Society. 84: 1513–1518.

Snover, A. K., G. S. Mauger, L. C. Whitely Binder, M. Krosby, and I. Tohver. 2013. Climate change impacts and adaptation in Washington State: Technical Summaries for Decision Makers. State of Knowledge Report prepared for the Washington State Department of Ecology. Climate Impacts Group, University of Washington. Seattle, WA.

Snow Data Assimilation System (SNODAS) data products. Available online at: http://nsidc.org/data/g02158.

Society for Range Management. 1998. Glossary of terms available online at: https://globalrangelands.org/glossary/

Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service, Washington D.C.

Soule, M. E. 1987. Viable populations for conservation. Cambridge University Press, Cambridge, MA.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. Funded jointly by the U.S. EPA, USDI Fish and Wildlife Service and National Marine Fisheries Service. TR-4501-96-6057. Man Tech Environmental Research Services Corp., Corvallis, OR.

Spies, T. A., M. A. Hemstrom, A. Youngblood, and S. Hummel. 2006. Conserving old-growth forest diversity in disturbance-prone landscapes. Conservation Biology 20(2): 351-362.

Spies, T. A., T. W. Giesen, F. J. Swanson, J. F. Franklin, D. Lach, and K. N. Johnson. 2010. Climate change adaptation strategies for federal forests of the Pacific Northwest, USA: ecological, policy, and socio-economic perspectives. Landscape Ecology.

Spokane Tribe of Indians. 2015. Sustainable Community Master Plan. Wellpinit, WA. Available online at: http://www.spokanetribe.com/userfiles/FINAL_2015_SCMP.pdf

Squires, J. R., N. J. DeCesare, L. E. Olson, J. A. Kolbe, M. Hebblewhite, and S. A. Parks. 2013. Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery. Biological Conservation. 157: 187-195.

Srivastava, A. 2013. Modeling hydrological processes in three mountainous watersheds in the U.S. Pacific Northwest. Doctoral dissertation, Washington State University, Department of Biological Systems Engineering.

Staab, B., M. Safeeq, G. Grant, D. Isaak, C. Luce, M. Kramer, D. Konnoff, J. Chatel, and J. Capurso. 2014. Climate change vulnerability assessment. Resources for national forests and grasslands in the Pacific Northwest -Water Resources and Aquatic Ecosystems. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Stanley, B. and P. A. Arp. 2002. Effects of forest harvesting on basin-wide water yield in relation of percent watershed cut: A review of literature. Fundy Model Forest Network, Natural Resources Department of Canada, Fredericton, New Brunswick.

State of Washington, Office of Financial Management. 2010. Decennial Census, Census 2010 Data, Percent Change in Population by County: 2000 to 2010. Available online at: http://www.ofm.wa.gov/pop/census2010/pl/maps/map02.asp

State of Washington Office of Financial Management. 2011. Forecast of the State Population. Available online at: www.ofm.wa.gov/pop/stfc/stfc2011/stfc_2011.pdf

State of Washington, Office of Financial Management, Forecasting Division. 2012. 2012 Projections County Growth Management Population Projections by Age and Sex: 2010-2040. Available online at: http://www.ofm.wa.gov/pop/gma/projections12/GMA_2012_county_pop_projections.pdf (December 18, 2014.)

Stavi, I., E. Ungar, H. Lavee, and P. Sarah. 2008. Grazing-induced spatial variability of soil bulk density and content of moisture, organic carbon and calcium carbonate in semi-arid rangeland. Catena 75(3): 288-296.

Stednick, J. D. 1996. Monitoring the effects of timber harvest on annual water yield. Journal of Hydrology, 176(1-4): 79-95.

Steinfeld, H. and T. Wassenaar. 2007. The Role of Livestock Production in Carbon and Nitrogen Cycles. Annual Review of Environment and Resources 32: 271-94.

Stevens County. 2007. Stevens County Washington Community Wildfire Protection Plan (CWPP), Volume II, October 25, 2007, updated May 30, 2008. Stevens County Community Wildfire Protection Plan Planning committee in cooperation with Northwest Management, Inc., 233 E. Palouse River Dr., P.O. Box 9748, Moscow, ID, 83843, Tel: 208-883-4488, www.Consulting-Foresters.com (Updated 2015)

Stevens County. 2008. Stevens County Comprehensive Plan. Colville, WA. Available online at: http://www.co.stevens.wa.us/landservices/ordinance_compplan.php

Stewart, I. T., D. R. Cayan, and M. D. Dettinger. 2004. Changes in snowmelt runoff timing in western North America under a 'business as usual' climate change scenario. Climate Change. 62: 217–232.

Stewart, I. T., D. R. Cayan, and M. D. Dettinger. 2005. Changes toward earlier streamflow timing across western North America. Journal of Climate, 18: 1136-1155.

Stinson, D.W. 2001. Washington state recovery plan for the lynx. Washington State Department of Fish and Wildlife, Olympia, WA. 78 p.

Stoelinga, M. T., M. D. Albright, and C. F. Mass. 2010. A new look at snowpack trends in the Cascade Mountains. Journal of Climate Vol. 23, No. 10 (2010): 2473-2491.

Streater, S. 2009. Climate Change: Interest grows in use of ranchland in fight against warming. Environment and Energy Daily, E&E Publishing LLC. January 8, 2009.

Sturtevant, W. 1996. Handbook of North American Indians. Smithsonian Institution, Washington DC. 10 p.

ST-Sim Software. Apex Resource Management Solutions, Ltd. 2014. Version 2.3.8. Available online at: http://www.apexrms.com/ (accessed November 20, 2014).

Suring, L. H., W. L. Gaines, B. C. Wales, K. Mellen-McLean, J. S. Begley, and S. Mohoric. 2011. Maintaining populations of terrestrial wildlife through land management planning: A case study. Journal of Wildlife Management. 75(4): 945-958.

Svejcar, T., R. Angell, J. Bradford, W. Dugus, W. Emmerick, A. Frank, T. Gilmanov, M. Haferkamp, D. Johnson, H. Mayeux, P. Meilnick, J. Morgan, N. Saliendra, G. Shuman, P. Sims, and K. Snyder. 2008. Carbon Fluxes on North American Rangelands. Rangeland Ecology and Management 62(5): 465-473.

Svejcar T., C. Boyd, K.Davies, M.Madsen, J.Bates, R.Sheley, C.Marlow, D. Bohnert, M.Borman, R.Mata-Gonzalez, J.Buckhouse, T.Stringham, B. Perryman, S.Swanson, K.Tate, M.George, G.Ruyle, B.Roundy, C.Call, K.Jensen, K.Launchbaugh, A.Gearhart, L.Vermeire, J.Tanaka, J.Derner, G.Frasier, and K.Havstad. 2014. Western Land Managers will Need all Available Tools for Adapting to Climate Change, Including Grazing: A Critique of Beschta et al. Environmental Management. 53(6): 1035-8.

Swanson, M. E., J. F. Franklin, R. L. Beschta, C. M. Crisafulli, D. A. DellaSala, R. L. Hutto, D. B. Lindenmayer, and F. J. Swanson. 2010. The forgotten stage of forest succession: early-successional ecosystems on forest sites. Frontiers in Ecology and Management 2010. Available online at: http://www.esajournals.org/doi/abs/10.1890/090157

Switalski, T. A., J. A. Bissonette, T. H. DeLuca, C. H. Luce, and M.A. Madej. 2004. Benefits and impacts of road removal. Frontiers in Ecology and the Environment. 2(1): 21-28.

Tague, C., G. Grant, M. Farrell, J. Choate, and A. Jefferson. 2008. Deep groundwater mediates streamflow response to climate warming in the Oregon Cascades. Climatic Change 86: 189-210.

Tate, K.W., Ph.D. 2015. Personal email communication between Tom Hilken, Rangeland Program Manager, USDA Forest Service R6 Regional Office (retired) and Dr. Kenneth Tate, Ph.D., Professor and Cooperative Extension Specialist, UC Davis. 2015.

Taylor, R. N. and M. Love. 2003. California Salmonid Stream Habitat Restoration Manual. Part IX: Fish Passage Evaluation at Stream Crossings. California Department of Fish and Wildlife. 100 p.

The International Selkirk Loop. http://www.selkirkloop.org/ (accessed August 2015).

The National Wildfire Coordinating Group (NWCG). 2016. Available online at: https://www.nwcg.gov/

Thomas, C. D. and J. J. Lennon. 1999. Birds extend their ranges northward. Nature 399: 213.

Thoms, A.V. 1987. Upland Land Use and the Initial Assessment of 45PO148: The Sullivan Lake Archaeological Project, Northeastern Washington. Pullman, WA: Center of Northwest Anthropology, Washington State University.

Thoms, A.V. and R. F. Schalk. 1984. Prehistoric Land Use in the Middle Kootenai Valley. In: Cultural Resources Investigations for Libby Reservoir, Northwestern Montana. Project Report Vol. 1. Environment, Archaeology and Land Use Patterns in the Middle Kootenai River Valley. Pullman, WA: Washington State University Center for Northwestern Anthropology.

Thuiller, W., D. M. Richardson, and G. F. Midgley. 2007. Will climate change promote alien plant invasions? In: Ecological Studies, Vol. 193. W. Nentwig, ed. Berlin. Berlin. Springer-Verlag: 197-211.

Trettin, C. C., M. F. Jurgensen, and J. M. Kimble. 2003. Carbon cycling in wetland forest soils. Lewis Publishers, Boca Raton, London, New York, Washington D.C.

Triangle Associates, Incorporated. 2015. Synthesis of Public Comments on the Process of Revising Forest Plans in the Northwest Forest Plan Area. Prepared for: U.S. Institute for Environmental Conflict Resolution and the United States Forest Service, Regions 5 and 6. 40 p.

Troendle, C. A. and R. M. King. 1985. The effect of timber harvest on the Fool Creek watershed 30 years later. Water Resources Research 21(12): 1915-1922.

Troendle, C. A., M. S. Wilcox, G. S. Bevenger, and L. S. Porth. 2001. The Coon Creek water yield augmentation project: Implementation of timber harvesting technology to increase streamflow. Forest Ecology and Management 143(1-3): 179-187.

Trotter, P., B. McMillan, N. Gayeski, P. Spruell, and A. Whitely. 2001. Genetic and phenotypic catalog of Native resident trout of the interior Columbia River Basin. Prepared for Northwest Power Planning Council. Funded by the Bonneville Power Administration (BPA report DOE/BP-00004575-1). Portland, OR. May 1, 2001.

Turner, M. G., R. H. Gardner, and R. V. O'Neill. 2001. Landscape Ecology in Theory and Practice. New York: Springer-Verlag. 401 p.

Tyser, R. and C. Key. 1988. Spotted Knapweed in Natural Area Fescue Grasslands: An Ecological Assessment. Northwest Science 62:4: 151-160.

Tyser, R. and C. Worley. 1992. Alien Flora in Grasslands Adjacent to Road and Trail Corridors in Glacier National Park, Montana (USA). Conservation Biology 6:2: 253-262. Available online at: http://www.jstor.org/stable/2386247

U.S. Bureau of Economic Analysis. 2012. Regional Economic Accounts, Local Area Personal Income. Available online at: http://www.bea.gov/regional/ (Accessed January 15, 2014).

U.S. Bureau of Labor Statistics. 2013. Local Area Unemployment. Available online at: http://www.bls.gov/lau (Accessed January 15, 2014).

U.S. Census Bureau. 1990. Decennial Census. Accessed via American FactFinder. Available online at: factfinder.census.gov (Accessed August 9, 2010).

U.S. Census Bureau. 2000. Decennial Census. Accessed via American FactFinder. Available online at: factfinder.census.gov (Accessed August 9, 2010).

U.S. Census Bureau. 2010. Decennial Census. Accessed via American FactFinder, version 2. Available online at: factfinder2.census.gov (Accessed January 5, 2012).

U.S. Census Bureau. 2012a. American Community Survey Five-Year Estimates, 2007-2011. Accessed via American FactFinder, version 2. Available online at: factfinder2.census.gov (Accessed January 24, 2012).

U.S. Census Bureau. 2012b. American Community Survey Five-Year Estimates, 2008-2012. Accessed via American FactFinder, version 2. Available online at: factfinder2.census.gov (Accessed December 30, 2013).

U.S. Climate Change Science Program, Subcommittee on Global Change Research. 2008. Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources, Final Report, Synthesis and Assessment Product 4.4.

U.S. Congress. 1972. Federal Water Pollution Control Act (Public Law, P.L. 92-500), commonly known as the Clean Water Act (as amended in 1977, 1981, 1987, and 2002). Washington DC.

U.S. Congress. 2003. Public Law 108-148, Healthy Forests Restoration Act of 2003. 108th Congress. Washington DC.

U.S. Department of Agriculture. 2015. Pollinator-friendly Best Management Practices for Federal Lands. U.S. Department of Agriculture. Report on file, Colville National Forest.

USDA Economic Research Service (ERS). 2015. 2013 Rural-Urban Continuum Codes. Available online at: http://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx (Accessed May 12, 2015).

USDA Forest Service. (No date). Forest Service Manual and Handbooks. USDA Forest Service Headquarters, Washington D.C. Available online at: http://www.fs.fed.us/im/directives/.

USDA Forest Service. (No date). Okanogan-Wenatchee National Forest. Land Management Plans. Available online at: http://www.fs.usda.gov/detail/okawen/landmanagement/planning/?cid=fsbdev3_053653 (accessed August 2015).

USDA Forest Service. 1974. National Forest Landscape Management. The Visual Management System, U.S. Government Printing Office, Washington D.C. U.S. Department of Agriculture.

USDA Forest Service. 1982a. 1982 Planning Rule, National Forest System Land and Resource Management Planning, sections 219.26 and 219.27. Available online at: http://www.fs.fed.us/emc/nfma/includes/nfmareg.html#scope and applicability

USDA Forest Service. 1982b. Recreation Opportunity Spectrum Users Guide. USDA Forest Service, Washington D.C. 40 p.

USDA Forest Service. 1988a. Colville National Forest Land and Resource Management Plan. USDA Forest Service.

USDA Forest Service. 1988b. Colville National Forest Land and Resource Management Plan, Final Environmental Impact Statement and Record of Decision. Portland, OR: Pacific Northwest Region.

USDA Forest Service. 1988c. Colville National Forest Guidelines for Management in Occupied Grizzly Bear Habitat.

USDA Forest Service. 1988d. General water quality best management practices. Pacific Northwest Region.

USDA Forest Service. 1988e. Regional Forester's Sensitive Species List and Transmittal of Strategic Species List. Transmittal memo and two enclosures. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 1993. Biological Evaluation of the Alternatives Considered for Timber Sale Planning and Interim Forest Plan Amendment for Nine Eastside National Forests in the Pacific Northwest Region of the Forest Service. January 10, 1993. 37 p.

USDA Forest Service. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 1995a. Inland native fish strategy environmental assessment decision notice and finding of no significant impact: interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana, and portions of Nevada (INFISH). USDA Forest Service, Intermountain, Northern, and Pacific Northwest Regions. 39 p.

USDA Forest Service. 1995b. Environmental Assessment for the continuation of interim management guidelines directing the establishment of riparian, ecosystem and wildlife standards for timber sales (Eastside Screens). Portland, OR: USDA Forest Service, Pacific Northwest Region. 23 p.

USDA Forest Service. 1995c. Landscape aesthetics: A handbook for scenery management. (Place of publication unknown). Agriculture handbook number 701.

USDA Forest Service. 1997. Programmatic Agreement Among the United States Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Officer Regarding Cultural Resources Management on National Forests in the State of Washington (R6 programmatic agreement).

USDA Forest Service. 1998a. Colville National Forest Environmental Assessment, Integrated noxious weed treatment. Unpublished. Colville National Forest. Colville, WA.

USDA Forest Service. 1998b. Properly functioning condition, rapid assessment process.

USDA Forest Service, 1998c. Region 6 Soil Quality Standards and Guidelines (No. FSM 2520), R-6 Supplement 2500.98-1.

USDA Forest Service. 1999a. Noxious Weed Prevention Guidelines for the Colville National Forest. Unpublished guidelines. Colville National Forest. Colville, WA.

USDA Forest Service. 1999b. Stemming the Invasive Tide: Forest Service Strategy for Noxious and Nonnative Invasive Plant Management.

USDA Forest Service. 1999c. Sustaining the peoples lands. Recommendations for stewardship of the National Forests and Grasslands into the next century. Committee of Scientists. U.S. Department of Agriculture, Washington D.C. 237 p.

USDA Forest Service. 2000. The National Fire Plan. Available online at: https://www.fs.fed.us/r6/fire/fireplan/

USDA Forest Service. 2001a. National Energy Plan. USDA Forest Service, Washington D.C.

USDA Forest Service. 2001b. Roadless area conservation rule. USDA Forest Service, Washington D.C.

USDA Forest Service. 2001c. The Built Environment Image Guide for the National Forests and Grasslands, Handbook 710, September 2001.

USDA Forest Service. 2003. Colville National Forest winter recreation strategy for the Sullivan Lake Ranger District. On file at: Colville National Forest, Sullivan Lake Ranger District, Metaline Falls, WA.

USDA Forest Service. 2004. National Strategy and Implementation Plan for Invasive Species Management.

USDA Forest Service. 2005a. Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants and accompanying Record of Decision. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 2005b (revised 2007). Pacific Northwest Region Aquatic Restoration Strategy (ARS). Portland, OR. 28 p.

USDA Forest Service. 2006a. Recreation Site Facility Master Plan: 5-year Proposed Program of Work and Programmatic Effects of Implementation. Colville National Forest, Pacific Northwest Region.

USDA Forest Service. 2006b (updated 2010). Species viability assessments in support of Forest Plan revision. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 2006c. Programmatic Agreement among the NF in WA State & WA SHPO, ACHP regarding Recreation Residence, Recreation Residence Tract and Organizational Camp/Club Management. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 2007a. Open Space Conservation Strategy. USDA Forest Service, Washington D.C. 16 p.

USDA Forest Service. 2007b. Technical guide to managing ground water resources. Minerals and Geology Management, Watershed, Fish, Wildlife, Air, and Rare Plants, and Engineering. FS-881.

USDA Forest Service. 2008a. Aquatic and riparian conservation strategy (ARCS). USDA Forest Service, Region 6. Portland, OR. August 13, 2008.

USDA Forest Service. 2008b. Forest Service Strategic Framework For Responding to Climate Change Version 1.0.

USDA Forest Service. 2009a. Colville and Okanogan-Wenatchee National Forest, Forest Plan Revision Team Wilderness Evaluations. Colville and Okanogan-Wenatchee National Forests, Pacific Northwest Region.

USDA Forest Service. 2009b. Designation of Section 368 Energy Corridors on National Forest System Land in 10 Western States. Record of Decision. USDA Forest Service, Washington D. C. 79 p.

USDA Forest Service. 2009c. Title IV of the Omnibus Public Land Management Act of 2009, Collaborative Forest Landscape Restoration Program. U.S. Department of Agriculture Forest Service. Washington D.C. Available online at: http://www.fs.fed.us/restoration/CFLRP/index.shtml (accessed August 2015).

USDA Forest Service. 2010a. National Visitor Use Monitoring (NVUM) Results, multiple National Forest reports. Available online at: http://www.fs.fed.us/recreation/programs/nvum

USDA Forest Service. 2010b. PNW Region 6 Stream Inventory Handbook. 2010 version 2.1. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 2010c. R6 Surrogate Species (formerly Focal Species) for Species Viability Assessments. USDA Forest Service, Pacific Northwest Region, Portland, OR.

USDA Forest Service. 2011a. Determining Lands Suitable For Timber Production, And Long-Term Sustained Yield, Allowable Sale Quantity And Harvest Volume Estimates For Forest Plan Revisions Under Provisions Of The 1982 Rule. USDA Forest Service, Pacific Northwest Region, Portland, OR. March 14, 2011. 34 p.

USDA Forest Service. 2011b. East Branch Le Clerc Creek watershed restoration action plan. Colville National Forest, Sullivan Ranger District, Metaline Falls, WA.

USDA Forest Service. 2011c. Record of Decision, Nationwide Application of Fire Retardant on National Forest System Land, December 13, 2011. 70 p.

USDA Forest Service. 2011d. Technical report: Analysis of the management situation for the revision of the Colville National Forest Plan. (updated in 2018)

USDA Forest Service. 2012a. Colville National Forest Recreation Strategy. Colville National Forest, Pacific Northwest Region.

USDA Forest Service. 2012b. Cut and Sold Reports. Available online at: http://www.fs.fed.us/forestmanagement/products/sold-harvest/cut-sold.shtml (Accessed December 3, 2013).

USDA Forest Service. 2012c. Level II Region 6 stream inventory protocol. Pacific Northwest Region.

USDA Forest Service. 2012d. National best management practices for water quality management on national forest system lands. Volume 1: National core BMP technical guide. FS-990a. 165 p.

USDA Forest Service. 2012e. National Visitor Use Monitoring Program: Colville NF Visitor Use Report. Available online at: http://www.fs.fed.us/recreation/programs/nvum (Accessed December 3, 2013).

USDA Forest Service. 2012f. Ninemile Creek watershed restoration action plan. Colville National Forest, Republic Ranger District, Republic, WA.

USDA Forest Service. 2012g. 2012 Planning Rule, National Forest System Land and Resource Management Planning. Available online at: http://www.fs.usda.gov/planningrule

USDA Forest Service. 2012h. Visitor Use Report, Colville NF, National Visitor Use Monitoring Data Collected FY 2009.

USDA Forest Service. 2012i. West Branch Le Clerc Creek watershed restoration action plan. Colville National Forest, Sullivan Lake Ranger District, Metaline Falls, WA.

USDA Forest Service. 2013a. Colville National Forest fiscal year 2013 forest plan monitoring and evaluation report. Colville National Forest, Supervisor's Office, Colville, WA.

USDA Forest Service. 2013b. Memorandum of understanding between the State of Washington Department of Transportation WSDOT agreements No. GCA 1336 and the USDA, Forest Service, Pacific Northwest Region. FS Agreement No. 13-RU-11060051-021. Pacific Northwest Region, Portland, OR.

USDA Forest Service. 2013c. Water quality protection on national forests in the pacific southwest region: Best management practices evaluation program, 2008-2010. 42 p.

USDA Forest Service. 2014a. Colville National Forest, Total maximum daily load-fecal coliform 2014 report and request for category changes. On file at: Colville National Forest Supervisor's Office, Colville, WA.

USDA Forest Service. 2014b. Climate change vulnerability assessment and adaptation: Resources for national forests and grasslands in the Pacific Northwest, water resources and aquatic ecosystems. Pacific Northwest Regional Office, Portland, OR.

USDA Forest Service. 2014c. Cut and Sold Reports. Available online at: http://www.fs.fed.us/forestmanagement/documents/sold-harvest/reports/2014/2014_Q1-Q4_CandS_R06.pdf (May 12, 2015).

USDA Forest Service. 2014d. Interior Columbia Basin Strategy (2003; revised 2014). Interior Columbia Basin Strategy: A Strategy for Applying the Knowledge Gained by the Interior Columbia Basin Ecosystem Management Project to the Revision of Land Use Plans and Project Implementation.

USDA Forest Service. 2014e. Payments to States and Counties. Available online at: http://www.fs.usda.gov/main/pts/securepayments/projectedpayments (May 12, 2015).

USDA Forest Service. 2014f. Proposed direction for groundwater resource management fact sheet. Available online at: http://www.fs.fed.us/geology/groundwater%20handout%20v3%205%202.pdf

USDA Forest Service. 2015a. 2015-2020 Strategic Plan. USDA Forest Service Headquarters, Washington D.C.

USDA Forest Service. 2015b. Forest plan revision – Forest listening sessions. Pacific Northwest Region.

USDA Forest Service. 2015c. Idaho Panhandle National Forests revised Land and Resource Management Plan. Missoula, MT and Coeur d'Alene, ID. Available online at: http://www.fs.usda.gov/detail/ipnf/landmanagement/planning/?cid=stelprdb5436518

USDA Forest Service. 2015d. Proposed directive on groundwater resource management, FSM 2560. Federal Register Vol. 79 No. 87, June 19, 2015, pages 25815-25824. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2014-05-06/pdf/2014-10366.pdf (79 FR 25815)

USDA Forest Service. 2015e. Regional Forester's Special Status Species List. Transmittal Memo and two enclosures. USDA Forest Service, Pacific Northwest Region, Portland, OR. July 2015. Available online at: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy

USDA Forest Service. 2015f. Watershed Condition Framework. Available online at: http://www.fs.fed.us/publications/watershed/

USDA Forest Service. 2016a. Aquatic and Riparian Conservation Strategy. Pacific Northwest and Pacific Southwest Regions. 125 p.

USDA Forest Service. 2016b. Future of Americas Forests and Rangelands: Update to the 2010 Resources Planning Act Assessment. Gen. Tech. Report WO-GTR-94. Washington D.C. 250 p.

USDA Forest Service. 2017a. Natural Resource Management Threatened, Endangered, and Sensitive Plants application (NRM TESP) database.

USDA Forest Service. 2017b. Regional aquatic and riparian conservation strategy guideline for annual livestock use and disturbance indicators (GM-3). Pacific Northwest and Pacific Southwest Regions. 30 p.

USDA Forest Service and USDI Bureau of Land Management. 1994b. Final Supplemental Environmental Impact Statement and Record of Decision On Management Of Habitat For Late-Successional And Old-Growth Forest Related Species Within The Range Of The Northern Spotted Owl (Northwest Forest Plan). Portland, Oregon. ACS references: https://reo.gov/documents/acs/final-seis/1final_eis.pdf

USDA Forest Service and USDI Bureau of Land Management. 1994a. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents in the range of the northern spotted owl and standards and guidelines for management of habitat for late-successional and old growth forest related species (Northwest Forest Plan). (Place of publication unknown). 74 p. (plus Attachment A: standards and guides) Available online at: https://reo.gov/documents/

USDA Forest Service and USDI Bureau of Land Management. 1995. Decision notice/decision record, FONSI, environmental assessment, and appendices for the implementation of interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California (PACFISH). (Place of publication unknown). 305 p.

USDA Forest Service and USDI Bureau of Land Management. 2000. The Interior Columbia Basin Supplemental Draft Environmental Impact Statement. Appendix 15 – Development of Restoration Priorities. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 26 p.

USDA Forest Service, USDI Bureau of Land Management, USDI Fish and Wildlife Service and USDC National Marine Fisheries Service. 2013. Memorandum to the Interagency Regional Executives from Interagency Coordinators Subgroup (ICS) of the Streamlined Consultation Procedures for section 7 of the Endangered Species Act. Subject: ICS Guidelines and Science review reports on tree thinning in Riparian Reserves of the Northwest Forest Plan.

USDA Forest Service and WADoE. 2000. Memorandum of agreement between the USDA Forest Service region 6 and Washington State Department of Ecology for meeting responsibilities under federal and state water quality laws.

USDA Global Change Program. 2008. U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990-2005. January 14, 2009.

USDA Natural Resources Conservation Service. 2006. Grazing and Grassland Management Can Improve Air Quality Through Carbon Sequestration. NRCS Grazing and Carbon Sequestration Fact Sheet 1, NRCS Pennsylvania August 2006.

USDA Natural Resources Conservation Service. 2007. Manure Chemistry – Nitrogen, Phosphorus, & Carbon. Manure Management Technology Development Team East National Technology Support Center. Manure Management Information Sheet, Number 7.

USDA Natural Resources Conservation Service. 2014. Snow Water Equivalent. Available online at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/snow/?cid=nrcs142p2_046155 (Accessed March 22, 2014)

U.S. Department of the Interior (USDI). 2012. The Department of the Interiors Economic Contributions, FY 2011. U.S. Department of the Interior. Washington D.C. 225 p.

USDI. 2014. Payments in Lieu of Taxes. Available online at: http://www.doi.gov/pilt/ (accessed May 12, 2015).

USDI Bureau of Land Management. (No date). Spokane District Resource Management Plan and Environmental Impact Statement, under revision. U.S. Department of the Interior Bureau of Land Management (BLM). Spokane, WA. Available online at: http://www.blm.gov/or/districts/spokane/plans/ewsjrmp/index.php (accessed August 2015).

USDI Bureau of Land Management. 2011. Analysis of the Management Situation: Eastern Washington and San Juan Resource Management Plan. March 2011. USDI BLM Spokane District. 356 p. Available online at: http://www.blm.gov/or/districts/spokane/plans/ewsjrmp/maps.php

USDI Bureau of Reclamation. 2011. Managing Water in the West: Climate and Hydrology Datasets for Use in the River Management Joint Operating Committee (RMJOC) Agencies' Longer Term Planning Studies: Part II Reservoir Operations Assessment for Reclamation Tributary Basins. 201 p. USDI Bureau of Reclamation, Pacific Northwest Region, Boise, ID.

USDI Bureau of Reclamation. 2014a. Grand Coulee Dam statistics and facts. Available online at: http://www.usbr.gov/pn/grandcoulee/pubs/factsheet.pdf

USDI Bureau of Reclamation. 2014b. Federal Columbia River power system biological opinion. Available online at: http://www.usbr.gov/pn/fcrps/index.html (Accessed April 25, 2014)

USDI Fish and Wildlife Service. (No date). Consultations – Overview. United States Department of Interior U.S. Fish and Wildlife Service (USFWS). Available online at: http://www.fws.gov/endangered/what-we-do/consultations-overview.html (Accessed August 2015).

USDI Fish and Wildlife Service. 1993. Grizzly Bear Recovery Plan. Missoula, MT.

USDI Fish and Wildlife Service. 1994. Recovery plan for woodland caribou in the Selkirk Mountains. Portland, OR: Selkirk Mountain Woodland Caribou Recovery Team, USDI Fish and Wildlife Service, Region 1. 71 p.

USDI Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants: Determination of threatened status for the Klamath River and Columbia River distinct population segments of bull trout. Federal Register 63 FR 31647. (June 10, 1998)

USDI Fish and Wildlife Service. 1999. A framework to assist in making Endangered Species Act determinations of effect for individual or grouped actions at the bull trout subpopulation watershed scale. Prepared by the USDI Fish and Wildlife Service (adapted from the National Marine Fisheries Service). February 1998; Revised 6/11/99. (Place of publication unknown). 45 p.

USDI Fish and Wildlife Service. 2000. Little Pend Oreille National Wildlife Refuge Comprehensive Conservation Plan. (Place of publication unknown). Available online at: http://www.fws.gov/refuge/Little_Pend_Oreille/what_we_do/planning.html (Accessed August 2015).

USDI Fish and Wildlife Service. 2001. Amended Biological Opinion for continued implementation of the Colville National Forest Land and Resource Management Plan: FWS Reference 1-9-00-F-4. 68 p.

USDI Fish and Wildlife Service. 2003a. 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation, Washington. Revised March 2003. Available online at: http://www.census.gov/prod/2003pubs/01fhw/fhw01-wa.pdf

USDI Fish and Wildlife Service. 2003b. Notice of Remanded Determination of Status for the Contiguous United States Distinct Population Segment of the Canada Lynx. Fed. Reg. 68(28): 40076-4101.

USDI Fish and Wildlife Service. 2005. Recovery outline for the Canada lynx. USDI Fish and Wildlife Service, Missoula, Montana.

USDI Fish and Wildlife Service. 2008. Bull trout (*Salvelinus confluentus*) 5 year review: summary and evaluation. Portland, OR: USDI Fish and Wildlife Service. 55 p. (Accessed May 3, 2008.) Available online at: http://www.fws.gov/pacific/bulltrout/pdf/Bull%20Trout%205YR%20final%20signed%20042508.pdf

USDI Fish and Wildlife Service. 2009. Revised final rule designating Critical Habitat for Canada lynx. Federal Register, 74(36): 8616-8702. (February 25, 2009)

USDI Fish and Wildlife Service. 2010a. Designation of critical habitat for bull trout.

USDI Fish and Wildlife Service. 2010b. Rising to the urgent challenge; strategic plan for responding to accelerating climate change. (Place of publication unknown).

USDI Fish and Wildlife Service. 2011a. Endangered and Threatened Wildlife and Plants; 12-Month findings.

USDI Fish and Wildlife Service. 2011b. Finding on a Petition to List *Pinus albicaulis* (whitebark pine) as Endangered or Threatened with Critical Habitat. Federal Register. Volume 76, No. 138. 50 CFR Part17: 42631-42654. (July 19, 2011)

USDI Fish and Wildlife Service. 2012a. Designation of critical habitat for the southern Selkirk Mountains population of woodland caribou: final rule. Federal Register: 77(229): 71042-71082.

USDI Fish and Wildlife Service. 2012b. Endangered Species Act Section 7 Consultation Biological Opinion. Consultation for Boundary Hydroelectric Project Commission (No. 225-013) Pend Oreille County, Washington. U.S. Fish and Wildlife Service Reference number: 13410-2011-F-0199. USDI Fish and Wildlife Service, Eastern Washington Field Office. Spokane, WA.

USDI Fish and Wildlife Service. 2013. Interim Consultation Guidance for Western Yellow-Billed Cuckoo (*Coccyzus americanus*). On file at: Colville National Forest Supervisor's Office. Colville, WA. (October 9, 2017)

USDI Fish and Wildlife Service. 2015a. National Wetlands Inventory descriptions. Available online at: http://www.fws.gov/wetlands/Data/Mapper-Wetlands-Legend.html

USDI Fish and Wildlife Service. 2015b. Recovery plan for the coterminous United States population of bull trout (*Salvelinus confluentus*). Portland, Oregon. xii + 179 p. Available at: https://www.fws.gov/pacific/ecoservices/endangered/recovery/plans.html

USDI Fish and Wildlife Service. 2015c. U.S. Fish and Wildlife Service Informal consultation re: Colville Confederated Tribes' Sanpoil River fish habitat restoration project, Ferry County, Washington. U.S. Fish and Wildlife Service Reference 01EWFW00-2015-I-0964. Eastern Washington Field Office. Spokane, Washington. 4 p.

USDI Fish and Wildlife Service. 2016. Endangered Species Act - section 7 consultation. Biological Opinion Le Clerc Creek cattle grazing allotment project Pend Oreille County, Washington. U.S. Fish and Wildlife Service Reference 01EWFW00-2015-F-0285. U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office. Spokane, Washington. 38 p.

USDI National Park Service. 2000. Air Quality Concerns Related to Snowmobile Usage in National Parks. USDI National Park Service, Air Resources Division. Denver, CO. 34 p.

USDI National Park Service. 2012. North Cascades National Park and Recreation Area Management Plan. USDI National Park Service, Sedro Woolley, WA.

U.S. Environmental Protection Agency (EPA). 2005a. Approval of Colville National Forest temperature and bacteria TMDL. Letter from M. Gearheard, Director, Office of Water and Watersheds, U.S. EPA Region 10.

U.S. Environmental Protection Agency. 2005b. Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture. Office of Atmospheric Programs (6207J) EPA 430-R-05-006.

U.S. Environmental Protection Agency. 2008. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006. EPA 430-R-08-005 April 2008. Washington D.C., USA.

U.S. Environmental Protection Agency. 2012a. 2010 Washington 303(d) list approval letter. Region 10, Olympia, WA. Available online at: https://www.epa.gov/aboutepa/epa-washington

U.S. Environmental Protection Agency. 2012b. Source water protection. Available online at: http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/basicinformation.cfm

WAC 173-201A-200. Freshwater designated uses and Criteria.

Wakkinen, W. L. and W. F. Kasworm. 2004. Demographics and population trends of grizzly bears in the Cabinet-Yaak and Selkirk Ecosystems of British Columbia, Idaho, Montana, and Washington. Ursus 15(1): 65-75.

Wakkinen, W. L., B. K. Johnson, and J. B. Slone. 2009. Selkirk Ecosystem Project. Idaho Department of Fish and Game. Boise, Idaho. 30 p.

Wald, A. R. 2009. High flows for fish and wildlife in Washington: Report of investigation in instream flow. Washington Department of Fish and Wildlife. Washington State Department of Printing: Olympia, WA.

Walker, B., C. S. Holling, S. R. Carpenter, and A. Kinzig. 2004. Resilience, adaptability and transformability in social–ecological systems. Ecology and Society 9(2): 5. Available online at: http://www.ecologyandsociety.org/vol9/iss2/art5/

Walter, E. M. and S. A. Fleury. 1985. Eureka Gulch: the Rush for Gold. Don's Printery, Colville, WA.

Walters, C. J. 1986. Adaptive Management of Renewable Resources. Executive Report 12. Macmillan Publishing, New York. 29 p.

Walther, G. R., A. Roques, P. E. Hulme, M. T. Sykes, P. Pyšek, I. Kühn, M. Zobel, S. Bacher, Z. Botta-Dukát, H. Bugmann, B. Czúcz, J. Dauber, T. Hickler, V. Jarošík, M. Kenis, S. Klotz, D. Minchin, M. Moora, W. Nentwig, J. Ott, V. E. Panov, B. Reineking, C. Robinet, V. Semenchenko, W. Solarz, W. Thuiller, M. Vilà, K. Vohland, and J. Settele. 2009. Alien species in a warmer world: risks and opportunities. Trends in Ecology and Evolution 24(12): 686-693.

Walther, G. R., E. Post, P. Convey, A. Menzei, C. Parmesan, T. Beebee, J. Gromentin, O. Hoegh-Guldberg, and F. Bairlein. 2002. Ecological responses to recent climate change. Nature 416: 389-395.

Washington Department of Fish and Wildlife. (No date). Wildlife Area Management Plans. Washington Department of Fish and Wildlife, Olympia, WA. Available online at: http://wdfw.wa.gov/lands/wildlife_areas/management_plans/ (accessed August 2015).

Washington Department of Fish and Wildlife (WDFW). 1993. Memorandum of understanding: Kalispel Tribe and Department of Wildlife.

Washington Department of Fish and Wildlife. 1994. Memorandum of understanding regarding fishing licensing and access permitting between the Kalispel Tribe of Indians and the Washington State Department of Fish and Wildlife.

Washington Department of Fish and Wildlife (WDFW) and Washington Department of Ecology (WADoE). 2004 (updated 2008). Instream flow study guidelines: Technical and habitat suitability issues.

Washington Department of Fish and Wildlife. 2008. 2009-2015 Game Management Plan. Washington Department of Fish and Wildlife, Olympia, WA.

Washington Department of Fish and Wildlife. 2010. White-tailed Deer Management Plan. Washington Department of Fish and Wildlife, Olympia, WA.

Washington Department of Fish and Wildlife. 2011. 2011-2017 Strategic Plan. Washington Department of Fish and Wildlife. Olympia, WA. Available online at: http://wdfw.wa.gov/about/strategic_plan/ (accessed August 2015).

Washington Department of Fish and Wildlife. 2012a. Annual Report: Woodland Caribou. Washington Department of Fish and Wildlife, Olympia, WA: 44-47.

Washington Department of Fish and Wildlife. 2012b. Annual Report: Yellow-billed Cuckoo. Washington Department of Fish and Wildlife, Olympia, WA: 200-202.

Washington Department of Fish and Wildlife. 2014. Selkirk Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 59 p.

Washington Department of Fish and Wildlife. 2015. 2013-2015 Strategic Plan. Washington Department of Fish and Wildlife. Olympia, WA. Available online at: http://wdfw.wa.gov/about/strategic_plan/ (accessed August 2015).

Washington Department of Fish and Wildlife. 2016. Washington State Mule Deer Management Plan, Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA, USA. 144 p.

Washington Department of Fish and Wildlife. 2017. 2017-2019 Strategic Plan. Washington Department of Fish and Wildlife. Olympia, WA. Available online at: http://wdfw.wa.gov/about/strategic_plan/ (accessed September 2017).

Washington Department of Fish and Wildlife (WDFW) and USDA Forest Service (USFS). 2011. Surveys for Canada lynx on the Colville National Forest. Report on file, Colville National Forest Supervisors Office, Colville, WA.

Washington Wildlife Habitat Connectivity Working Group (WWHCWG). 2010. Washington Connected Landscapes Project: a statewide assessment. Washington Departments of Fish and Wildlife, and Transportation. Olympia, WA. 223 p. Available online at: http://waconnected.org/statewide-analysis/

Washington Wildlife Habitat Connectivity Working Group. 2012. Washington connected landscapes project: Analysis of the Columbia Plateau Ecoregion. Executive Summary. 22 p. Available online at: http://waconnected.org/

Washington State Department of Ecology (DOE). 2000. Washington State and USDA Forest Service's forest management agreement. In: Focus. Number 00-10-048. November 2000. Olympia, WA.

Washington Department of Ecology. 2006. Colville National Forest temperature and bacteria total maximum daily load: water quality implementation plan. Publication no. 06-10-059. Olympia, WA.

Washington State Department of Ecology. 2012a. Focus on water availability Colville watershed, WRIA 59. Publication Number 11-11-063. Available online at: https://fortress.wa.gov/ecy/publications/publications/1111063.pdf

Washington State Department of Ecology. 2012b. Focus on water availability Kettle watershed, WRIA 60. Publication Number 11-11-064. Available online at: https://fortress.wa.gov/ecy/publications/publications/1111064.pdf

Washington State Department of Ecology. 2012c. Focus on water availability Middle Lake Roosevelt watershed, WRIA 58. Publication Number 11-11-062. Available online at: https://fortress.wa.gov/ecy/publications/publications/1111062.pdf

Washington State Department of Ecology. 2012d. Focus on water availability Pend Oreille watershed, WRIA 62. Publication Number 11-11-066. Available online at: https://fortress.wa.gov/ecy/publications/publications/1111066.pdf

Washington State Department of Ecology. 2012e. Focus on water availability Sanpoil watershed, WRIA 52. Publication Number 11-11-056. Available online at: https://fortress.wa.gov/ecy/publications/publications/1111056.pdf

Washington State Department of Ecology. 2012f. Focus on water availability Upper Lake Roosevelt watershed, WRIA 61. Publication Number 11-11-065. Available online at: https://fortress.wa.gov/ecy/publications/publications/1111065.pdf

Washington State Department of Ecology. 2013a. Addendum to the Colville National Forest temperature and bacteria total maximum daily load: Water quality implementation plan. Publication no. 13-10-040. Available online at: https://fortress.wa.gov/ecy/publications/publications/1310040.pdf

Washington State Department of Ecology. 2013b. Instream flow glossary. Available online at: http://www.ecy.wa.gov/programs/wr/instream-flows/isf-glossary.html

Washington State Department of Ecology. 2013c. Water rights in Washington. Publication 96-1804-S&WR. Available online at: https://fortress.wa.gov/ecy/publications/publications/961804swr.pdf

Washington State Department of Ecology. 2014a. 2012 Washington state water quality assessment 303(d) spatial data. Available online at: http://www.ecy.wa.gov/services/gis/data/data.htm

Washington State Department of Ecology. 2014b. Differences between the recent 303(d) lists. Available online at: http://www.ecy.wa.gov/programs/wq/303d/History303d.html

Washington State Department of Ecology. 2014c. Sullivan Lake Water Supply Project. Available online at: http://www.ecy.wa.gov/programs/wr/cwp/cr_sullivan.html.

Washington State Department of Ecology. 2014d. Washington water resource inventory area maps. Available online at: http://www.ecy.wa.gov/water/wria

Washington State Department of Ecology. 2014e. Water Rights Adjudications. Available online at: http://www.ecy.wa.gov/programs/wr/rights/adjhome.html

Washington State Department of Ecology. 2014f. Water quality assessment for Washington-303(d)/305(b) integrated report viewer. Available online at: https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx

Washington State Department of Ecology. 2015. Washington State Department of Ecology 2015-2017 Strategic Plan. Publication Number: 14-01-004. Olympia, WA.

Washington State Department of Health. 2005. Washington's source water assessment program. Available online at: http://www.doh.wa.gov/Portals/1/Documents/Pubs/331-148.pdf

Washington State Department of Natural Resources (WDNR). 1996 (updated 2002). Canada Lynx Conservation and Management Plan for the Loomis State Forest. Washington Department of Natural Resources, Olympia, WA.

Washington State Department of Natural Resources. 2010. Strategic plan 2010-2014; the Goldmark agenda. Olympia, WA (Updated 2014-2017). Available online at: https://www.dnr.wa.gov/publication/em_strategic_plan_2014_2017.pdf (Accessed September 2017)

Washington State Department of Natural Resources. 2015. Geology of Washington - Okanogan Highlands. Available online at: http://www.dnr.wa.gov/programs-and-services/geology/explore-popular-geology/geologic-provinces-washington/okanogan

Washington State Department of Natural Resources. 2015. Species Lists, Washington Natural Heritage Program, Department of Natural Resources. Available online at: http://www.dnr.wa.gov/NHPlists.

Washington State Department of Natural Resources Forest Health Program. 2014-1. Forest Health Highlights in Washington – 2013. Available online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3801872.pdf (accessed November 4, 2014).

Washington State Department of Natural Resources Forest Health Program. 2014-2. Eastern Washington Forest Health: Hazards, Accomplishments and Restoration Strategy - A report to the Washington State Legislature.

Washington State Department of Transportation. 2010. Washington State Scenic and Recreational Highways Strategic Plan 2010-2030.

Washington State Parks and Recreation Commission. 2009. Strategic Plan 2009-2015. (Place of publication unknown). Olympia, WA.

Washington State Parks and Recreation Commission. 2013. 2010-2013 Progress Report. Washington State Parks. Available online at: http://www.parks.wa.gov/ArchiveCenter/ViewFile/Item/66. Olympia, WA. (accessed August 2015).

Washington State Parks and Recreation Commission. 2014. Strategic Plan 2014-2019. (Place of publication unknown). Available online at: http://parks.state.wa.us/ArchiveCenter/ViewFile/Item/67. Olympia, WA. (Accessed September 2015).

Washington State Recreation and Conservation Office. 2013. Outdoor Recreation in Washington, The 2013 State Comprehensive Outdoor Recreation Plan. Olympia, Washington.

Wehner, M. F. 2013. Very extreme seasonal precipitation in the NARCCAP ensemble: Model performance and projections. Climate Dynamics, 40: 59-80.

Welker, J., J. Fahnestock, K. Povirk, C. Bilbrough, and R. Piper. 2004. Alpine Grassland CO_2 Exchange and Nitrogen Cycling: Grazing History Effects, Medicine Bow Range, Wyoming, USA. Arctic, Antarctic, and Alpine Research 36(1): 11-20.

Weltzin, J. F., M. E. Loik, S. Schwinning, D. G. Williams, P. A. Fay, B. M. Haddad, J. Harte, T. E. Huxman, A. K. Knapp, G. Lin, W. T. Pockman, M. R. Shaw, E. E. Small, M. D. Smith, S. D. Smith, D. T. Tissue, and J. C. Zak. 2003. Assessing the response of terrestrial ecosystems to potential changes in precipitation. BioScience 53(10): 941-952.

Wemple, B. C., F. J. Swanson, and J. A. Jones, 2001. Forest roads and geomorphic process interactions, Cascade range, Oregon. Earth Surface Processes and Landforms. 26: 191-204.

Wemple, B. C., J. A. Jones, and G.E. Grant, 1996. Channel network extension by logging roads in two basins, western Cascades, Oregon. Water Resources Bulletin. 32: 1195-1207.

Wenger, S. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia.

Wenger, S. J., C. H. Luce, A. F. Hamlet, D. J. Isaak, and H. M. Neville. 2010. Macroscale hydrologic modeling of ecologically relevant flow metrics. Water Resources Research. 46: W09513. Available online at: http://www.treesearch.fs.fed.us/pubs/36238

Wenger, S. J., D. J. Isaak, J. B. Dunham, K. D. Fausch, C. H. Luce, H. M. Neville, B. E. Rieman, M. K. Young, D. E. Nagel, D. L. Horan, and G. L. Chandler. 2011. Role of climate and invasive species in structuring trout distributions in the interior Columbia River Basin, USA. Canadian Journal of Fisheries and Aquatic Sciences 68: 988-1008.

Westerling, A. L. 2016. Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. Phil. Trans. R. Soc. B 371: 20150178. Available online at: http://dx.doi.org/10.1098/rstb.2015.0178

Westerling, A. L., A. Gershunov, T. J. Brown, D. R. Cayan, and M. D. Dettinger. 2003. Climate and wildfire in the western United States. Bulletin of the American Meteorological Society 84(5): 595-604.

Westerling, A. L., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science, 313: 940-943.

Western Forestry Leadership Coalition (WFLC). 2010. Threats to Western Private Forests A Framework for Conserving and Enhancing the Benefits from Private Working Forests in the Western U.S. 34 p.

Whiley, A. J. and K. Baldwin. 2005. Colville National Forest temperature, bacteria, pH, and dissolved oxygen total maximum daily load (water cleanup plan). Water Quality Program. Washington State Department of Ecology, publication number 05-10-047.

White, E. M. and D. J. Stynes. 2010. Spending profiles of national forest visitors, NVUM Round 2 Update. Unpublished report. 67 p. Special report to the USDA Forest Service Ecosystem Management Staff, Washington D.C. Headquarters.

White, E. M., D. B. Goodding, and D. J. Stynes. 2012. Estimation of national forest visitor spending averages from national visitor use monitoring: round 2. http://www.treesearch.fs.fed.us/pubs/43869 (January 12, 2015).

Whitehead, R. L. 1994. Groundwater atlas of the United States: Idaho, Oregon, and Washington. USGS, HA 730-H. Available online at: http://pubs.usgs.gov/ha/ha730/ch_h/index.html

Wiens, J. A., G. D. Hayward, R. S. Holthausen, and M. J. Wisdom. 2008. Using surrogate species and groups for conservation planning and management. Bioscience. 58: 241-252.

Wiles, G. J. 2017. Periodic status review for the woodland caribou in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 37 p.

Wiles, G. J., and K. S. Kalasz. 2017. Draft Status Report for the Yellow-billed Cuckoo in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 38 p.

Williams, C. K., B. F. Kelley, B. G. Smith, and T. R. Lillybridge. 1995. Forested plant associations of the Colville National Forest. General Technical Report PNW-GTR-360. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 375 p. In cooperation with: Pacific Northwest Region, Colville National Forest.

Williams, D. W. and A. M. Liebhold. 2002. Climate change and the outbreak ranges of two North American bark beetles. Agricultural and Forest Entomology. Vol 2, No. 2 (2002): 87-99.

Williams, J. E., A. L. Haak, H. M. Neville, and W. T. Colyer. 2009. Potential consequences of climate change to persistence of cutthroat populations. North American Journal of Fisheries Management 29: 533-548.

Williams, J. E., C. A. Wood, and M. P. Dombeck, editors. 1997. Watershed restoration: Principles and practices. American Fisheries Society, Bethesda, Maryland.

Winward, A. H. 2000. Monitoring the vegetation resources in riparian areas. Gen. Tech. Rep. RMRS-GTR-47. Ogden, Utah: USDA Forest Service, Rocky Mountain Research Station. 49 p.

Wipfli, M. S., J. S. Richardson, and R. J. Naiman. 2007. Ecological Linkages Between Headwaters and Downstream Ecosystems: Transport of Organic Matter, Invertebrates, and Wood Down Headwater Channels. Journal of the American Water Resources Association, 43(1): 72–85.

Wisdom, M. J., A. A. Ager, H. K. Preisler, N. J. Cimon, and B. K. Johnson. 2005. Effects of off-road recreation on mule deer and elk. Pages 67-80 in: Wisdom, M. J. (tech. ed.) The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Group Communications, Lawrence, Kansas, USA.

Wisdom, M. J. and L. J. Bate. 2008. Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management 255: 2085-2093.

Wisdom, M. J., N. J. Cimon, B. K. Johnson, E. O. Garton, and J. W. Thomas. 2005. Spatial partitioning by mule deer and elk in relation to traffic. Pages 53-6680 in: Wisdom, M.J. (tech. ed.) The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Group Communications, Lawrence, Kansas, USA.

Wisdom, M. J., R. S. Holthausen, B. C. Wales, (and others). 2000. Source habitat for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. Vol. 2 Gen. Tech. Rep. PNW-GTR-485. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Wissmar, R. C. 2004. Riparian corridors of eastern Oregon and Washington: Functions and sustainability along lowland-arid to mountain gradients. Aquatic Sciences: 66: 373-387.

Wissmar, R. C., J. E. Smith, B. A. McIntosh, H. W. Li, G. H. Reeves, and J. R. Sedell. 1994. A history of resource use and disturbance in riverine basins of eastern Oregon and Washington (early 1800s-1900s). Northwest Science 68: 1-35.

Wondzell, S. M. 2001. The influence of forest health and protection treatments on erosion and stream sedimentation in forested watersheds of eastern Oregon and Washington. Northwest Science 75(Special Issue): 128-140.

Wondzell, S. M. and F. J. Swanson. 1999. Floods, channel change, and the hyporheic zone. Water Resources Research 35(2): 555-567.

Wondzell, S. M. and J. G. King. 2003. Post-fire erosional processes in the Pacific Northwest and Rocky Mountain regions. Forest Ecology and Management 178: 75-87.

Woods, L.G. 1966. Increasing water yield though soil management. Journal of Soil and Water Conservation. 21: 95-97.

Wormworth, J. and K. Mallon. 2006. Bird species and climate change. Sydney, Australia. World Wildlife Fund. 12 p.

Wotton, B. M. and M. D. Flannigan. 1993. Length of the fire season in a changing climate. Forestry Chronicle 69: 187-192.

Wydoski, R. S. and R. R. Whitney. 2003. Inland fishes of Washington. Bethesda, MD: American Fisheries Society and Seattle, WA: University of Washington Press. 322 p.

XiuZhi, M., W. YanFen, W. ShiPing, W. JinZhi, and L. ChangSheng. 2005. Impacts of grazing on soil carbon fractions in the grasslands of Xilin River Basin, Inner Mongolia. Acta Phytoecologica Sinica 29(4): 569-576.

Yanai, R. D., W. S. Currie, and C. L. Goodale. 2003. Soil Carbon Dynamics after Forest Harvest: An Ecosystem Paradigm Reconsidered. Ecosystems (2003) 6: 197-212. DOI: 10.1007/s10021-002-0206-5

Yount, J. D. and G. J. Niemi. 1990. Recovery of lotic communities and ecosystems from disturbance - a native case study. Environmental Management 14: 547-570.

Ziemer, R. R. 1987. Water yields from forests: an agnostic view. Proceedings of the California Watershed Management Conference, Report No. 11. November 18-20, 1986, West Sacramento, California, Wildland Resources Center, University of California, Berkeley.

Glossary

TERM	DEFINITION
Active channel	The portion of a stream channel commonly wetted during and above base flows, identified by a break in rooted vegetation or moss growth on rocks along stream margins (Taylor and Love 2003). The active channel is somewhat lower than bankfull and is sometimes called the ordinary high water mark.
Active floodplain	The area bordering a stream that is inundated by flows at a surface elevation defined by two times the maximum bankfull depth measured at the thalweg. (Thalweg is a line drawn to join the lowest points along the entire length of a streambed in its downward slope, defining the deepest channel, thus making the natural direction or profile of a watercourse. The thalweg is almost always the line of fasted flow in any river).
Active restoration	Deliberate activities to influence the processes needed to improve conditions. Investment of human actions of the ecosystem processes and functions. As an example, this might include seeding native grasses and planting native shrubs and trees, or thinning trees to restore fire regimes.
Activity	A measure, course of action, or treatment that is undertaken to directly or indirectly produce, enhance, or maintain a desired condition or objective on a Forest, Grassland, Prairie, or other comparable administrative unit.
Allowable Sale Quantity (ASQ)	This calculation reflects the quantity of timber that may be sold from lands suitable for timber production, within tree utilization standards, for the first decade of the plan given an unlimited budget.
Animal unit month (AUM)	The amount of oven-dry forage required by 1 animal unit for a period of 30 days. An animal unit is considered to be 1 mature cow, either dry or with calf up to 6 months in age. (Society for Range Management 1998)
Aquatic ecological condition	The AEC is a model to evaluate the status of local populations of surrogate species and their habitat at the HUC12 or sub-watershed scale. The results are then aggregated to produce an ecological sustainability or viability outcome for each surrogate species at the subbasin (HUC 8) scale. It is described in the Process for Evaluating the Contribution of National Forest System Lands to Aquatic Ecological Sustainability (Reiss et al. 2008).
Aquatic ecosystem	Any body of water and its associated riparian area, and all organisms and non-living components within it functioning as a natural system.
Aquatic Restoration Strategy	Forest Service Region 6 Aquatic Restoration Strategy was originally developed in 2005 to provide guidance for watershed and aquatic and

TERM	DEFINITION
	riparian condition improvement at a regional scale through both passive and active restoration techniques.
Aquatic and Riparian Conservation Strategy	The Aquatic and Riparian Conservation Strategy provides direction for management of aquatic resources. It was developed by Forest Service Region 6 in 2008 to consolidate management direction from the Northwest Forest Plan, PACFISH, INFISH, and ARS into a framework document to be used in forest plan revision.
Assessment	An analysis and interpretation of the social, economic, or ecological characteristics of an area using scientific principles to describe existing conditions as they affect sustainability.
Bighorn Sheep Source Habitat	Habitat is Douglas-fir, ponderosa pine forest with <60% canopy closure and shrub-steppe cover types that occur within 1,600 feet of escape terrain. Escape terrain are areas with a slope steepness between 31-85 degrees at least 4 acres in size (Gaines et al. 2017).
Biological legacy	Organisms, organic matter, and biologically created patterns that persist from the pre-disturbance ecosystem and influence recovery processes in the post-disturbance ecosystem.
Canopy closure	The proportion of the sky hemisphere obscured by vegetation when viewed from a single point (Korhonen et al. 2006).
Canopy cover	The proportion of the forest floor covered by the vertical projection of tree crowns (Korhonen et al. 2006).
Capability	The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as silviculture or protection from fire, insects, and disease.
Characteristic fire	When a fire occurs within the time, space, and severity parameters of the natural fire regime of the vegetation group (Hardy 2005). Also, see uncharacteristic fire.
Class I and II areas (air quality)	Class I areas defined under the Clean Air Act Amendments of 1977 are afforded the highest level of protection from air pollutants in the nation. All other lands in the nation are designated as Class II areas.
Coarse filter/coarse filter management	Land management that addresses the needs of all associated species, communities, environments and ecological processes in a land area (see fine filter management).

TERM	DEFINITION
	Coarse filter conservation focuses on assuring adequate representation of ecosystem diversity, and is generally accomplished by comparing the current condition of landscape structure and composition to a set of reference conditions. Management direction then addresses the landscape components that have departed from reference conditions to assure adequate representation across the plan area. A fine-filter approach may be needed if the coarse-filter does not adequately provide ecosystem conditions needed to maintain populations (Samson 2002) (see fine-filter).
Coarse woody debris	Coarse woody debris consists of any woody material greater than 3 inches in diameter and is derived from tree limbs, boles, roots, and large (greater than 12 inches in diameter) wood fragments and fallen trees in various stages of decay. Provides living spaces for a host of organisms and serves as long-term storage sites for moisture, nutrients, and energy.
Code of Federal Regulations (CFR)	The listing of various regulations pertaining to management and administration of the Colville National Forest.
Community (ecological)	A group of organisms living together; any group of interacting organisms.
Connectivity	See *habitat connectivity*.
Core area/ core habitat	A core area represents the closest approximation of a biologically functioning unit consisting of habitat that could supply all the necessary elements for every life stage (e.g., spawning, rearing, migratory and adult) and include one or more groups of bull trout (USFWS 2015b)
Corridor (utility)	See *Transportation and utility corridors*.
Corridor (wildlife)	Avenues along which wide-ranging animals can travel, plants can propagate, genetic interchange can occur, populations can move in response to environmental changes and natural disasters, and threatened species can be replenished from other areas.
Cover	Vegetation used by wildlife for protection from predators, or to ameliorate conditions of weather, or in which to reproduce. **Hiding cover** – vegetation consisting primarily of trees, capable of hiding 90 percent of a standing adult animal from the view of a human at a distance of 200 feet or less. **Thermal cover** – cover used by animals to ameliorate chilling effects of weather, for elk, a stand of coniferous trees 40 feet or taller with an average crown closure of 70 percent or more.

TERM	DEFINITION
Critical (key) habitat	Specific areas • within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and • outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation • http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm
Crossing (structure)	That point in a linear feature (i.e., trail, road, stream) where the feature intersects and continues past another feature (i.e., a road crosses over or through a stream). Crossing structures are human-made structures that facilitate the ability of an animal to travel across a road and reduce the likelihood of a collision with a vehicle.
Cultural resources	Such resources as archeological, historical, or architectural sites, structures, places, objects, ideas, and traditions that are identified by field inventory, historical documentation, or other evidence and that are important to specified social or heritage groups or scientific and management endeavors.
Cumulative effects	The combined effects of two or more management activities. The effects may be related to the number of individual activities, or to the number of repeated activities on the same piece of ground. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
Decommission (roads)	Activities that result in restoration of unneeded roads to a more natural state through reestablishment of vegetation and restoration of ecological processes interrupted or adversely affected by the unneeded road (FSM 7734).
Degrade	A change to an existing condition to one that is measurably worse.
Designated Monitoring Area (DMA)	A representative Designated Monitoring Area is a monitoring site in a riparian complex that is representative of a larger area. The DMA should be placed in the most sensitive complex responsive to management influences. (MIM Technical Reference 1737-23, 2011)
Designated route	A National Forest System (NFS) road or an NFS trail on NFS lands that is designated for motor vehicle use pursuant to 36 CFR 212.1 on a motor vehicle use map.
Desired conditions	The social, economic, and ecological attributes toward which management of the land and resources of the plan area are to be directed. Desired conditions are aspirations and are not commitments or final decisions

TERM	DEFINITION
	approving projects and activities, and may be achievable only over a long period (36 CFR 219.7).
Detrimental soil conditions	The effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement that indicate when changes in soil properties and soil conditions would result in significant change or impairment of soil quality.
Desired landscape character	Appearance of the landscape to be retained or created over time, recognizing that a landscape is a dynamic and constantly changing community of plants and animals. Combination of landscape design attributes and opportunities, as well as biological opportunities and constraints. (Landscape Aesthetics-A Handbook for Scenery Management, Agriculture Handbook Number 701, December 1995, USDA Forest Service)
Developed recreation site	Distinctly defined area where facilities are provided for concentrated public use; e.g., campgrounds, picnic areas, boating sites, and ski areas.
Diameter at breast height (d.b.h.)	The diameter of a standing tree at a point 4 feet, 6 inches from ground level.
Dispersed recreation	Outdoor recreation that takes place outside developed recreation sites.
District population segment (DPS)	The U.S. Fish and Wildlife Service (USFWS) uses the term “DPS” to refer to regional subgroups of bull trout and is the term used in the Endangered Species Act to describe subunits of species that are eligible for listing, or to describe subgroups of species that could be delisted separately by meeting specific recovery objectives identified in a Species Recovery Plan.
Disturbance	A discrete event that changes existing plant and wildlife community composition or structure, and interrupts, changes, or resets the ongoing successional sequence.
Disturbance processes	Stresses and agents that influence ecosystem dynamics and processes operating within known resilience parameters. Stresses and agents can include invasive species, fire, changes in climate, weather events (wind, ice), pollution, and timber harvest.
Disturbance regime	Any recurrent disturbance that tends to occur in a forested area. It is often defined in terms of timing, frequency, predictability, and severity. (Puettmann et al. 2009).
Diversity	The distribution and abundance of different plant and animal communities and species within an area.

TERM	DEFINITION
Down wood	Down wood (or coarse woody debris) consists of any woody material greater than 3 inches in diameter and is derived from tree limbs, boles, roots, and large (greater than 12 inches in diameter) wood fragments and fallen trees in various stages of decay. Provides living spaces for a host of organisms and serves as long-term storage sites for moisture, nutrients, and energy.
Ecological conditions	Components of the biological and physical environment that can affect diversity of plant and animal communities and the productive capacity of ecological systems. These components could include the abundance and distribution of aquatic and terrestrial habitats, roads and other structural developments, human uses, and invasive, exotic species. (36 CFR 219.16)
Ecological health (ecosystem health)	The state of and ecosystem in which processes and functions are adequate to maintain diversity of biotic communities commensurate with those initially found there.
Ecological restoration	The process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions (FSM 2000 Chapter 2020).
Ecosystem	An interacting system of organisms considered together with their environment; for example, marsh, watershed, and lake ecosystems.
Ecosystem diversity	The variety and relative extent of ecosystem types, including their composition, structure, and processes, within all or a part of an area of analysis. (36 CFR 219.16)
Ecosystem health (ecological health)	A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, such that goals for uses, values, and services of the ecosystem are met. (www.icbemp.gov)
Ecosystem services	Ecosystem services are the benefits people obtain from ecosystems. For example, healthy ecosystems provide: • The stuff of life – food, fresh water, timber, and fiber for clothing. • Protection from extreme weather, floods, fire, and disease. • Regulation of the Earth's climate. • Filtration of wastes and pollutants. • Regeneration of clean air, water, and soil. • Inspiration, recreation and spiritual sustenance, and support for a way of life. (Island Press 2007)

TERM	DEFINITION
Edaphic	Relating to, or determined by, conditions of the soil, especially as it relates to biological systems; soil characteristics, such as water content, pH, texture, and nutrient availability that influence the type and quantity of vegetation in an area.
Effect (impact), economic	The change, positive or negative, in economic conditions, including the distribution and stability of employment and income in affected local, regional, and national economies that directly or indirectly results from an activity, project, or program.
Effect (impact), physical, biological	The change, positive or negative, in the physical or biological conditions that directly or indirectly results from an activity, project, or program.
Effect (impact), social	The change, positive or negative, in social and cultural conditions that directly or indirectly results from an activity, project, or program.
Endangered species	Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. An endangered species must be designated by the Secretary of Interior as endangered in accordance with the Endangered Species Act of 1973.
Evaluation	An appraisal and study of social, economic, and ecological conditions and trends relevant to a unit. The analysis of monitoring data that produces information needed to answer specific monitoring questions. Evaluation may include comparing monitoring results with a predetermined guideline or expected norm that may lead to recommendations for changes in management, a land management plan, or monitoring plan. Evaluations provide an updated compilation of information for use in environmental analysis of future project and activity decisions.
Even-aged management	The application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and, therefore, tree sizes) throughout the forest area. An even-aged stand of trees is one in which there are only small differences in age among the individual trees. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.
Fine filter management	Management that focuses on the welfare of a single or only a few species rather than the broader habitat or ecosystem (see coarse filter management). Coarse and fine-filter management approaches are generally complimentary to provide ecological conditions that support ecosystem and species diversity.

TERM	DEFINITION
Fire intensity	A general term relating to the heat energy released by a fire.
Fire management	Activities required for the protection of burnable wildland values from fire and the use of prescribed fire to meet land management objectives.
Fire regime	Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval (NWCG 2016).
Fire severity	The degree to which a site has been altered or disrupted by fire. A product of fire intensity, fuel consumption, and residence time.
Floodplain	Lowland and relatively flat area adjacent to rivers and streams, formed from river sediments that are subject to recurring flooding.
Focal species	Those species whose abundance, distribution, health, and trend over time and space are indicative of the functioning of the larger ecological system (Committee of Scientists USDA Forest Service 1999). Focal species serve an umbrella function in terms of encompassing habitats needed for other species, are sensitive to the changes likely to occur in the area, or otherwise serve as an indicator of ecological sustainability. The long-term sustainability of the focal species is assumed to be representative of a group of species with similar ecological requirements and this group is assumed to respond in a similar manner to environmental change.
Forage	All browse and non-woody plants available to livestock or wildlife for grazing or harvestable for feed.
Forb	Any herb other than grass.
Forest health	The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects and disease, and resilience to disturbance. Perception and interpretation of forest health are influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health in stands that comprise the forest, and the appearance of the forest at a point in time.

TERM	DEFINITION
Forest land	Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential or administrative areas, improved roads of any width and adjoining road clearing, and powerline clearings of any width (36 CFR 219.16).
Forest products, commercial use (non-timber harvest)	The sale of special forest products to commercial entities.
Forest products, firewood, commercial use	The sale of firewood, a type of special forest product, to commercial entities.
Forest products, firewood, permitted personal use	The collection of firewood, a type of special forest product, for personal, non-commercial use.
Forest road or trail	A road or trail wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization. (Title 36, Code of Federal Regulations, Part 212—Administration of the Forest Transportation System, section 212.1.)
Fuels	Any material that will carry and sustain a forest fire, primarily natural materials, both live and dead.
Goods and services	The various outputs, including on-site uses, produced from forest and rangeland resources.
Government Performance and Results Act	Provides enhanced performance planning, management, and reporting tools to improve information sharing and coordination among federal agencies while helping address issues that hinder the government's ability to address fragmentation, overlap, and duplication (Public Law 111-352).
Grazing allotment	Area designated for the use of a certain number and kind of livestock for a prescribed period of time.
Grizzly bear core habitat	An area of secure habitat within a bear management unit that contains no motorized travel routes or high use non-motorized trails during the non-denning season and is more than 0.3 mile (500 meters) from a drivable road. Core areas do not include any gated roads, but may contain roads that are impassible due to vegetation or constructed barriers. Core areas strive to contain the full range of seasonal habitats that are available in the bear management unit.

TERM	DEFINITION
Grizzly bear management unit (GBMU)	Areas established for use in grizzly bear analysis. GBMUs generally (a) approximate female home range size; and (b) include representations of all seasonal habitat components. A subunit of the Selkirk Grizzly Bear Recovery Area. Each BMU is intended to approximate the size of a female grizzly bear home range, include some portion of all seasonal habitats, and not cross political boundaries of land management agencies. Boundary lines follow natural features such as rivers, streams, and watershed boundaries; and man-made features such as roads, ownership and Public Land Survey System section lines. A project analysis unit upon which direct, indirect, and cumulative effects analyses are performed.
Groundwater-dependent system (ecosystem)	An area that requires access to groundwater to maintain its community of plants, animals, and processes. Examples include springs, seeps, fens, and wetlands.
Guidelines	Information and guidance for project and activity decision making to help achieve desired conditions and objectives in the plan area.
Habitat capability	The estimated ability of an area, given existing or predicted habitat conditions, to support a wildlife, fish, or plant population. It is measured in terms of potential population numbers.
Habitat connectivity	A measure of the ability of organisms to move among separated patches of suitable habitat (Hilty et al. 2006), and is important for providing the long-term viability of populations (Hanski 2002) and for allowing species to respond to changing climate (Heller and Zavaleta 2009). Landscape features influence how or if a species can move. These may include natural features such as topography or land cover, or human-created features such as highways or roads.
Habitat effectiveness (zone of influence)	A measurement of the effect of human access on wildlife and wildlife habitat. In this proposal, habitat effectiveness is analyzed as an index of the amount of habitat that is impacted by human access for a given species. Generally, two types of indices (measures) are used to assess the impacts of roads and trails on wildlife habitats: (1) the density of travel routes (e.g., miles of route/square miles of habitat) or (2) the zone of influence. The zone of influence refers to the distance on each side of a road or trail within which habitat use by a species of interest is affected by the human use that occurs on the road or trail. Both density and zone of influence are determined by species-specific research (see Gaines et al. 2003 for a review).

TERM	DEFINITION
Heritage resources	Archaeological and historic sites, structures, buildings, artifacts, sacred sites, and traditional cultural properties identified through research, field inventory, and historic documentation that are important to the American public and American Indian Tribes.
High quality habitat	Habitat that completely satisfies a species life history (e.g., food, shelter, security) requirements.
Historical range of variability	Refers to the dynamic behavior and functioning of ecosystems before dramatic changes occurred with European settlement, generally considered to be the mid-1800s for this area (Aplet and Keeton 1999). The historical range of variability provides a framework to determine changes to ecosystem attributes that have occurred between historical and current conditions and recognizes that ecosystems experience a range of conditions across which processes are resilient and self-sustaining.
Horizontal cover	That portion of a tree or shrub that grows horizontally (parallel to the ground) out from the main trunk/stem of the plant (i.e., a tree bough) and provides cover up to approximately 5 to 7 feet above the ground. Horizontal cover refers to the stems/boughs that are used by snowshoe hares and are subsequently considered foraging habitat for lynx.
Hydrologic stabilization	Road storage and stabilization treatments to avoid, minimize, or mitigate adverse effects to water quality, aquatic habitat, and riparian resources. Hydrologically stabilized roads minimize road erosion and road hydrologic connectivity to the stream system. Practices could include, but are not limited to, removal of culverts and fill material that present an unacceptable risk of failure or flow diversion, and suitable measures to ensure the road surface will intercept, collect, and remove water from the road surface in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces without frequent maintenance. Since hydrologically stabilized roads remain on the NFS road system, the integrity of the roadway is retained to the extent practicable and measures are implemented to reduce sediment delivery from the road surface and fills and reduce the risk of crossing failure and stream diversion.

TERM	DEFINITION
Hydrologic unit (HU) system	A nested-hierarchical classification of hydrologic units (watersheds) delineated national by the United States Geological Survey with six levels of classification of successively smaller hydrologic units. Individual hydrologic units are denoted numerically by a unique hydrologic unit code, with the number of digits within the code based on the level of classification, and both a general hydrologic unit name and a specific name. The following table shows the classification, names, # of digits in the code, level of classification, average size, and an example of name and number of at each level of classification from the hydrologic hierarchy of the Ninemile subwatershed.

Hydrologic Unit (HU) name	# of digits in HUC	HU Level	Average Size (sq. miles)	Example Name	Example Number
Region	2	1st	180,000	Pacific Northwest Region	17
Subregion	4	2nd	17,000	Upper Columbia Subregion	1702
Basin	6	3rd	10,000	Upper Columbia Basin	170200
Subbasin	8	4th	700	Sanpoil Subbasin	17020004
Watershed	10	5th	227 (40,000-250,000 acres)	Upper Sanpoil Watershed	1702000401
Subwatershed (SWS)	12	6th	40 (10,000-40,000 acres)	Ninemile Subwatershed	170200040107

Hydrologically connected road	A segment of road that is connected to the natural stream channel network via surface flow (Flanagan et al. 1998). Roads that are hydrologically connected deliver water, sediment, and chemicals generated on the road surface directly to the stream channel network.
Inconsistent uses (recreation)	Recreation opportunities that are considered inconsistent with wilderness management direction. Inconsistent uses include mountain biking, motorized trail use, motorized trail maintenance and reconstruction, historic structure maintenance, and rental cabin management.
Indicator	A measure or measurement of an aspect of a sustainability criterion. A quantitative or qualitative variable that can be measured or described and, when observed periodically, shows trends. Indicators are quantifiable performance measures of outcomes or objectives for attaining criteria designed to assess progress toward desired conditions.
Inland Native Fish Strategy	Interim direction to protect habitat and populations of resident native fish outside of anadromous fish habitat in eastern Oregon, eastern Washington, Idaho, western Montana, and portions of Nevada. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_033158.pdf

TERM	DEFINITION
Inner gorge	An area where a stream has incised into a hillslope or valley bottom where surface materials may be unstable or erodible. The top of the inner gorge occurs where the slope of the wall breaks to less than 50 percent.
Instream flow	Water flowing in a stream channel. Instream flow is used to designate a specific stream flow measured in cubic feet per second (cfs) at a particular location for a defined time for protection and preservation of fish, wildlife, recreation, and other non-consumptive water uses in a waterway.
Interdisciplinary team (ID Team)	A group of people that collectively represent several disciplines and whose duty is to coordinate and integrate the planning activities.
Intermittent/ephemeral stream	Any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria.
Invasive species	Non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Non-native species are any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem (with respect to a particular ecosystem) (EO13112).
Inventoried roadless area	Areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps through the land management planning process (36 CFR 294.11).
Issue	Issues may be considered as: (1) A potential factor for determining need for change for a plan; (2) Specific resource concerns about a proposed action under NEPA (FSM 1950); (3) Points of contention or disagreement; or (4) A subject or question of widespread public interest about management of the National Forest System.
Key habitat (grizzly bear)	Vegetation components that are crucial for grizzly bear survival, such as whitebark pine, riparian habitats, berry-producing shrub fields, natural meadows, and forest cover.
Key watershed	Key watersheds are a network of watersheds designated at the subwatershed scale (6th field, HUC12), to serve as strongholds for important aquatic resources or having the potential to do so. They are areas crucial to threatened or endangered fish and aquatic species of concern and/or interest, and/or areas that provide high quality water that is important for maintaining downstream populations. Management emphasizes minimizing risk and maximizing restoration or retention of ecological health.

TERM	DEFINITION
Landscape	A heterogeneous land area composed of interacting ecosystems evaluated at a broad scale to facilitate understanding of process, composition, structure, and pattern. In most cases this will be at a scale of a 5th field HUC, at tens of thousands of acres, to provide an understanding of coarse filter broad scale interplay and dynamics of soils, climate, fire, insects, hydrology, genetics, large home range wildlife, and vegetation.
Landscape character	Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable and unique. (Agricultural Handbook Number 701)
Large woody debris	Large pieces of relatively stable woody material located within the bankfull channel and appearing to influence bankfull flows.
Life history requirements	Habitat and other environmental conditions need to support the series of living phenomena exhibited by an organism in the course of its development from inception to death. This includes seasonal behaviors and daily routines of juvenile and adults of the species.
Lynx analysis unit (LAU)	An area of at least the size used by an individual lynx, from about 25 to 50 square miles. A project analysis unit upon which direct, indirect, and cumulative effects analyses are performed.
Listed species (TE)	Listed species (threatened and endangered) are those listed by the U.S. Department of the Interior, U.S. Fish and Wildlife Service, or the National Oceanic and Atmospheric Administration, National Marine Fisheries Service as threatened or endangered under the Endangered Species Act (FSH 1909.12, 43.22a).
Long-term Sustained Yield (LTSY)	The highest uniform wood yield that may be sustained given multiple-use objectives on lands managed for timber production. LTSY assumes that all suitable land for timber production is in the desired condition.
Maintain	To produce no change in the existing conditions of a resource relative to their condition status (i.e., properly functioning, functioning at risk, or not functioning properly). Conditions that are “maintained” are neither restored nor degraded, but remain essentially the same as the existing condition. The term “maintain” can apply to any condition indicator at the appropriate scale, but those scales need to be identified.
Maintenance level (roads)	Maintenance levels define the level of service provided by, and maintenance required for, a specific road. Maintenance levels must be consistent with road management objectives and maintenance criteria. The objective maintenance level is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level

TERM	DEFINITION
	may be the same as, or higher or lower than, the operational maintenance level (FSH 7709.59).
Management area	A specifically identified area on National Forest System lands to which specific plan components (desired conditions, objectives, identification of suitable and unsuitable land uses, or special designations) are applied.
Management direction	A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.
Management indicator species (MIS)	A species selected because its welfare is presumed to be an indicator of the welfare of other species using the same habitat. A species whose condition can be used to assess the impacts of management actions on a particular area.
Management practice	A specific activity, measure, course of action, or treatment.
Management prescription	Management practices and intensity selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives.
Mechanized	Wheeled forms of transportation (including non-motorized carts, wheelbarrows, bicycles, and any other non-motorized, wheeled vehicle).
Mechanical transport	Any contrivance for moving people or material in and over land, water, or air, having moving parts that provides a mechanical advantage to the user and that is powered by a living or non-living power source. This includes, but is not limited to, sailboats, hang gliders, parachutes, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as necessary medical appliances. It also does not include skis, snowshoes, rafts, canoes, sleds, travois, or similar primitive devices without moving parts (FSM 2320.3).
Minerals – leasable	Coal, oil, gas, phosphate, sodium, potassium, oil shale, sulphur, and geothermal resources. Leasable minerals also include locatable minerals on National Forest System lands with Acquired land status.
Minerals – locatable	Those hardrock minerals that are mined and processed for the recovery of metals. They also may include certain nonmetallic minerals and uncommon varieties of mineral materials, such as valuable and distinctive deposits of limestone or silica.
Minerals – salable	Salable mineral materials include petrified wood, and common varieties of sand, gravel, stone, pumice, pumicite, cinders, clay and other similar materials. They are used for agriculture, animal husbandry, building, abrasion, construction, landscaping, and similar uses.

TERM	DEFINITION
Minimum impact suppression tactics (MIST)	The concept of minimum impact suppression tactics is to use the minimum amount of forces necessary to effectively achieve fire management protection objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects, when determining how to implement an appropriate suppression response. Fire managers and firefighters select tactics that have minimal impact to values at risk. These values are identified in approved land or resource management plans. Standards and guidelines are then tied to implementation practices, which result from approved fire management plans. The term minimum impact suppression tactics is not intended to represent a separate or distinct classification of firefighting tactics, but rather a mindset of how to suppress a wildfire while minimizing the long-term effects of the suppression action on other resources. The principle of fighting fire aggressively but providing for safety first will not be compromised in the process; and when selecting an appropriate suppression response, firefighter safety must remain the highest concern.
Mitigation measures	Modifications of actions taken to: (a) avoid impacts by not taking a certain action or parts of an action; (b) minimize impacts by limiting the degree or magnitude of the action and its implementation; (c) rectify impacts by repairing, rehabilitating, or restoring the affected environment; (d) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or, (e) compensate for impacts by replacing or providing substitute resources or environments.
Monitoring	A systematic process of collecting information to evaluate changes in actions, conditions, and relationships over time and space, or progress toward meeting desired conditions or plan objectives.
Motorized	A vehicle or device equipped with a motor to operate or propel it.
Motor Vehicle Use Map	A map reflecting designated roads, trails, and areas on an administrative unit or a ranger district of the National Forest System (36 CFR 212.1).
Municipal supply watershed	A watershed which provides water for human consumption where Forest Service management could have a significant impact upon the quality of water at the intake point and that provides water used by a community or other public water system regularly serving at least 25 individuals at least 60 days out of the year or providing at least 15 service connections (FSM 2542). Municipal watersheds on the CNF include East Deer Creek, and North Fork Sullivan Creek. These watersheds provide water to the communities of Orient and Metaline Falls, respectively.

TERM	DEFINITION
National Forest System (NFS)	All national forest lands reserved or withdrawn from the public domain of the United States; all national forest lands acquired through purchase, exchange, donation, or other means; the national grasslands and land utilization projects administered under Title III of the Bankhead-Jones Farm Tenant Act (50 Stat. 525, 7 U.S.C. 1010-1012), the Midewin Tallgrass Prairie, and other lands, waters, or interests therein which are administered by the Forest Service or are designated for administration through the Forest Service as a part of the system (16 U.S.C. 1608).
National visitor use monitoring program (NVUM)	To gain a better understanding of the recreation use, importance of, and satisfaction associated with national forest recreation opportunities, the Forest Service embarked on the national visitor use monitoring project (NVUM) in the late 1990s. Each survey is conducted over the course of one year (October 1 – September 30) and includes questions regarding visitor use (activities), expenditures on recreation activities, and user satisfaction associated with the activities, settings, and infrastructure used while visiting the Forest.
Northwest Forest Plan	Management direction developed to adopt coordinated management direction for the lands administered by the USDA Forest Service and the USDI Bureau of Land Management and to adopt complimentary approaches by other Federal agencies within the range of the northern spotted owl. The management of these public lands must meet dual needs: the need for forest habitat and the need for forest products. http://www.fs.usda.gov/detail/r6/landmanagement/planning/?cid=fsbdev2_026990
Objectives	Concise projections of measurable, time-specific intended outcomes. The objectives for a plan are the means of measuring progress toward achieving or maintaining desired conditions. Like desired conditions, objectives are aspirations and are not commitments or final decisions approving projects and activities (36 CFR 219.7).
Occupied habitat	An area that is currently being used by a species for one or more parts of its life history (such as nesting, foraging, roosting, denning). This area will receive repeat use and the animal is not simply travelling through to somewhere else.
Off-highway vehicle (OHV)	Any motor vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain (36 CFR 212.1).
Open motorized trail	Trails that are passable by motorcycles or all-terrain vehicles and are not legally restricted.

TERM	DEFINITION
Overstory	That portion of the trees in a forest of more than one story, forming the upper or uppermost canopy layer.
Outstandingly remarkable value (wild and scenic rivers)	A river-related value that is a rare, unique, or exemplary feature that is significant at a comparative regional or national scale.
PACFISH	An interim strategy for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_033465.pdf
Patch (patch size)	A relatively uniform area of vegetation that differs from its surroundings (NCSSF 2005). Patch size is influenced by disturbance history, vegetation dynamics, topographic position, and soils. For fisheries, a patch or patch size is the connected length of stream available to the surrogate species. Habitat patches within the subbasin are delineated by aggregating all connected stream kilometers of occupied habitat.
Plan area	The National Forest System lands covered by a plan (36 CFR 219.16).
Plan components	Broad guidance in a plan that identifies desired conditions, objectives, standards, guidelines, suitability of areas, and areas with special designations.
Plan set of documents	The complete set of documentation supporting the land management plan. It may include, but is not limited to, evaluation reports, documentation of public involvement, the plan including applicable maps, applicable plan improvement documents, applicable NEPA documents, and the monitoring program for the plan area.
Planned fire (planned ignition)	An intentionally ignited fire with the intent to achieve specific objectives. A planned fire is generally covered under a NEPA decision document specifying a specific location, burning conditions, operational and management objectives, and monitoring measures. Includes all prescribed fire including pile burning slash piles. Also, see *unplanned fire*.
Planning period	The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects, and benefits (generally 15 to 20 years).
Population (ecological)	Organisms of the same species that occur in a particular place at a given time.

TERM	DEFINITION
Population viability	The likelihood of continued existence of a well-distributed population or species for a specific period. For most scientific analyses, the period is 100 years. For example, high viability is a high likelihood of continued existence of well-distributed populations for a century or longer.
Potential wilderness area	Inventoried lands within National Forest System lands that satisfy the definition of wilderness found in section 2(c) of the 1964 Wilderness Act (FSH 1909.12, chapter 70, 01/31/2007).
Primitive recreation	Those recreation activities that are non-motorized and do not involve mechanical transport. Examples include hiking, horseback riding, hunting, canoeing, and cross-country skiing.
Project	An organized effort to achieve an objective identified by location, activities, outputs, effects, times, and responsibilities for execution.
Project design	The process of developing specific information necessary to describe the location, timing, activities, outputs, effects, accountability, and control of a project.
Projected Timber Sale Quantity (PTSQ)	The estimated quantity of timber meeting applicable utilization standards that is expected to be sold during the plan period. As a subset of PWSQ, PTSQ includes volume from timber harvest for any purpose (except salvage or sanitation harvest) from all lands in the plan area based on expected harvests that would be consistent with the plan components. The PTSQ is also based on the planning unit's fiscal capability and organizational capacity
Projected Wood Sale Quantity (PWSQ)	The estimated quantity of timber and all other wood products that are expected to be sold from the plan area for the plan period. The PWSQ consists of the projected timber sale quantity as well as other woody material such as fuelwood, firewood, or biomass that is also expected to be available for sale. The PWSQ includes volume from timber harvest for any purpose (except salvage or sanitation harvest) from all lands in the plan area based on expected harvests that would be consistent with the plan components.
Proper functioning condition	Proper functioning condition is a concept used to assess natural habitat forming processes of riparian and wetland areas (Pritchard et al. 1998). Systems in a properly functioning condition are dynamic and resilient to disturbance to structure, composition and processes of their biological and physical components. Primary elements typically include hydrologic characteristics, physical structure/form, vegetative characteristics, water quality and quantity, and aquatic/riparian biological community characteristics. The general methodology to assess properly functioning condition provides an integrated measure of condition and can be used at a variety of scales from individual reaches to watersheds.

TERM	DEFINITION
Public access	Usually refers to a road or trail route over which a public agency claims a right-of-way for public use.
Public involvement (public participation)	A Forest Service process designed to broaden the information base upon which agency approvals and decisions are made by: (a) informing the public about Forest Service activities, plans, and decisions, and (b) encouraging public understanding about and participation in the planning processes that lead to final decision making.
Public issue	A subject or question of widespread public interest relating to management of the National Forest System.
Public participation	See *public involvement*.
Range allotment	A designated area containing land suitable and available for livestock grazing use upon which a specified number and kind of livestock are grazed under an approved allotment management plan. It is the basic management unit of the range resource on National Forest System lands administered by the Forest Service.
Rangeland	Land upon which the indigenous vegetation (climax or natural potential) is predominately grasses, grass-like plants, forbs, or shrubs, and is managed as a natural ecosystem. If plants are introduced, they are managed similarly. Rangeland includes natural grasslands, savannas, shrub lands, many deserts, tundras, alpine communities, marshes, and meadows.
Reach	A relatively homogenous section of stream having a repetitious sequence of habitat types and relatively uniform physical attributes such as channel slope, habitat width, habitat depth, streambed substrate and degree of interaction with its floodplain (PNW Region 6 Stream Inventory Handbook (2010 version 2.1)).
Record of decision (ROD)	A document separate from but associated with an environmental impact statement that states the decision; identifies all alternatives, specifying which were environmentally preferable; and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not (40 CFR 1505.2).

TERM	DEFINITION
Recovery unit (bull trout)	Bull trout recovery units are the major units for managing recovery efforts; each recovery unit is described in a separate chapter in the recovery plan. Most recovery units consist of one or more major river basins. Several factors were considered in identifying recovery units, for example, biological and genetic factors, political boundaries, and ongoing conservation efforts. In some instances, recovery unit boundaries were modified to maximize efficiency of established watershed groups, encompass areas of common threats, or accommodate other logistic concerns. Recovery units may include portions of mainstem rivers (e.g., Columbia and Snake Rivers) when biological evidence warrants inclusion. Biologically, bull trout recovery units are considered groupings of bull trout for which gene flow was historically or is currently possible (USFWS 2015b).
Recreation opportunity	An opportunity for a user to participate in a preferred activity within a preferred setting, in order to realize those satisfying experiences which are desired.
Recreation opportunity spectrum	A framework of land delineations that identifies a variety of recreation experience opportunities categorized into classes on a continuum. The spectrum's continuum has been divided into six major classes for Forest Service use: Urban (U), Rural (R), Roaded Natural (RN), Semi-Primitive Non-Motorized (SPNM), Semi-primitive Motorized (SPM), and Primitive (P) (FSM 2311).
Recreation residence	A privately owned dwelling within an established recreation residence tract or group on NFS land, authorized for maintenance and use under a special use permit. A vacation structure authorized for the purpose of facilitating the use and enjoyment of related national forest land and recreation resources by holders, their families, and guests. A recreation residence is not intended for use as the primary or permanent residence of the owner (FSM 2340.5).
Recreation sites	Specific places in the Forest other than roads and trails that are used for recreational activities. These sites include a wide range of recreational activities and associated development. These sites include highly developed facilities like ski areas, resorts, and campgrounds. It also includes dispersed recreation sites that have few or no improvements, but show the effects of repeated recreation use.
Reforestation	The natural or artificial restocking of an area with forest trees; most commonly used in reference to artificial restocking.
Refugia	Locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range (i.e., endemic populations) (FEMAT).
Regional Forester	The official responsible for administering a single Forest Service region.

TERM	DEFINITION
Regulated timber production	The technical (rather than legal or administrative) aspect of controlling forest stocking, periodic harvests, growth, and yields to meet management objectives including sustained yield. This control can be done either by area, volume of growing stock, or basal area measures. A regulated forest reaches sustained yield when the volume cut periodically equals the amount of net volume growth for that same period.
Rehabilitation	A short-term management alternative used to return existing visual impacts in the natural landscape to a desired visual quality.
Resilience	The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (FSM 2000, Chapter 2020).
Responsible official	The official with the authority and responsibility to oversee the planning process and to approve plans, plan amendments, and plan revisions (36 CFR 219.16).
Restoration	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems' sustainability, resilience, and health under current and future conditions (36 CFR 219.19).
Restore	Design and implement actions for the specific purpose of moving toward desired conditions. This generally applies when the existing conditions are outside the range of desired conditions.
Retard attainment	Measurably slow the recovery rate toward the desired conditions.
Reviewing officer	The supervisor of the responsible official. The reviewing officer responds to objections made to a plan, plan amendment, or plan revision prior to approval (36 CFR 219.16).
Riparian area	Areas adjacent to rivers, streams, seeps, springs, and wetlands that are shaped and maintained by water table height, flooding, scour, and soil deposition. Riparian areas provide habitat for aquatic and upland plants and animals, and provide shade, bank stability, and runoff filtration.
Riparian-dependent resources	Resources that owe their existence to the riparian area.
Riparian ecosystem	An ecosystem whose components are directly or indirectly attributed to the influence of surface and groundwater (www.icbemp.gov), located adjacent to rivers, streams, and other hydrologic features. Riparian ecosystems

TERM	DEFINITION
	encompass both the river and adjacent floodplain, and provide the transition between the aquatic and terrestrial ecosystem.
Riparian Habitat Conservation Area / Riparian management area	Lands along permanently flowing streams, ponds, lakes, wetlands, seeps, springs, intermittent streams, and unstable sites that may influence these areas where management activities are designed to maintain, restore, or enhance the ecological health of aquatic and riparian ecosystems and dependent resources.
Road	A motor vehicle route over 50 inches wide, unless identified and managed as a trail.
Road construction	FSM 7705 defines road construction or reconstruction together as the supervising, inspecting, actual building, and incurrence of all costs incidental to the construction or reconstruction of a road (36 CFR 212.1).
Road decommissioning	Activities that result in restoration of unneeded roads to a more natural state. *See decommissioning* (FSM 7734).
Road maintenance	Ongoing upkeep of a road necessary to maintain or restore the road in accordance with its road management objectives. (FSM 7714)
Roadless area	*See inventoried roadless area*
Scenic integrity objective (SIO)	The scenic integrity objectives serve as the desired conditions for the scenic resources and represent the degree of intactness of positive landscape attributes. SIOs are categorized into five levels. The highest scenic integrity ratings are given to those landscapes where valued landscape attributes will appear complete with little or no visible deviations evident. Lower SIOs are given to those landscapes where modifications to the landscape will be more evident.
Segregation	The term “segregation” as it pertains to withdrawals, refers to the closure of the lands to the operation of all/some of the public land laws and/or mineral laws. Public land laws authorize some means to dispose of the surface estate, whereas the mineral laws authorize disposal of the subsurface estate.
Self-sustaining population	Populations that are sufficiently abundant, interacting, and well distributed in the plan area, within the bounds of their life history and distribution of the species and the capability of the landscape, to provide for their long-term persistence, resilience and adaptability over multiple generations.

TERM	DEFINITION
Semi-primitive characteristics	The combination of biophysical and experiential elements that distinguish backcountry settings (those areas of the forest generally accessed by trail or cross-country travel not located in a designated wilderness or recommended wilderness area) from the frontcountry (those areas of the forest generally accessed by vehicles). Semi-primitive characteristics include: 1) predominantly natural or natural-appearing environment of moderate to large size, 2) low concentration of and probability of interaction between users, 3) minimum on-site controls or restrictions, 4) moderate to high probability of experiencing isolation, 5) opportunity for independence, closeness to nature, tranquility and self-reliance through the application of outdoor skills in an environment that offers challenge and risk.
Sensitive species	Those species of plants or animals that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species, that are on an official state list, or that are recognized by the Regional Forester as needing special management to prevent their being placed on Federal or state lists.
Seral stage	A biotic community that is a developmental, transitory stage in an ecological succession.
Sidecast	Placement of unconsolidated excavated material from road construction and maintenance over the downhill side of the road.
Silvicultural practices	Activities that control the establishment, composition, structure, and function of forested ecosystems.
Slope distance	A measure of distance along a slope.
Snag	A standing dead tree usually greater than 5 feet in height and 6 inches in diameter at breast height (d.b.h.).
Source water protection area habitat	Source water is untreated water from streams, rivers, lakes or underground aquifers that provides public drinking water. A source water protection area is the land area contributing to a public water system where potential contamination could affect the drinking water supply. Those characteristics of macrovegetation that contribute to stationary or positive population growth. Distinguished from habitats associated with species occurrence: such habitats may or may not contribute to long-term population persistence (Wisdom et al. 2000).
Special areas	Areas in the National Forest System designated for their unique or special characteristics (36 CFR 219.7).

TERM	DEFINITION
Special forest products	Products collected from NFS lands that include, but are not limited to, bark, berries, boughs, bryophytes, bulbs, burls, Christmas trees, cones, ferns, firewood, forbs, fungi (including mushrooms), grasses, mosses, nuts, pine straw, roots, sedges, seeds, transplants, tree sap, wildflowers, fence material, mine props, posts and poles, shingle and shake bolts, and rails. Special forest products do not include sawtimber, pulpwood, non-sawlog material removed in log form, cull logs, small roundwood, house logs, telephone poles, derrick poles, minerals, animals, animal parts, insects, worms, rocks, water, and soil (36 CFR part 223 Subpart G).
Special use authorization	A permit, term permit, lease, or easement that allows occupancy, use, rights, or privileges of National Forest System land.
Species viability	A viable population is one for which the number and distribution of reproductive individuals would “insure its continued existence” (1982 planning rule).
Standards	Constraints upon project and activity decision-making explicitly identified in a plan as ‘standards.’ Standards are established to help achieve the desired conditions and objectives of a plan and to comply with applicable laws, regulations, executive orders, and agency directives (36 CFR 219.7(a)(3). A standard differs from a guideline in that a standard is a strict design criteria, allowing no variation, whereas a guideline allows variation if the result would be equally effective (FSH 1909.12).
Stewardship	Natural resource management emphasizing careful and conscientious use and conservation of resources and ecosystems in a sustainable manner.
Structural Stage	Tree structure is classified into five general groups based on diameter and canopy cover. The diameter is based on the quadratic mean diameter in inches of trees whose heights are in the top 25 percent of all tree heights in the stand. This generally means that the diameters of the larger co-dominant trees in a stand are used to define the structure class.
Structural Stage – Early	Trees less than 10 inches d.b.h.[4] or canopy cover less than 10 percent
Structural Stage – Mid Open	Trees 10 to 20 inches d.b.h., canopy cover between10 and 40 percent
Structural Stage – Mid Closed	Trees 10 to 20 inches d.b.h., canopy cover 40 percent or greater
Structural Stage – Late Open	Trees 20 inches or greater d.b.h., canopy cover between 10 and 40 percent

[4] d.b.h. = diameter at breast height.

TERM	DEFINITION
Structural Stage – Late Closed	Trees 20 inches or greater d.b.h., canopy cover 40 percent or greater
Subbasin	A watershed with a drainage area of approximately 800,000 to 1,000,000 acres, equivalent to a 4th-field hydrologic unit code (HUC8). Hierarchically, subwatersheds are contained within a 5th-field watershed, which are contained within subbasins (ICBEMP). See *Hydrologic Unit System*
Subwatershed	A watershed with a drainage area of 10,000 to 40,000 acres, equivalent to a 6th-field Hydrologic Unit Code (HUC12). Hierarchically, subwatersheds are contained within 5th-field watersheds, which are contained within subbasins (ICBEMP). See *Hydrologic Unit System*
Succession	The sequential replacement over time of one plant community by another, in the absence of major disturbance. The different stages of succession are often referred to as seral stages. Developmental stages are as follows: **Early seral:** Communities that occur early in the successional path and generally have less complex structural developmental than other successional communities. Seedling and sapling size classes are an example of early seral forests. **Mid-seral:** Communities that occur in the middle of the successional path. For forests, this usually corresponds to the pole or medium saw timber-size growth stages. **Late-seral:** Communities that occur in the later stage of the successional path with mature, generally larger individuals, such as mature forests.
Suitable habitat	Habitat that currently has both the fixed and variable attributes for a given species habitat requirements. Variable attributes change over time and may include seral stage, cover type and overstory canopy cover.
Suitability	The appropriateness of a particular area of land for applying certain resource management practices, as determined by an analysis of the existing resource condition and the social, economic, and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.
Surrogate species	Intended to represent ecological conditions that generate sustainable ecosystems
Sustainability	Meeting needs of the present generation without compromising the ability of future generations to meet their needs. Sustainability is composed of desirable social, economic, and ecological conditions or trends interacting at varying spatial and temporal scales embodying the principles of multiple-use and sustained-yield.

TERM	DEFINITION
Thermal cover	Cover used by animals to lessen the effects of weather; for elk, a stand of coniferous trees 12 meters (40 feet) or more tall with an average crown closure of 70 percent or more; for deer, cover may include saplings, shrubs, or trees at least 1.5 meters (5 feet) tall) with 75 percent crown closure.
Threatened species	Any species of animal or plant that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and which has been designated in the Federal Register by the Secretary of Interior as a threatened species.
Timber harvest	The removal of trees for wood-fiber use and other multiple-use purposes.
Timber harvest as a tool	Areas where timber harvest is allowed to be used to reach multiple-use objectives, but regulated timber production is not a suitable use.
Timber harvest, scheduled production	Lands where regulated timber production is suitable.
Timber production	The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use (36 CFR 219.16). In addition, managing land to provide commercial timber products on a regulated basis with planned, scheduled entries.
Transportation and utility corridor	A parcel of land, without fixed limits or boundaries, which is used as the location for one or more transportation or utility rights-of-way (36 CPR 219.3).
Transportation system	The system of National Forest System roads, trails, and airfields on National Forest System lands (36 CFR 212.1).
Travel management	Travel management decisions include adding a route to or removing a route from the forest transportation system, constructing a National Forest System road or National Forest System trail, acquiring a National Forest System route through a land purchase or exchange, decommissioning a route, approving an area for motor vehicle use, or changing allowed motor vehicle classes or time of year for motor vehicle use (FSM 7715).
Unauthorized roads or trails	A road or trail that is not a National Forest System road or trail nor a temporary road or trail and that is not included in a forest transportation atlas (36 CFR 212.1).

TERM	DEFINITION
Uncharacteristic fire	Any fire that occurs outside the time, space, and severity parameters of the natural fire regime for the vegetation group. RCW 76.06.020(16), “ecologically atypical for a forest or vegetation type or plant association and refers to fire, insect or disease events that are not within a natural range of variability.” WDNR. 2012. Staff Report: Forest Health Technical Advisory Committee. Washington State Department of Natural Resources.
Understory reinitiation	Establishment of tree regeneration as older trees occupy less than full growing space.
Uneven-aged management	The application of a combination of actions that results in the creation or maintenance of stands with several different ages of trees. Managed uneven-aged forests are characterized by a distribution of tree ages throughout the forest area. An uneven-aged stand of trees is one in which there are differences in age among the individual trees. Group selection, variable density thinning, and shelterwood with reserves are methods that produce uneven-aged stands (Helms 1998).
Unplanned fire	Any unplanned non-structural fire. Any unplanned fire may be concurrently managed for one or more objectives and those objectives can change as the fire spreads across the landscape, encountering new fuels, weather, social conditions, and governmental jurisdictions. Current policy requires that all arson fires be suppressed.
Unroaded	Unroaded areas are large and contiguous areas, usually over 5,000 acres, with no National Forest System roads. They provide a recreational setting without National Forest System roads.
Utility and transportation corridors	See *Transportation and utility corridors*.
Variable density thinning	A type of variable retention harvest system that retains structural elements and biological legacies (snags, logs, trees) from the harvested stand for incorporation into the new stand to achieve various ecological objectives (Helms 1998).

TERM	DEFINITION
Vegetation management	Activities designed primarily to promote the health of forest vegetation in order to achieve desired results. When vegetation is actively managed, it means that it is manipulated or changed on purpose by humans to produce desired results. Where active management of vegetation is required, techniques are based on the latest scientific research and mimic natural processes as closely as possible. Vegetation management is the practice of manipulating the species mix, age, fuel load, and/or distribution of wildland plant communities within a prescribed or designated management area in order to achieve desired results. It includes prescribed burning, grazing, chemical applications, biomass harvesting, and any other economically feasible methods of enhancing, retarding, modifying, transplanting, or removing the aboveground parts of plants.
Watershed	The area of land where all contributing water drains to a single defined outlet point. (FEMAT, IX-39). Watersheds occur and are categorized at various scales, described in the Hydrologic Unit system definition. A watershed is also the 5th field hydrologic unit within the Hydrologic Unit system. Fifth-field watersheds classified by the Hydrologic Unit system are approximately 250,000 acres. Hierarchically, 5th-field watersheds are contained within subbasins and contain subwatersheds.
Watershed condition class	Watershed condition is the state of physical and biological characteristics and processes within a watershed that affect the hydrologic and soil functions supporting aquatic ecosystems (Potyondy and Geier 2010). Three classes are used to describe watershed condition (FSM 2521.1): • Class 1: Functioning properly--watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition; • Class 2: Functioning at risk--watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition; • Class 3: Impaired function--watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Change in watershed condition class through focused restoration activities is the nationally consistent measure to demonstrate improvement in watershed condition on NFS lands.

TERM	DEFINITION
Watershed Condition Framework	The Watershed Condition Framework (WCF) was conceptualized at the national scale to change the Forest Service's approach to landscape and watershed restoration. The WCF established a nationally consistent approach to classify watersheds based on underlying ecological, hydrological, and geomorphic functions, and targets implementation of focused restoration activities in priority subwatersheds.
Wetlands	Areas that are inundated by surface or ground water with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.
Wild and scenic rivers	Those rivers or sections of rivers designated as such by congressional action under the 1968 Wild and Scenic Rivers Act, as supplemented and amended, or those sections of rivers designated as wild, scenic, or recreational by an act of the legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories: 1. Wild River Areas-- Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America. 2. Scenic River Areas-- Those rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. 3. Recreational River Areas-- Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.
Wilderness	An area of National Forest System land designated by Congress that is defined in sec. 2(c) of the Wilderness Act (16 U.S.C. 1131-1136). The term wilderness is applied to all National Forest System lands included in the National Wilderness Preservation System (FSM 2320.5).
Wilderness character	The combination of biophysical, experiential, and symbolic ideals that distinguish wilderness from all other lands. The four qualities of wilderness related to wilderness character as found in the definition of Wilderness from Section 2 (c) of the Wilderness Act include: untrammeled, natural, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. A fifth component of wilderness character that must also be considered includes the unique qualities of a particular wilderness area.

TERM	DEFINITION
Wilderness resource spectrum (WRS)	A spectrum of wilderness conditions including finer gradations of naturalness and solitude mapped as pristine, primitive, semi-primitive, and transition. WRS is a kind of zoning where different management prescriptions apply.
Wildland-urban interface (WUI)	The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels (NWCC 2012). In applying Title I of Healthy Forests Restoration Act (HFRA) (P.L. 108-148), this term means: • An area within or adjacent to an at-risk community identified in recommendations to the Secretary in a Community Wildfire Protection Plan (CWPP), or, in the case of any area for which a CWPP is not in effect: • An area extending ½ mile from the boundary of an at-risk community; an area within 1½ miles of the boundary of an at-risk community including any land that has a sustained steep slope that creates the potential for wildland fire behavior endangering the at-risk community, has a geographic feature that aids in creating an effective firebreak, such as a road or ridgetop, or is in Condition Class 3, as documented by the Secretary in the project-specific environmental analysis; and an area that is adjacent to an evacuation route for an at-risk community that the Secretary determines (in cooperation with the at-risk community) requires hazardous fuel reduction to provide safer evacuation. When not using Title I of the HFRA, use the definition of wildland-urban interface community from the Federal Register, January 4, 2001, pages 752 to 753.
Winter Range	The area available to and used by wildlife (big game) during the winter season (December 1 to April 30). Generally, lands below 4,000 feet in elevation, on south and west aspects, that provide forage and cover.
Withdrawal	A withdrawal is a management tool used to implement resource management planning prescriptions. A withdrawal creates a title encumbrance on the land, restricting an agency's ability to manage its lands under multiple-use management principles. Administrative withdrawals are made by the President, the Secretary of the Interior, or other authorized officer of the Executive Branch of the Federal Government. Examples include Executive Orders, Presidential Proclamations, Secretarial Orders, Public Land Orders, etc. As stated in the Federal Land Management Policy Act of 1976, PL94-579, (43 U.S.C. 1714), the Secretary of the Interior is authorized to make, modify, extend, or revoke withdrawals.
Zone of Influence	See *Habitat Effectiveness*

This page left blank intentionally

Index

Adaptive management, 238, 351, 413, 647, 652, 656, 664, 793
Affected Environment, 85, 91, 92, 134, 162, 185, 197, 309, 415, 606, 776, 785
Air quality, 33, 37, 184, 417, 766
Alternatives, ix
  analyzed in detail, 30
  comparison of, v, ix, 74, 357, 369, 380, 403, 404
  development of, 29
  eliminated from detailed study, 80
  environmental consequences, 85, 135, 158, 167, 186, 233, 349, 428, 460, 621, 644, 656, 681, 688, 708, 763, 783, 787
Analysis of the Management Situation, iv, 5, 29
Aquatic and Riparian Conservation Strategy (ARCS), vi, 31, 57, 238, 335, 359
Assumptions
  climate change, 86
  fiscal capability, 86
Best available science, use of, 85, 151
Best management practices, 338, 351
Botany, 134–49
Canopy cover, 324, 326, 650
Capability
  rangeland, 657
  wilderness, 702
Climate Change, 6, 23, 86, 149–58, 238, 258, 273, 283, 294, 298, 303, 307, 410, 412, 445, 458, 465, 467, 469, 471, 474, 476, 477, 478, 481, 483, 485, 487, 489, 492, 495, 496, 498, 499, 502, 504, 506, 509, 511, 513, 516, 517, 519, 521, 523, 525, 528, 530, 532, 535, 538, 539, 541, 542, 545, 547, 549, 551, 553, 555, 559, 560, 561, 563, 566, 567,570, 572, 574, 576, 580, 581, 582, 584, 587, 588, 653, 663
Comments
  agency, 16
  public, iv, 2, 16, 29, 64, 371, 614, 620, 622, 627, 630, 689, 725, 731
Consultation, 88, 785, 788, 790
Cumulative Effects, 134, 137, 149, 183, 187, 195, 258, 272, 283, 294, 298, 303, 305, 407, 413, 465, 467, 469, 472, 474, 476, 477, 479, 481, 483, 485, 488, 490, 492, 495, 497, 498, 500, 503, 504, 507, 509, 511, 513, 516, 518, 519, 521, 524, 525, 528, 530, 532, 535, 538, 539, 541, 542, 545, 547, 549, 552, 554, 556, 559, 560, 562, 563, 566, 568, 570,572, 574, 577, 580, 581, 583, 584, 587, 589, 624, 629, 632, 634, 637, 649, 677, 688, 751, 776, 785
Economic Resources, 590–605
Endangered Species Act of 1973, 89
Environmental Justice, 611, 624, 626, 629, 632, 634, 637
Federal Land Policy Management Act of 1976, 89
Federal laws, 89
  Clean Air Act, 89
  Clean Water Act, 89
  Endangered Species Act, 89
  Federal Land Policy Management Act, 89
  Forest Rangeland Renewable Resources Planning Act, 89
  Granger-Thye Act, 90
  Healthy Forests Restoration Act, 90
  Multiple-Use Sustained Yield Act, 90
  National Environmental Policy Act, 90
  National Forest Management Act, 90
  National Historic Preservation Act, 90
  Wilderness Act, 90
Federally listed species
  bull trout, 4, 7, 51, 202, 204–7, 213, 214, 225, 226, 240, 247, 251, 256, 267, 276, 296, 299, 303, 306–9, 348
  Canada lynx, 4, 38, 450–57, 466–68, 486–88, 495, 508–10, 529–31, 550–53, 571–73
  grizzly bear, 3, 37, 449, 464–65, 485–86, 506–7, 527–29, 549–50, 569–71, 666
  woodland caribou, 3, 38, 447, 468–70, 489–91, 510–12, 532–33, 553–55, 574–75
Fire ecology
  fire regime condition class, 17, 164, 170, 221, 759
Heritage Resources, 606–49
Historic range of variability (HRV), 35, 54, 151, 327, 356, 368, 377, 393, 398, 401, 529, 753
Hydrology, 309–414, 421
INFISH (Inland Native Fish Strategy), 8, 50, 51, 230, 238, 250, 254
Invasive Plants, 184–96
Key indicators, 17, 18, 19, 21, 79, 233, 235, 236
Key Watershed, 251, 262
Lands, 776–85
Livestock Grazing, 38, 328, 475–76, 496–97, 517–18, 539–40, 560–61, 581–82, 603, 650–78
Management Areas, 39–46
Management Indicator Species, 39–46
Minerals and Geologic Resources, 678–88
Mitigation measures, 148, 306, 645, 647, 652, 656, 782, 787, 791

Monitoring, 9, 34, 139, 215, 216, 230, 238, 239, 245, 273, 284, 295, 299, 333, 592, 624, 627, 630, 632, 635, 652, 775, 793
Motor vehicle use map, 49, 711
Motorized use
  off-highway vehicles (OHVs), 24, 144, 146, 148, 305, 613, 623, 697, 723, 744
National Environmental Policy Act of 1969, 90
National Forest Management Act of 1976, 90
National Historic Preservation Act, 90
Nationally Designated Trails, 711
Need for Change, 5–8, 166, 186, 233, 348, 428, 654, 695, 760, 783
Potential natural vegetation type (PNVT), 646
Proposed Action, iii, 2, 52–59, 112–16, 173–76, 190, 259–73, 359–71, 485–505, 667–68, 717–25
Public Involvement, iv, 15–21
Purpose and Need, iii, ix
Recreation, 592, 602, 644, 689–751
Recreation Opportunity Spectrum (ROS), 712, 717, 718, 725, 731, 738, 744
Regulatory Framework
  laws, regulations, and policies, 89, 90
Research Natural Areas (RNAs), ix, 184, 756
Responsible Official, 695
Restoration
  focused, 8, 40, 58, 190, 191, 256, 262, 278, 287, 295, 300, 316, 331, 349, 361, 370, 382, 404
  forest, 86, 469, 489, 511, 513, 525, 532, 553, 554, 574, 575, 627
  general, 190, 191, 277, 295, 300, 362, 367, 377, 389, 625, 628, 630, 731
  of historic fire regimes, 138, 144, 146, 148
  watershed, 239, 240, 333, 354, 363, 373, 409
Riparian Areas, 320–21, 359, 652
Road density, 49, 259, 260, 264, 274, 330–31, 355, 358, 365, 376, 388, 397, 401, 683
Roadless Areas, 81, 140, 614, 620, 623, 701, 737, 742
Safety, 81, 356, 478, 479, 497, 512, 520, 521, 542, 543, 563, 564, 584, 597, 614, 625, 628, 630, 633, 688, 699, 710, 715, 740, 746
Scenery, 751–76
Scenery Management, 39, 752
Significant Issues, v, 16–21, 48, 54, 60, 65, 69, 73
Social Resources, 785
  community resilience, 614, 622, 624, 626, 627, 629, 630, 632, 634, 635, 636, 637
Soils, 37, 415–46
Special Uses, 776–85
Species of management interest, 455, 459, 482–85, 503–5, 524–26, 546–47, 567–69, 588–90
Species viability, 599, 625, 628, 630
  aquatic, 216–30, 263, 276, 286, 296, 301
  plants, 149
Suitability, 659
  livestock grazing, 660
  timber, 9
Surrogate wildlife species, 451–57, 460, 470, 474, 475, 476, 478, 481, 491, 494, 496, 497, 498, 502, 512, 516, 517, 518, 520, 523, 534, 537, 539, 540, 542, 544, 555, 558, 560, 561, 563, 565, 576, 579, 581, 582, 583, 586
Threatened, endangered, and sensitive species, 21, 135, 211, 447
Traditional cultural properties (TCP), 642, 788–93
Travel Management Rule, 10, 49, 89, 697, 700, 711, 715, 740, 746, 761
Tribal Resources, 785–93
Watershed
  condition framework, 8, 217, 317, 330, 335, 375
  focus, 258, 314, 334, 336, 351
  key, 58, 63, 240, 267, 275, 314, 361–65, 372, 373, 376, 383, 400
  priority, 51, 256, 314, 336, 351, 352, 353, 354, 358, 376, 399, 524, 545, 566, 587
Wild and Scenic Rivers, ix, 9, 22, 706–7, 706–7, 756
Wilderness
  congressionally designated, ix, 44, 170, 665, 704, 757
  potential, 706, 747, 762
  recommended, 19, 44, 50, 55, 62, 66, 70, 74, 167, 176, 177, 179, 181, 183, 186, 237, 261, 265, 275, 278, 285, 287, 296, 298, 300, 302, 624, 626, 629, 631, 634, 636, 655, 664, 668, 669, 672, 675, 676, 683, 686, 701, 716, 721, 728, 734, 741, 747, 757, 761, 765, 772
Wilderness Act of 1964, 90
Wildland-urban interface (WUI), 161, 171, 620
Wildlife, 5, 20, 50, 56, 62, 67, 71, 74, 190, 192, 193, 194, 233, 447–590, 655, 666, 668, 669, 673, 675, 676, 684, 76