



United States Department of Agriculture

Taylor Hellroaring Project Environmental Assessment



Forest Service

Flathead
National Forest

Tally Lake
Ranger District

January 2018

**Taylor Hellroaring Project
Environmental Assessment
Flathead County, Montana**

Lead Agency: US Forest Service

Responsible Official: Chip Weber, Forest Supervisor
650 Wolfpack Way
Kalispell, MT 59901

For Information Contact: Deb Bond, Project Leader
dbond01@fs.fed.us

Telephone: (406) 758-5318

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

Data Accuracy - The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification.

If a map contains contours, these contours were generated and filtered using the Digital Elevation Model (DEM) files. Any contours generated from DEM's using a scale of less than 1:100,000 will lead to less reliable results and should be used for display purposes only.

Table of Contents

			Pages
Chapter 1	Purpose and Need	1-1	- 1-8
Chapter 2	Alternatives	2-1	- 2-30
Chapter 3	Introduction	3-1	- 3-6
	Specialists Reports		
	Vegetation	3-7	- 3-18
	Fire, Fuels and Air Quality	3-19	- 3-30
	Scenic Quality	3-31	- 3-56
	Aquatics	3-57	- 3-76
	Recreation	3-77	- 3-88
	Soils	3-89	- 3-104
	Threatened and Sensitive Plant Species	3-105	- 3-112
	Invasive Plant Species	3-113	- 3-122
	Socioeconomics	3-123	- 3-134
	Heritage Resources	3-135	- 3-140
	Wildlife - Introduction	3-141	- 3-146
	Wildlife – Threatened and Proposed Species	3-147	- 3-186
	Wildlife – Sensitive Species	3-187	- 3-200
	Wildlife- Old Growth, Snags, and Downed Wood Habitat	3-201	- 3-212
	Wildlife – Commonly Hunted Big Game	3-213	- 3-220
	Wildlife – Neotropical Migratory Birds and Riparian Habitat	3-221	- 3-228
Appendices			
Appendix A	Maps (see below for descriptions)	A-1	- A-4
Appendix B	Trail Class Definitions	B-1	B-2
Appendix C	Literature Cited	C-1	C-27

List of Tables

		Page
Chapter 2		
Table 2-1	Proposed Unit Treatment Summary.	2-6
Table 2-2	Retention Descriptions for Vegetation and Fuel Treatments.	2-7
Table 2-3	Trail Proposals for Alternative 2.	2-9
Table 2-4	Road Construction.	2-11
Table 2-5	Haul Routes	2-13
Table 2-6	Trail Proposals for Alternative 3.	2-13
Table 2-7	Proposed Alternatives Comparisons.	2-15
Table 2-8	Summary Comparison of how the Alternatives Address the Key Issues.	2-15
Chapter 3		
Introduction		

Table 3-1	Cumulative Effects Summary on All Ownerships.	3-2
Table 3-2	Cumulative Effects Summary on National Forest System Lands.	3-4
Table 3-3	Cumulative Effects Summary on State and Private Lands.	3-5
<i>Vegetation</i>		
Table 3-4	Resource Indicators and Measures for Assessing Effect.	3-8
Table 3-5	Existing Cover Types.	3-8
Table 3-6	Canopy Cover.	3-10
Table 3-7	Expected Cover Types.	3-12
Table 3-8	Expected Canopy Cover.	3-13
Table 3-9	Comparison of Alternatives.	3-14
<i>Scenery</i>		
Table 3-10	Scenery Resource Indicators and Measures for Assessing Scenery Effects.	3-33
Table 3-11	Scenic Integrity, VQO, Condition and Time to Achieve the VQO.	3-36
Table 3-12	Scenery resource indicators and measures for the existing condition.	3-38
Table 3-13	Units by Distance Zone from High Concern Level Locations	3-40
Table 3-14	Summary of Travel-way/use Area Based Observer Points and their Visual Quality Objectives, Distance Zones to Project Units and Concern Levels	3-40
Table 3-15	MA7 Units and their VAC determinations.	3-42
Table 3-16	Summary of Impacts with Views of Moderate Concern From Intermediate Harvest Treatment.	3-45
Table 3-17	Summary of Impacts With Views of Minor, Moderate and Major Concern From Regeneration Harvest Treatment.	3-47
Table 3-18	Scenery Resource Assessment for Alternative 2.	3-49
Table 3-19	Resource Indicators and Measures for Alternative 2 Cumulative effects.	3-51
Table 3-20	Units Impacting High Concern Viewsheds.	3-52
Table 3-21	Summary Comparison of Environmental effects to Scenery Resources.	3-54
<i>Aquatics</i>		
Table 3-22	Resource Indicators and Measures for Assessing Effects.	3-57
Table 3-23	ECA and Associated PFI in Affected Sub-Watersheds.	3-60
Table 3-24	GIS Estimated Lengths for Road/Trail Interaction with Riparian Habitats.	3-61
Table 3-25	Sediment Delivery Estimates for Existing Conditions on National Forest.	3-62
Table 3-26	Road / Trail stream crossings.	3-63
Table 3-27	Sediment Delivery Under the No Action Alternative.	3-65
Table 3-28	Estimated ECA Values Following Implementation of Proposed Timber Harvest and Road Building.	3-66
Table 3-29	Road / Trail Riparian Interaction Under Alternative 2.	3-67
Table 3-30	Estimated Maximum Annual Anthropogenic Sediment Delivery.	3-68
Table 3-31	Number of Road / Trail Interaction with Streams.	3-68

Table 3-32	Summary Comparison of how the Alternatives Address the Relevant Issues.	3-71
Table 3-33	Review of PCEs and Potential Impacts from the Taylor Hellroaring Project.	3-73
Tables 3-34 to 3-38	Not used	
<i>Recreation</i>		
Table 3-39	Summary Comparison of how the Alternatives Address the Key Issues.	3-83
Table 3-40	Suggested Implementation Actions and Timelines.	3-86
<i>Soil</i>		
Table 3-41	Existing Detrimental Soil Disturbance.	3-91
Table 3-42	Landtypes of Treatment Units – Alternative 2.	3-92
Table 3-43	Cumulative Effects Summary – Alternatives 2 and 3.	3-100
<i>Socioeconomics</i>		
Table 3-44	Travel and Tourism Private Employment in Flathead County	3-126
Table 3-45	Timber Private Employment in Flathead County	3-126
Table 3-46	Estimated Present Net Value of Timber and Non-Timber Activity by Alternative	3-132
Table 3-47	Estimated Economic Impacts by Non-Timber and Timber Activity by Alternative.	3-133
<i>Wildlife - Introduction</i>		
Table 3-48	Presence and Status of Wildlife Management Indicator Species and Habitats In and Near the Taylor Hellroaring Project Area.	3-141
Table 3-49	Species-Specific Habitat Occurrence and Other Issues Related to the Taylor Hellroaring Project Affected Area.	3-142
Table 3-50	Species and Rationale for Not Being Included in the Detailed Effects Analysis for the Taylor Hellroaring Project	3-143
<i>Wildlife – Threatened Species</i>		
Table 3-51	Potential Lynx Habitat across the Upper Big and Lakalaho LAU.	3-152
Table 3-52	Acres of Lynx Habitat Components and Percentages of Mapped Lynx Habitat across the Upper Big and Lakalaho LAUs.	3-152
Table 3-53	Vegetation Management Changes in Lynx Habitat Used for Effects Analysis.	3-153
Table 3-54	Changes in Potential Lynx Habitats through Vegetation Management, Upper Big and Lakalaho LAUs, in acres and percent of lynx habitat	3-153
Table 3-55	Summary of Changes to Potential Lynx Habitats through Vegetation Management, Upper Big and Lakalaho LAUs, in acres.	3-154
Table 3-56	Summary of Changes to Potential Lynx Habitats through Road Construction, Upper Big and Lakalaho LAUs, in acres	3-154
Table 3-57	Summary of Changes to Potential Lynx Habitat through Trail Construction by Alternative and LAU, in acres, before vegetation management.	3-155
Table 3-58	Changes to Potential Lynx Habitat through all Project Activities by Alternative and LAU, in acres and percent of lynx habitat.	3-156

Table 3-59	Summary of Changes to Potential Lynx Habitat through all Project Activities by Alternative, in acres,	3-157
Table 3-60	Miles of Over Snow Routes by LAU.	3-157
Table 3-61	Northern Rockies Lynx Management Direction Applicable to the Taylor Hellroaring Project	3-158
Table 3-62	Current Conditions of Potential Lynx Habitats Relevant for Critical Habitat Analysis by Lynx Analysis Unit and Percentages of Potential Lynx Habitat in the LAU.	3-162
Table 3-63	Changes through Vegetation Management in Potential Lynx Habitats relevant for Critical Habitat Analysis, Upper Big and Lakalaho LAUs, in acres.	3-163
Table 3-64	Changes through Road Construction in Lynx Habitats relevant for Critical Habitat Analysis, in acres.	3-163
Table 3-65	Changes through Trail Construction on Lynx Critical Habitat by alternative, in acres, before vegetation management.	3-163
Table 3-66	Changes to potential lynx habitat in Critical Habitat through all Project Activities by Alternative and LAU, in acres.	3-164
Table 3-67	Summary of Changes to Potential Lynx Habitat in Critical Habitat through all Project Activities by Alternative, in acres.	3-165
Table 3-68	Primary Constituent Elements of Canada Lynx Critical Habitat and the Taylor Hellroaring Project	3-166
Table 3-69	Land Ownership in Project Grizzly Bear Subunits.	3-167
Table 3-70	Amendment 19 Existing Access Conditions in Project Subunits.	3-170
Table 3-71	Existing Conditions for Seasonal Habitats and Cover within Project Subunits.	3-171
Table 3-72	Summary of Management Situation Lands within the Project subunits.	3-172
Table 3-73	Effects of Proposed Vegetation Management on Hiding Cover in Project Subunits.	3-174
Table 3-74	Proposed Trail Construction and Grizzly Bear Concerns.	3-175
Table 3-75	Miles of Proposed Trail by Management Situation.	3-181
Table 3-76	Alternatives 2 and 3 Summary of Vegetation Management in Maternal Denning and Primary Wolverine Habitats.	3-184
Table 3-77	Alternatives 2 and 3 Summary of Trail Construction in Maternal Denning and Primary Wolverine Habitats, in miles.	3-185
<i>Wildlife – Sensitive Species</i>		
Table 3-78	Potential Fisher Habitat and Vegetation Management Effects by Alternative.	3-191
Table 3-79	Riparian Landtypes NL1A and NL1E in the Taylor Hellroaring Wildlife Analysis Area.	3-198
Table 3-80	Cumulative Effects Sections in this Chapter and Project File Project File Exhibits for Cumulative Effects for Sensitive Wildlife Species.	3-199
Table 3-81	Biological Evaluation Determinations for Sensitive Wildlife Species.	3-200
<i>Wildlife- Old Growth, Snags, and Downed Wood Habitat</i>		
Table 3-82	Timber Harvest or Burning in mature late-seral forests that appear to be moving toward old growth conditions.	3-205
Table 3-83	Proposed Units that would Affect Important Forested Connections.	3-205

Table 3-84	Early, Mid, and Late Seral/structural Stages, by Alternative, for All Ownerships across the Taylor Hellroaring Wildlife Analysis Area.	3-208
Table 3-85	Cumulative Abrupt Edge on Old Growth Habitat and Acres Old Growth Affected.	3-208
Table 3-86	Forest Plan Amendment 21 Snag and Downed Wood Standards.	3-211
<i>Wildlife – Commonly Hunted Big Game</i>		
Table 3-87	Open Road Densities Across Forest Service Lands.	3-215
Table 3-88	Vegetation Treatment that Would Temporarily Negate cover Values for Large Mammals or Reduce the Effectiveness of Cover Values for Large Mammals.	3-216
Table 3-89	Cover Remaining Across the Taylor Hellroaring Wildlife Analysis Area after Regeneration Harvest, and cover with Altered Effectiveness.	3-217
Table 3-90	Forage Across the Taylor Hellroaring Wildlife Analysis Area Unavailable to Elk and Deer after Vegetation Treatments.	3-217
<i>Wildlife –Neotropical Migratory Birds and Riparian Habitat</i>		
Table 3-91	Migratory Birds of Concern Known or Suspected to Occur in the Taylor Hellroaring Wildlife Analysis Area.	3-223
Table 3-92	Riparian Habitats across the Taylor Hellroaring Wildlife Analysis Area.	3-224
Table 3-93	Alternatives 2 and 3 Road construction and Mapped Riparian Habitats.	3-225

List of Figures

Figure 1-1	Project Vicinity Map	1-2
Figure 3-1	Visual quality objectives for Taylor Hellroaring Project area.	3-37
Figure 3-2	Visibility, Concern Level, Prescription and Observer Point Location Map.	3-41
Figure 3-3	Farm-to-Market Road intersection with Star Meadow Road as it looks currently (top) and visualized post-treatment during both summer (middle) and winter (bottom)	3-53
Figure 3-4	Temporal distribution of ECA within affected Sub-watersheds.	3-61
Figure 3-5	Temporal distribution of ECA under Alternative 2.	3-70
Figure 3-6	Social and Economic Analysis Area, Flathead County, Montana.	3-124
Figure 3-7	Flathead County Population, 1970 to 2015	3-125
Figure 3-8	Employment by base sector in Flathead County, 1970-2015.	3-125
Figure 3-9	Wildlife Analysis Areas for the Taylor Hellroaring Project.	3-144
Figure 3-10	Taylor Hellroaring Project Area, affected LAUs, and Critical Habitat.	3-149
Figure 3-11	Current Lynx Habitat Conditions, Upper Big and Lakalaho Lynx Analysis Units, including Mapped Wildland Urban Interface	3-151
Figure 3-12	Land ownership in project grizzly bear subunits.	3-168

List of Maps

Map 1	Proposed Action (Alternative 2) Vegetation Treatments
Map 2	Proposed Action (Alternative 2) Trails
Map 3	Alternative 3 Trails
Map 4	Management Areas

Agencies and Persons Consulted

Agencies and Tribes Consulted

The Forest Service consulted with the following groups, individuals, Federal, state and local agencies, and tribes during the development of this environmental assessment:

Federal, State, and Local Agencies:

Flathead County Commissioners

United States Fish and Wildlife Service

Montana Department of Fish, Wildlife, and Parks

City of Whitefish

Montana Department of Environmental Quality

Tribes:

Confederated Salish-Kootenai Tribes

Chapter 1 – Purpose and Need

Introduction

The Taylor Hellroaring Project was developed to address multiple resource objectives in an area on the Tally Lake Ranger District of the Flathead National Forest.

This environmental assessment (EA) was prepared to determine whether effects of the proposed activities may be significant enough to prepare an environmental impact statement (EIS). By preparing this environmental assessment, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations.

This document is organized into three chapters:

Chapter 1 outlines the project area and the purpose and need for the project. It identifies the desired condition as defined by the Flathead National Forest Land and Resource Management Plan (Forest Plan) and how the proposed activities will move the existing condition towards that desired condition.

Chapter 2 presents detailed descriptions of the proposed action (released to the public in March, 2017), identifies key issues, and describes the alternatives to the proposed action (including the no action alternative). The alternatives were developed to address or resolve issues related to the proposed action that were identified through public comments on the proposed action. This chapter also includes design features, which were developed to minimize the potential effects to resources during project implementation.

Chapter 3 describes the natural and human environment potentially affected by the proposed activities and discloses potential effects. Chapter 3 is organized by resource area.

Appendices:

- Appendix A, Map 1 shows Alternative 2 Proposed Vegetation Treatments
- Appendix A, Map 2 shows Alternative 2 Proposed Trails
- Appendix A, Map 3 shows Alternative 3 Proposed Trails
- Appendix A, Map 4 shows Management Areas
- Appendix B describes in detail the 5 different Trail Classes
- Appendix C, Literature Citations

Additional documentation is located in the project file at the Tally Lake Ranger Station. It includes field investigations, notes, literature cited, methodology used, public involvement information, and other documents used for developing alternatives and background for the resource specialists' analyses. These records are available for public review.

This project contains actions which would implement the Flathead National Forest Land and Resource Management Plan (1985) and is subject to the pre-decisional administrative review process under 36 CFR 218.

Location of the Proposed Project Area

The Flathead National Forest (FNF) is proposing to manage vegetation, treat fuels and construct trails on National Forest System (NFS) lands northwest of Whitefish, MT. The **Taylor Hellroaring Project** is administered by the FNF, Tally Lake Ranger District and is located in portions of section 11, T31N, R22W, sections 8,9,16,17,20-23, 25-27, 34, 35, Principal Meridian, Montana. (Refer to Figure 1 - Vicinity Map). Approximately 43 percent of the 7808 acre project area is located within the Wildland Urban Interface (WUI) and has been identified as a high priority for treatment.

Purpose and Need for Action

Existing and desired conditions in the Taylor Hellroaring area indicate a need to:

- Increase forest resilience to insect infestation and disease infection and wildland fire disturbances while maintaining a natural-appearing forested setting viewed from the surrounding area.
- Reduce the risk and severity of large scale stand-replacing fires to protect values at risk within the Wildland Urban Interface, Whitefish Mountain Resort (WMR) and electronic sites along the Whitefish Divide.
- Restore rust-resistant whitebark and western white pine.
- Provide a range of trail experiences for hikers, mountain bikers and horse riders to connect the local community with the Flathead National Forest. Opportunities will vary from highly developed accessible trails near trailheads and roads to more primitive and challenging trails in more remote backcountry.
- Maintain and improve terrestrial wildlife species habitat and security.

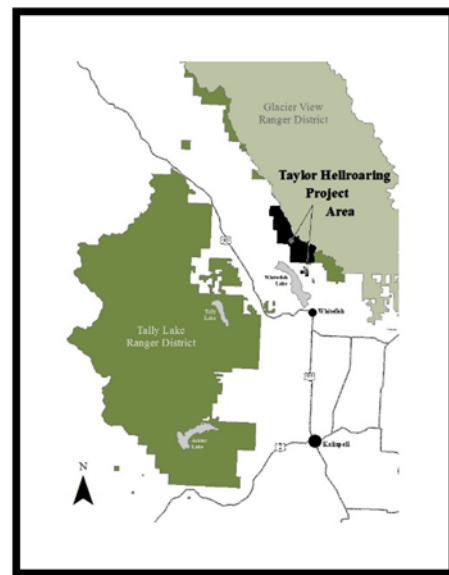


Figure 1-1. Project Vicinity Map

Increase forest resilience to insect infestation and disease infection and wildland fire disturbances while maintaining a natural-appearing forested setting viewed from the surrounding area.

The Forest Service land within the Taylor Hellroaring project area consists primarily of mature forest originating from a wildland fire approximately 120-200 years ago. The lack of recent forest management and the lack of recent wildland fire on the majority of National Forest lands contributed to the development of mature stands. Only the northern tip of the project area has recently experienced a large fire. The Werner Peak fire burned approximately 730 acres of National Forest land in 2001.

A large proportion of the mature forest is subalpine fir and Engelmann spruce at the high elevations. Many of these high elevation stands once contained a sizable component of whitebark pine. The exotic disease white pine blister rust killed most of the whitebark pine within the project area and altered the composition of these high elevation stands. The older subalpine fir and Engelmann spruce in these stands are also experiencing mortality from root disease, western balsam bark beetle and spruce beetle.

The remaining mature stands on NFS lands within the project area consist of mid-elevation mixed conifer stands primarily composed of Douglas-fir, western larch and lodgepole pine. These stands originated from a mixed severity fire approximately 120-140 years ago and are on productive sites capable of growing large diameter trees. Many large diameter Douglas-fir and western larch exhibit fire scars from past mixed severity fires. Lodgepole pine within these stands is nearing the end of its natural lifespan and declining. The lack of fire activity in the project area over the last century has allowed a dense understory of shade tolerant Douglas-fir, subalpine fir and grand fir to develop within many of these stands. These shade tolerant species provide ladder fuels and are more susceptible to root disease than western larch. Root disease along with corresponding bark beetles, such as Douglas-fir beetle, is currently the primary disturbance agent within these stands. Additionally, a parasitic plant, dwarf mistletoe, is affecting western larch within some of these stands. Conspicuously absent from these productive stands is western white pine. White pine blister rust likely killed most of the western white pine in these stands.

Stands originating from harvest comprise a minority of the NFS lands within the project area. The majority of these stands appear to be the result of harvesting in the 1960's. Stands clearcut in the 1960s are composed primarily of lodgepole pine, western larch and Douglas-fir. Some western white pine can be found in these stands. These stands are generally in good condition and healthy currently, though growth is beginning to slow due to overstocking. Stands experiencing liberation cuts in the 1960s are currently comprised of shade tolerant species that made up the advance regeneration released during the liberation cuts. The liberation cuts primarily removed the large-diameter western larch, western white pine and Douglas-fir from these stands. These stands exhibit symptoms of root disease and contain dwarf mistletoe in the few western larch remaining in the stands.

Reduce the risk and severity of large scale stand-replacing fires to protect values at risk within the Wildland Urban Interface, Whitefish Mountain Resort (WMR) and electronic sites along the Whitefish Divide.

The project area historically experienced stand replacement fire in the higher elevation subalpine fir/spruce stands every 35-200 years. Low-mixed severity fire in the lower elevation Douglas-fir/western larch stands also historically occurred every 35-200 years. The stands that burned in 1910 or that were harvested in the 1960's are within the historic range of variability of fire disturbance return interval. The stands that have not experienced fire for 160-200 years are close to being outside the historic disturbance return interval. Due to the high amount of annual precipitation in this area and associated dense vegetation of a relatively moist climate, the area would only experience a stand replacement fire during periods of high to extreme fire danger similar to the summer of 2015.

There are four general scenarios for wildland fire impacting the project area in its current condition:

1. *A wildland fire is successfully suppressed.* The current fire management direction for Hellroaring Basin and the Whitefish Mountain Resort portion of the project area is full suppression. Any fire start in this area would be fought immediately and aggressively with direct suppression tactics given the proximity to residences and other community values. National and local fire suppression efforts employing this tactic are approximately 98% successful. However, given the lack of access, snag hazard to fire fighters and heavy fuels in the area a relatively small initial attack fire (<3 acres) could take up to a week or more to suppress and require 20+ firefighters to extinguish.

2. *A wildland fire escapes initial response below the project area and runs with the slope and wind to the ridge top.* This would likely have fairly dramatic effects leaving little or no surviving above ground vegetation in the mature stands on NFS lands. Fire history records indicate the majority of fire starts in this area are in and around the inhabited lands below the project area. The burn pattern from one of the large fires that impacted the area in 1910 indicate it started near Whitefish Lake, below the project area, and burned north -northeast with the slope and prevailing wind. A fire of this type would most likely not be extinguished or controlled until a fire season ending weather event sometime in September or early October or without a substantial and expensive fire suppression effort that would put firefighters at risk. This scenario is not dissimilar to the 2001 Werner Peak Fire which burned 730 acres of NFS lands within the project area.
3. *A high or mid elevation wildland fire escapes initial attack.* The mature mid to high elevation stands have a significant snag component and large amounts of down wood due to insect and disease mortality, and fire suppression, which increases resistance to control and decreases firefighter effectiveness and safety. This type of fire would most likely create a mosaic of stand replacement and mixed severity fire since it would most likely be kept in check by aviation and other fire suppression tactics. A fire of this type would also most likely not be extinguished or controlled until a fire season ending weather event or with a substantial fire suppression effort that would put firefighters at risk.
4. *A managed naturally ignited wildland fire on portion of project area outside of MT DNRC fire protection responsibility.* The small size of this area and adjacent land ownership with high resource values and protection objectives thereon does not encourage practical management of natural ignitions in these management areas during early to mid-fire season. The appropriate management response to wildland fires here is suppression in the early to mid-fire season. However, from mid to late fire season, natural ignitions may be assessed for potential management under a multiple objectives (i.e. Hazards, Values at Risk, Probability of Success) Line Officers and Fire Managers may choose to manage natural ignitions in this area for multiple objectives.

For a variety of reasons wildland fire has been unable to play its natural role in the project area. A full suppression policy began in 1910 in this area and that will most likely continue into the foreseeable future with the exception of limited opportunity for naturally ignited managed fires. Air quality, scenery, timber production, municipal water supply, proximity to private homes and developments and a general misunderstanding of wildland fire during the last century has made wildland fire in this area socially undesirable. Topography, weather and fuel are the primary drivers of wildland fire. Fuels are the only component that can be altered. Even though weather and topography can't be controlled, fire behavior can be altered through fuels management.

The proposed treatments in the Wildland Urban Interface (WUI) are designed to address the Whitefish Area Community Wildlife Protection Plan. The electronic sites along the Whitefish divide are essential infrastructure.

Restore rust-resistant whitebark and western white pine.

Whitebark pine and its habitat is present in the upper elevations of the project area. Several interrelated factors threaten the western white and whitebark pine populations pine, including: 1) past and ongoing fire suppression and exclusion; 2) mortality due to several major mountain pine beetle epidemics over the last 80 years; 3) extensive infections of the exotic pathogen white

pine blister rust fungus (*Cronartium ribicola*); and 4) effects of weather and climate, including climate change over time. Whitebark pine provides food and nest sites for Clark's nutcrackers during the breeding season. There is a need to restore both species through planting rust resistant seedlings on sites that have been burned or opened up through vegetation removal. Thinning of sapling or larger-sized stands may also increase resilience. Cone producing whitebark pine, that exhibit resistance to blister rust, would be protected, where identified, to provide seed for regeneration or collection.

Provide a range of trail experiences for hikers, mountain bikers and horse riders to connect the local community with the Flathead National Forest. Opportunities will vary from highly developed accessible trails, near trailheads and roads to more primitive and challenging trails in more remote backcountry.

The Whitefish area in northwest Montana is a major destination for outdoor recreationists. Over the last decade, running, hiking and mountain bike use of the area has grown dramatically. Conflicts between user groups are increasing in part due to the increase in use and the limited availability of trails adjacent to the city of Whitefish.

In 2006, in response to public interest, the city of Whitefish began a process to plan and build a trail system including a loop trail around Whitefish Lake. The primary purpose of the Whitefish Trail system was to increase recreational trail and access opportunities adjacent to the town of Whitefish. There is currently an established trail system in the valley bottom with several in-town and near town trailheads that connect private, city, and state lands and will eventually connect to NFS lands. These trails were built for activities including hiking, equestrian and cross country mountain bike use.

The Whitefish Face trails proposal was submitted in conjunction with proposals for timber harvesting, fuels reduction, and watershed protection. The recreation component of this proposal is designed to provide multi-use recreational experiences that connect existing Whitefish Trails and other community trails with NFS trails in the Whitefish Range.

The proposed trails provide a connection from the short and well-used trails in and around the community of Whitefish and more remote trails on NFS lands. This would create opportunities for trail users to disperse from the current system onto more remote and challenging trails with greater opportunities for solitude. It would also connect existing trails on the landscape that are not currently easily accessible, such as the Ralph Thayer and Smokey Range Trail.

The trail network emphasizes a series of looping trails that provide opportunities for progressively longer and more challenging excursions. This layout allows users to choose the length and challenge of their excursion, and reduces user conflict. We expect that some hikers such as families or people with limited time will primarily use the lower elevation, shorter loops. Trail runners, beginner and intermediate mountain bikers, and more adventurous hikers will likely head for the middle loops, and advanced mountain bikers will likely use the longer loops. Looping trails such as these often develop a preferred direction of travel, which further reduces user conflict and improves safety.

The Forest Service supports the Whitefish Trails Master Plan (2006) as well as the Whitefish Working Group collaboration to develop the Proposed Action for the proposed trails to meet current policy, direction, and consistency with Forest Plan Standards and Guidelines.

The underlying need for these activities is to implement direction from the Flathead National Forest Land and Resource Management Plan (page 2-5): "Provide a range of quality outdoor

recreation opportunities within a forest environment that can be developed for visitor use and satisfaction including motorized and non-motorized, in an undeveloped forest environment.

More specifically the need for the Taylor Hellroaring trails proposal is to provide a sustainable non-motorized trail system in the vicinity of Whitefish to meet current and anticipated public demand, within natural resource and Forest Service capabilities, that reduces user conflict through trail use designation, trail design and management.

Specific goals associated with the purpose and need for this project include the following:

- Create trail loops of different lengths and challenge to meet needs and desires of users in an effort to disperse use and reduce user conflicts.
- Provide clear and concise information to users about trails, destinations, connections, trail etiquette and safety. Specific information to limit the risk of wildlife conflicts would be included.

Maintain and improve terrestrial wildlife species habitat and security.

Much of the project area is composed of mature forest that has reached a condition where the canopy is closed and understory vegetation is minimal. Vegetation management proposed in this project will restore spatial heterogeneity by creating openings, vegetation clumps, and widely spaced single trees. A diverse forest structure lends to increased wildlife diversity. Where openings are created, forage growth will be promoted which will benefit a variety of wildlife species. Returning fire to the landscape will also promote forage growth and benefit wildlife.

Relationship to the Forest Plan

Forest Plan Direction

The Forest Plan embodies the provisions of the National Forest Management Act (NFMA), its implementing regulations, and other guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Flathead National Forest. Where appropriate, this EA tiers to the Forest Plan Final Environmental Impact Statement and Record of Decision, in compliance with 40 CFR 1502.20

Management Areas

The Forest Plan uses management areas (MAs) to guide management of National Forest System lands within the Flathead National Forest. The Forest has been divided into twenty-two MAs, each with different management goals, and resource potential and limitations. The following MAs in the project area may be affected by proposed management activities.

MA 2A - Consists of unroaded lands suited for dispersed recreation that meet the ROS (Recreation Opportunity Spectrum) of primitive.

MA 20 - Consists of Whitefish Mountain Resort permit area and surrounding undeveloped area.

MA 7 - Consists of timberlands in areas of high scenic value.

MA 10-Old administrative site: abandoned Holbrook Overlook Picnic Area

The Flathead National Forest is in the process of revising its Forest Plan. This project will be analyzed under the 1986 Flathead National Forest Plan. If a decision is made on the Revised Forest Plan before the completion of this project, the project will demonstrate compliance with the new forest plan at that time.

This page intentionally left blank.

Chapter 2 – Alternatives

Introduction

This chapter describes the issue and alternative development process (including how public comments helped formulate the alternatives), the issues identified as “key issues”, and the descriptions of the alternatives. In this analysis, three alternatives are carried forward and analyzed in detail in Chapter 2 by resource. Tables 2-7 and 2-8 display an alternative comparison of proposed activities, project objectives, and key issues, providing a clear comparison for the decision maker and the public (40 CFR 1502.14).

Public Involvement

This section summarizes public involvement for the Taylor Hellroaring project. More detailed information, including mailings, legal notices, and public comment received can be found in the Project File Exhibits B and E.

Collaborative Group Input

Local groups and citizens initiated the concept of starting a collaborative forest management proposal for the Whitefish Face area from Haskill Basin to Werner Peak. The Whitefish Face Working Group (WFWG) started meeting in May of 2014. This diverse group of citizens, recreationists and landowners submitted a proposal in March of 2015 supporting treatment of vegetation and providing a range of non-motorized recreation trail experiences including connectivity with existing valley trails such as the Whitefish Trail in the Taylor Hellroaring area. This group identified a need to build upon opportunities to meet vegetation management, recreational access and restoration goals in an integrated manner.

Proposed Action

On March 28, 2017, the Proposed Action for the Taylor Hellroaring project was sent to local landowners and interested members of the public to ask for site specific comments on proposed management activities (*Project File Exhibit B-4*). The district sent out 116 packets of maps, project information, details about a public open house, and instructions on how to comment (*Project File Exhibit B-3*). District staff met with several landowners in person to discuss their concerns and received 95 written comments on the proposed management activities (*Project File Exhibit Folder E*).

Open House

The district held a public open house on April 6, 2017 at the Whitefish Community Center, from 4:00 – 6:00 pm. This served as an opportunity to provide information to the public and allow people to ask questions to project team members about the activities proposed in the Taylor Hellroaring Project. Approximately 21 individuals attended the open house to discuss the project area and proposed activities (*Project File Exhibit E-1*).

Summary of Comments Received during Scoping

Over 95 comments were received during scoping. The comments covered a wide variety of concerns and suggestions. These comments are in the project file in total and in summary. See *Project File Exhibit E-1 through E-95*.

The majority of comments received were focused on the proposal to construct trails. Many commenters expressed support for adding these trails to the system for non-motorized use, with the majority of comments specifically mentioning mountain bike use. Other commenters expressed concern that by adding the trails to the system it would lead to more conflicts between recreationists and wildlife and possibly displace wildlife. Most comments focused on grizzly bear impacts. Other commenters were neighbors who were concerned about proposed trails near their property.

Some commenters expressed concerns about the proposal to add existing road templates and new roads to the road system and then place in intermittent stored service. These concerns focused on potential impacts of roads to wildlife, climate change and aquatics as well as cost of maintaining roads.

Issues

The Interdisciplinary Team (ID) reviewed and compiled a list of potential issues based upon comments from the public, organizations, and government agencies. These issues were then evaluated against the following criteria to determine the appropriate method for resolution:

- Is the issue already decided by law, regulation, or existing plans? Is it supported by scientific or factual evidence?
- Could the issue be resolved through design and location of activities in the Proposed Action or addressed through the application of Design Features to minimize or reduce the impact to resources?
- Could the issue be addressed by measuring the effects of different alternatives and comparing or contrasting differences between alternatives?

If none of the above criteria applied and the issue was determined to be within the scope of the decisions being made, then the issue was identified as a “key issue” and an alternative to the Proposed Action should be considered to address the issue. See *Project File Exhibit E-99*.

Key Issues that Drove Alternative Development

The ID Team identified the following key issues, for which an alternative to the proposed action was developed:

These issues were used to develop Alternative 3 which makes modifications to address each issue, all associated with trail development.

Conflict between wildlife and trail users recreating at ‘high speed’

Public comment expressed a concern that adding trails to the NF system would create a situation where recreationists, specifically mountain bikes, would move at high speed on trails and create opportunities for conflicts to occur between recreationists and wildlife or create conflict between different types of trail users.

Measurement Indicators: Effects of management activities to wildlife and miles of trails and location of trails.

Density of proposed trail construction and impacts to wildlife habitat and security and aquatic resources.

Public comment expressed a concern that the amount of trails and the location of some trails would impact wildlife security and cause displacement. There were concerns about the amount of trails near riparian areas. There was also concern about trails through wildlife habitat areas such as huckleberry patches.

Measurement Indicators: Effects of management activities to wildlife displacement, changes in habitats and security, miles of trails and location of trails.

Trail Impacts to Neighbors in the Holbrook Area

Neighbors in the Holbrook area had concerns about trails affecting the privacy of their homes.

Measurement Indicators: Evaluate trails that are visible or come close to neighbor properties, location and miles of trail near neighbors.

Range of Alternatives

Alternatives Developed but Not Studied in Detail

The original proposed action that was sent out during scoping will not be studied in detail. Further field surveys indicated portions of the proposal were not feasible. Changes to meet visual quality objectives, retain hiding cover for grizzly bears, maintain lynx habitat and protect riparian areas were incorporated into the proposed action and addressed several of the issues identified during scoping. The proposal for a rental cabin is not included in this project.

Some commenters were concerned about any road building in this area and potential impacts to grizzly bears and other concerns with roads documented in *Project File Exhibit E-98*. A “no road” alternative was not studied in detail because all road management proposed will meet grizzly bear road management guidelines. Roads are needed to access areas to treat to meet the purpose and need of the project.

Another alternative that addressed several of the concerns with proposed trail construction was developed but not studied in detail. This alternative proposed 29 miles of trails. It was similar to Alternative 3 which was studied in detail. The only difference was that the alternative kept trails 2 and C4. This alternative addressed the need to connect the Whitefish Trail System through NFS lands if easements cannot be secured through private property by allowing the construction of Trail 2. It also addressed the need to provide access to the back side of WMR and to the Smoky Range Trail #270 by allowing the construction of trail connector C4. This alternative was not considered in detail because the proposed action and Alternative 3 provided the full range of effects of each trail. The responsible official can examine effects and choose which trails to approve.

Other Concerns Evaluated

Effects of all road construction

Measurement indicators

1. Number of miles of temporary roads constructed and impacts

2. Number of miles of road placed in intermittent stored service and impacts

Effects of management activities to wildlife

Public comment expressed a concern that vegetation management activities, trail construction and other activities would have impacts.

Measurement indicator

1. Effects to habitat for a variety of wildlife species.

The environmental assessment will disclose potential effects to wildlife habitat and several other resources as described in Chapter 3.

Alternatives Studied in Detail

Alternative 2- Proposed Action

Fuel Reduction, Fuel Breaks and Vegetation Management Activities

The Proposed Action was designed to reduce the risk of stand replacement wildland fire, improve forest stand vegetative structure and species composition. A comparison of current stand structure and composition to the desired future conditions for each stand determined the proposed silvicultural treatment. Tree retention would emphasize the largest dominant and co-dominant root-firm trees, which are typically western larch and Douglas-fir. Trees retained after treatments would be variably dispersed over the entire harvest unit.

Several types of silvicultural treatments are proposed on a total of 954 acres. The treatments include commercial thinning harvest, clear cut harvest and seed tree harvest using both skyline and ground-based (tractor) yarding systems. Commercial thinning is proposed on 527 acres, clearcut harvest on 82 acres, 28 acres of Shelterwood harvest and seed tree harvests is proposed on 317 acres. The result of all of the timber harvest activities would be a more diverse forest structure, a more insect and disease resilient, sustainable forest and a reduction in hazardous fuels within the treated stands. Excavator piling using tracked excavators followed by burning or whole tree yarding is the proposed method for slash treatment. Some skyline units would be underburned. Approximately 121 acres of harvest will take place within the WUI, and 297 acres of understory removal to create forest stand conditions that lower the risk of future high-intensity and high-severity wildfire. These treatments are designed to reduce the risk to essential infrastructure in the WUI. Approximately 65 acres of fuel understory removal is planned outside the WUI but adjacent to State and private lands.

Topography, weather and fuel are the primary drivers of wildland fire. Fuels are the only component that can be altered. Even though weather and topography can't be controlled, fire behavior can be altered through fuels management.

Approximately 861 acres within the project area are proposed to fuel reduction treatments by either prescribed burning of 500 acres or other hazard fuel reduction treatments using mechanized equipment or hand treatments on 361 acres.

Commercial thinning would retain the healthiest trees with large, well-formed crowns. Leave tree selection would favor shade-intolerant and fire-resistant species, primarily western larch. These trees would then have more growing space, light, nutrients, and water to allow them to develop into large overstory trees with improved insect, disease, and fire resilience.

Commercially thinned stands would not require reforestation. Fully stocked stands would remain after treatment. This treatment would mimic a low-mixed severity fire and reduce the potential for future stand replacement crown fire. This treatment is prescribed in stands where the stand can be modified to meet desired conditions and does not need to be replaced and regenerated at this time. This treatment would mimic a low-mixed severity fire where the overstory would be thinned and ladder fuels reduced thus reducing the potential for future stand replacement crown fires.

Shelterwood, seed tree, and clearcut are regeneration treatments that utilize timber harvesting to create a new forest stand of shade intolerant tree species. These silvicultural methods would change the stands from large and medium tree structure classes to the seedling stage. These stands would either regenerate naturally from seed or through planting. The purpose of these treatments is to reduce fuels and regenerate species that are tolerant of root disease. These treatments provide the conditions to regenerate resilient shade intolerant species including western larch, western white pine and ponderosa pine. These shade-intolerant tree species would dominate for at least 20 to 80 years. These treatments would mimic a stand replacement fire where more than 75% of the over story would be replaced reducing the potential for future stand replacement crown fires. All regeneration harvests will have either natural regeneration and / or planting of desired species.

Whole tree yarding in conjunction with slashing a portion of advanced regeneration of shade tolerant undesirable species followed by excavator piling using tracked excavators and burning of piles is the proposed method of slash treatment in ground based timber harvest units. Prescribed fire may be ignited within regeneration harvest units to meet fuel reduction and land management objectives. Fireline may be constructed in units treated with prescribed fire.

Prescribed burning and slashing treatments would return fire to the project area and reduce the risk and impacts of a relatively large stand replacement fire in the future. Using prescribed fire combined with the other proposed treatments would reduce and break up the continuity of fuel at a landscape level. Prescribed fire will be ignited within the areas identified, however, may be allowed to burn, to a limited degree, outside of those areas within the maximum manageable area (MMA). These treatments would be implemented over a 10-15 year period because areas would be burned multiple times to achieve the desired results. Burn timing and ignition patterns will be staggered to create a mosaic vegetation pattern on the landscape. Collaboration with the Montana Department of Natural Resource and Conservation (DNRC) may occur to provide an opportunity to implement prescribed fire across land ownership boundaries. Helicopters may be used for ignition. Other benefits include increased huckleberry production, improved wildlife winter/spring range and site preparation for planting blister rust resistant white bark pine.

Shaded Fuel Break: Fuel breaks will be designed as to not allow unauthorized OHV use. The entire length is approximately 1500 feet in length on either side of Burn Unit B-3. Where constructed it would be up to 30 feet wide with primarily smaller trees <7" diameter at breast height (DBH) and shrubs removed that are taller than 2 feet. Large snags within 2 ½ tree lengths that pose a risk to implementation personnel may be felled after alternative methods like relocating fuel break, scraping around the tree to mineral soil, wetting the tree down with water have been ruled out as effective means to save the tree for wildlife. Portions of this fuel break may not be constructed until after ignition of prescribed fire on an as needed basis. Wet lines and other minimum impact suppression tactics would be used in riparian areas to the extent practical.

Hazard Fuel Reduction is a fuels treatment proposed to minimize hazardous fuel accumulation, ladder fuels and break up the continuity of fuel. Primarily small trees (up to 7 inches diameter at breast height) and down wood (up to 9 inch diameter) would be cut, larger diameter trees could be cut as needed to meet objectives, within specified design features. Trees and slash would be yarded, hand or excavator piled and burned or masticated. This type of treatment is intended to reduce the potential for crown fire and allow firefighters to more safely engage fires and provide point protection for values at risk from fire. The majority of over story trees and large snags in these stands would remain. Hand treatment would be utilized on slopes generally greater than 35%, where access is limited, otherwise mechanical treatments would be utilized. Units 100 and 101 would maintain and improve future dry forest old growth habitat by removing small trees established since the start of fire suppression a century ago. Removing small trees would reduce ladder fuels to restore the historic fire regime class within the stands. This treatment would improve the resilience of the stands to potential wildland fire. Most of these treatments are located in the WUI and are designed to protect communities at risk which includes the essential infrastructure of the electronic sites on the Whitefish Divide. Table 2-1 provides a summary of silvicultural treatments and fuel reduction activities proposed. Table 2-2 provides a summary of the silvicultural treatments retention descriptions.

Table 2-1. Proposed Unit Treatment Summary

Unit	Acres	Treatment	Logging System	Fuel/Site Preparation Treatment
1	18	Seedtree	Skyline	WTY, Broadcast Burn
2	12	Seedtree	Skyline	WTY, Broadcast Burn
3	14	Seedtree	Ground based	WTY, no additional slash treatment
4	47	Commercial Thin	Ground based	WTY
5	38	Commercial Thin	Skyline	WTY
6	39	Seedtree	Skyline	WTY, Machine Pile and/or Broadcast Burn
7	16	Clearcut	Skyline	WTY, Broadcast Burn
8	14	Clearcut	Skyline	WTY, Machine Pile and/or Broadcast Burn
9	50	Commercial Thin	Ground based	Cut to Length-soil concerns
10	12	Commercial Thin	Ground based	WTY
11	8	Commercial Thin	Skyline	WTY
12	13	Commercial Thin	Ground based	WTY
13	7	Seedtree	Ground based	WTY, Machine Pile and/or Broadcast Burn
14	20	Seedtree	Skyline	Machine Pile and/or Broadcast Burn
15	14	Seedtree	Ground based	Machine Pile and/or Broadcast Burn
17	16	Seedtree	Ground based	WTY, Machine Pile and/or Broadcast Burn
19	11	Seedtree	Skyline	WTY, Machine Pile and/or Broadcast Burn
20	6	Commercial Thin	Ground based	WTY
21	3	Seedtree	Ground based	WTY, no additional slash treatment
22	47	Seedtree	Skyline	WTY, Broadcast Burn
23	30	Commercial Thin	Skyline	WTY
24	8	Commercial Thin	Skyline	WTY
25	37	Commercial Thin	Ground based	WTY
27	17	Seedtree	Ground based	WTY, Machine Pile and/or Broadcast Burn
28	38	Commercial Thin	Ground based	WTY
29	15	Commercial Thin	Skyline	WTY
30	27	Seedtree	Skyline	WTY, Machine Pile and/or Broadcast Burn
31	10	Commercial Thin	Skyline	WTY

32	8	Shelterwood	Skyline	WTY, Machine Pile and/or Broadcast Burn
33	20	Shelterwood	Skyline	WTY, Machine Pile and/or Broadcast Burn
34	44	Seedtree	Skyline	WTY, Broadcast Burn
37	8	Hazard Fuel Reduction	Machine	NA
38	11	Hazard Fuel Reduction	Machine	NA
41	45	Commercial Thin	Skyline	WTY
42	24	Seedtree	Skyline	WTY
43	31	Clearcut	Ground based	WTY, Machine Pile and/or Broadcast Burn
44	86	Commercial Thin	Ground based	WTY
45	8	Commercial Thin	Skyline	WTY
46	10	Commercial Thin	Ground based	WTY
47	20	Commercial Thin	Ground based	WTY
48	11	Commercial Thin	Ground based	WTY
49	4	Seedtree	Skyline	WTY, Machine Pile and/or Broadcast Burn
50	32	Commercial Thin	Ground based	WTY
51	3	Commercial Thin	Loader	N/A
52	12	Clearcut	Ground based	WTY, Machine Pile
53	9	Clearcut	Ground based	WTY, Machine Pile
100	9	Old Growth Improvement/ HFR	Hand	N/A
101	37	Old Growth Improvement/ HFR	Hand	N/A
103	32	HFR	*Machine/Hand	N/A
104	53	HFR	*Machine/Hand	N/A
105	1	HFR	*Machine/Hand	N/A
106	24	HFR	*Machine/Hand	N/A
107	14	HFR	*Machine/Hand	N/A
108	6	HFR	*Machine/Hand	N/A
143	45	HFR	*Machine/Hand	N/A
144	59	HFR	*Machine/Hand	N/A
145	15	HFR	*Machine/Hand	N/A
146	45	HFR	Hand	N/A
B1	102	Burn	N/A	N/A
B2	318	Burn	N/A	N/A
B3	80	Burn	N/A	N/A
Sum	1815			

Skyline Regeneration Harvest Units may require some yarding of merchantable (YUM) material to meet slash reduction objectives and to allow for regeneration.

WTY - Whole tree yarding

*Hazardous Fuel Reduction (HFR) units will be mostly machine treatments except on slopes greater than 35% then treatment would occur by hand.

Table 2-2. Retention Descriptions for Vegetation and Fuel Treatments.

Stand Level Vegetation/Fuel Treatment Type	Retention Description	
	Trees per acre	Canopy Cover
Commercial Thin (CT)	50 to 150 medium to large trees per acre	30-70% (avg 40%)
Shelterwood (SW)	25-35 medium to large trees per acre	20-30%
Seed Tree (ST)	5 to 20 medium to large trees per acre.	5-10%
Clearcut (CC)	5-15 medium to large trees per acre	3-7%
Hazard Fuel Reduction	50 to 200 medium to large trees per acre	30-75%

Prescribe Burn/Slashing	0 to 40 large trees per acre depending on location	0-30%

Creation of Openings Over 40 Acre

Regional Forester policy (FSM 2471.1) directs the size of harvest openings created by even-aged silvicultural practices (e.g. seed tree, shelterwood, and clearcut harvest prescriptions) would be normally 40 acres or less. The proposed action could result in up to five openings greater than 40 acres in size. These openings would be the result of the proposed regeneration harvests on NFS lands (Units 6, 7, 8 and 13, 14, 15 and 21, 22, 27, 30 and 32, 33, 34 and 42, 52, 53). The openings could range in size from 41 acres to 94 acres. The large size of the openings are needed to address vegetation conditions, primarily root disease found across the landscape affecting Douglas-fir. Intermediate treatments such as commercial thinning are unlikely to be effective and may actually increase the effects of root disease within those stands. These openings have been designed to meet visual quality objectives and security cover for grizzly bear. Regional Forester approval is required for creation of openings greater than 40 acres, and this would occur prior to the signing of a decision for this project. More information is in *Project File Exhibit P-9*.

Trail Construction Activities

The proposed trail system would create non-motorized trails that enhance recreation experiences and are designed for safety, environmental protection, and operational efficiency. Trails would be located, designed, constructed and maintained to limit the risk of user and wildlife/human conflict. Trail Classes range from 1-5 and determine elements including tread width, obstacles, constructed features, signing and the recreational environment and experience. For further definitions of these trail classes, see design features at the end of this chapter.

Table 2-3. Trail Proposals for Alternative 2.

Trails Proposed Action					
Trail #	Description of Location	Type	Trail Class	Managed use	Miles
1	WT – Haskill Basin to Hellroaring	Standard Trail	4	Pedestrians, Bicycles	1.06
2	WT - Alternate - WMR Access	Standard Trail	3/4	Pedestrians, Bicycles	2.11
3	WT – Main Hellroaring Trail - South Access	Standard Trail	3/4	Pedestrians, Bicycles	.25
4*	WT - Main Hellroaring Trail	Standard Trail	3/4	Pedestrians, Bicycles, Equestrian	.76
5	WT - Main Hellroaring Trail – West Access	Standard Trail	3/4	Pedestrians, Bicycles, Equestrian	.31
C1	WF Face - Connector to Ptarmigan	Standard Trail	3/4	Pedestrians, Bicycles	0.47
C2	WF Face - Lower Loop connector	Standard Trail	3	Pedestrians, Bicycles, Equestrian	0.07
C3	WF Face - Backside Loop East Connector	Standard Trail	2	Pedestrians, Bicycles, Equestrian	0.73
C4	WF Face - Backside Loop West Connector	Standard Trail	2	Pedestrians, Bicycles, Equestrian	0.56

C5	Taylor Hellroaring connection to State & possible WT Alternate	Standard Trail	3	Pedestrians, Bicycles, Equestrian	2.31
L1 A	WF Face – Holbrook Entry Loop - ADA	Standard Trail	4/5	Pedestrians, Bicycles	.51
L1 B	WF Face - Holbrook West Loop 1	Standard Trail	4	Pedestrians, Bicycles	1.97
L1 C	WF Face - Holbrook East Loop 2	Standard Trail	4	Pedestrians, Bicycles	0.59
L3	WF Face - Lower West 2 - East Side	Standard Trail	3	Pedestrians, Bicycles, Equestrian	1.45
L4	WF Face - Lower West 1 - West Side	Standard Trail	3	Pedestrians, Bicycles, Equestrian	1.54
L5	WF Face - West 1 (East side of the loop)	Standard Trail	3	Pedestrians, Bicycles, Equestrian	2.60
L6	WF Face - West 2 (West side of the loop)	Standard Trail	3	Pedestrians, Bicycles, Equestrian	2.55
L7	WF Face - West 3 (East)	Standard Trail	2	Pedestrians, Bicycles, Equestrian	2.12
L8	WF Face - West 4 (West)	Standard Trail	2	Pedestrians, Bicycles, Equestrian	5.54
L9	WF Face - West 5	Standard Trail	2	Pedestrians, Bicycles, Equestrian	4.3
R1**	WF Face - Ridgeline	Standard Trail	2/3	Pedestrians, Bicycles, Equestrian	8.24
				New Trail Construction Total	40.04
M1** *	1658 Werner Divide (Tally Lake RD)	Existing Road	0	Open road with trail overlay	1.82
M2** *	1658 Werner Divide (Glacier View RD)	Existing Road	0	Open road with trail overlay	2.59
M3** *	9790 Taylor Hellroaring Rd	Existing Road	0	Open road with trail overlay	2.39
M4** *	9790 Taylor Hellroaring Rd on State	Existing Road	0	Open road with trail overlay	1.50
M5** *	WT Alternate - Taylor Hellroaring Road	Existing Road	0	Open road with trail overlay	6.55
				Road with Trail Overlay Total	14.85

* Trail 4 has No Equestrian from intersection of L3 heading east toward Hellroaring Creek.

** Trail R1 has No Equestrian within WMR permit area for 1.96 miles from the intersection of C3 heading east toward WMR.

***Trails M1, M2, M3, M4 and M5 will not be analyzed as they are open roads and would just add a trail overlay.

WT=Whitefish Trail, WF=Whitefish

A series of short loops is proposed in the Holbrook parcel, immediately adjacent to the trailhead. These shorter loops will serve those looking for a short walk and help disperse users in the areas nearest the trailhead. All trails in the Holbrook area (4.6 miles) will be managed for pedestrians and bicyclists. Equestrian use would be restricted on Trail 4 (.47 miles) from the intersection of L3 heading east toward Hellroaring Creek and all 2.11 miles of Trail 2 and 1.96 miles of trail R1

that is within in the WMR permit boundary to the intersection of Trail C3. A total of 9.43 miles would not be available for equestrian use.

Extended portions of the proposed trail system along with National Forest System Roads (NFSR) will provide access for trail users to Ralph Thayer Memorial Recreation Trail 26, Smoky Range National Recreation Trail 270, and Danny On Memorial National Recreation Trail 370.

Portions of the proposed trails C3, C4 and R1 are on the Glacier View Ranger District (GVRD). Approximately 2.59 miles of NFSR #1658 and the Werner Divide Road (6.1 miles) are also on GVRD.

The proposal does not show all portions of the Whitefish Trail as proposed corridors pass through private property and negotiations are not finalized at this time. Access from Holbrook to Hellroaring, Trail 1 connecting to Trail 5, is contingent upon a grant of access through certain privately held properties. Access from Trail 5 in Hellroaring to the Swift Creek portion of the Whitefish Trail is similarly contingent upon a grant of access through private property. Trail 2 serves as an alternative access point in the event access through private ownership is not obtained. Trail C5 serves as the primary northern access point into the network. Taylor Creek NFSR 9790 is identified as a connector trail within the network, with connection to Big Mountain Summit and WMR trails. Additionally, this road corridor may be considered as an alternate Whitefish Trail connection as originally proposed in the Whitefish Trail Master Plan (2006) if access through private property is not granted.

Some portions of existing open roads will serve as trail connectors. In particular, the Taylor Creek Road NFSR 9790, which has 1.5 miles of trail M4 on DNRC lands, and Trail M5 which has .66 miles on F.H. Stoltze lands. NFSR 1658 has 4.41 miles of proposed trails, M1 and M2. These are currently open roads so they will not be analyzed the same way as newly created trails. Furthermore, historic trail tread, historic logging roads, skid trails and temporary roads will be used in lieu of new trail construction where reasonably practicable. Use of these existing roads accomplishes a number of goals, including minimizing impacts associated with crossing streams by utilizing existing bridges, and providing additional loop opportunities. The road corridors also provide for a more direct and less challenging experience for users. Use of the roads, such as NFSR 316 Road in conjunction with the proposed trail system would also provide connections to some backcountry trails in the area, including a National Recreation Trail, the Ralph Thayer Memorial NFST #26 and the Smoky Range Standard Peak NFST #270. Taylor Creek Road is not anticipated to be a primary access point for the network due to the lengthy access.

All trails on National Forest System land would be constructed, managed, and maintained according to standards and guidelines outlined in Forest Service Handbook (FSH) 2309.18.

Other Recreation Proposals

The current Holbrook parking area would be upgraded to a designated trailhead. This trailhead would consist of a vault toilet and an information kiosk. Other improvements could include picnic tables, interpretative signs and a spotting scope. The proposed trail system in the Holbrook area would be a Trail Class 4 or 5 to allow accessibility for people with disabilities.

Up to 10 pullouts on open NFS roads may be created to provide safe parking opportunities that do not impinge or obstruct traffic. Recreation and travel specialists will identify these locations based on traffic, sight distance and use levels. Flat areas, landings and road intersections will be utilized where available.

Other Activities

Best Management Practices/Aquatics

Best Management Practices (BMPs) are the primary mechanism used by land management agencies to achieve State water quality standards. BMPs are practices that have been adopted to minimize non-point source water pollution from forestry practices. While not required by regulation, the use of BMPs has been widely accepted by the Forest Service, the State of Montana, forest products industry, family forests, tribal governments, and other agencies. BMPs include, but are not limited to, structural, and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

Best Management Practices (BMPs) help reduce the concentration of sub-surface and surface water runoff, minimize road surface erosion, filter ditch water before entering streams, and decrease the risk of culvert failures during peak runoff events. The main Taylor Road (9790) and road 9869 had BMPs applied in 2016, however minor may be needed during project implementation, especially on new roads. Road maintenance work could include culvert installation, replacement of existing culverts with larger culverts, installation of drainage dips and surface water deflectors, placement of rip-rap to armor drainage structures, aggregate surface replacement, aggregate placement to reinforce wet surface areas, ditch construction and cleaning where needed, and surface grading to restore the drainage efficiency of the road surface. These actions would bring the roads up to current BMP standards and provide benefits to streams in the analysis area (refer to the Aquatics section of this document).

Road Construction

A project level Transportation Analysis Plan (TAP) report completed a risk/benefit analysis for each road proposed for use in the Taylor Hellroaring Project (*Project File Exhibit M-1*). In order to access proposed harvest units, approximately 0.5 mile of temporary road and 4 miles of system road are proposed on US Forest System Lands. These roads are shown below in Table 2-4 and displayed on Map 1, Appendix A. Temporary roads would be constructed to the minimum standards necessary for log hauling and would be rehabilitated following completion of timber harvest activities using a variety of techniques described in the design features. The roads would be used for the Taylor Hellroaring project and all but two roads (E-8 and N-5) would be placed in Intermittent Stored Service (ISS) at the completion of project activities. Roads E-8 and N-5 would have year-long closures with gates. The ISS roads are maintenance level 1 roads closed to traffic that have been put into a condition that there is little resource risk if maintenance is not performed.

Table 2-4. Road Construction.

Road Name	System or Temporary Road	Template Type	Existing Template Temp Road (mi)	New Construction Temp Road (mi)	Existing Template System Road (mi)	New Construction System Road (mi)
*E1	System	Existing Template			1.1	
*E2	System	Existing Template			0.5	
*E3	System	Existing Template			0.5	

*E6	System	Existing Template			0.5	
*E7	System	Existing Template			0.4	
*E8	System	Existing Template			0.2	
*N2	System	New Construction				0.7
*N5	System	New Construction				0.1
**E11 To unit 44	Temp	Existing Template	0.2			
**E12 To unit 6	Temp	Existing Template	0.1			
**N3 To Unit 34	Temp	New Construction		0.1		
**N4 To Unit 12	Temp	New Construction		0.1		
Total			0.3mi	0.2 mi	3.2 mi	0.8 mi
Total Temp/System Road			0.5 mi		4.0 mi	

*Placed in ISS

**Rehabilitated

Other Proposals and Access Needs

Access to several units bordering State lands will need to be accessed through DNRC Anchor Creek road. Temporary bridges or culverts will be installed on Trail Creek (Road E-3) and removed at the completion of Timber Sale activities. Access via new system road N5 off NFSR # 9868 could be used to provide access to units South of Anchor Creek forgoing the use of the existing temporary bridge installation at Anchor Creek. Road use agreements with the DNRC for access using their roads would be put in place prior to implementation.

Before road E6 is placed in intermittent stored service, a culvert in Trail Creek would be removed.

Three private roads providing access to Unit 44 in the Holbrook area are needed and have been discussed with the landowners who have agreed to allow the Forest Service use the roads for the project. The lower road takes off Big Mountain road at mile point 4.7 would be used under a road use agreement with the landowner. The Forest Service is pursuing easement for permanent access to road E8 that takes off the Big Mountain Road at mile point 5.3 with the same landowner. The third road is located off the Big Mountain Road at mile point 5.9 in the NW1/4 Sec. 12, T31N, and R22W and would be used to access the portion of Unit 44 between the switch back of the Big Mountain Road.

Haul Routes

Approximately 31.5 miles of haul routes are needed for log hauling under various jurisdictions as shown below in Table 2-5. Approximately 11 miles are under Forest Service jurisdiction and

these roads were brought up to BMP standards during the summer of 2016. Haul routes across Montana State lands would also meet State BMP requirements. Road use agreements on county and private haul routes would be put in place prior to implementation. Anticipated haul routes for the project are displayed on the maps in appendix A.

Table 2-5. Haul Routes

Road Jurisdiction	Haul Route (mi)
Forest Service Open Yearlong	8.5
Forest Service Closed Yearlong	2.7
Private	0.8
Special Use Roads Administered by Forest Service	0.7
Flathead County	6.0
State Hwy (Big Mountain Road)	4.0
Other State (Includes Whitefish Lake Road)	8.9
Total	31.5 mi

Refer to *Project File Exhibit M-6* for more detailed information on road and access management.

Wildlife Habitat Improvement Proposals

- Ecosystem burns along ridgelines
- Whitebark pine restoration (including thinning around individual trees)
- Fuel reduction near old growth habitat or in future old growth habitat if associated characteristics are retained
- Change to tree species composition and increase diversity of forest structure
- Shrub or tree planting in some harvest units to supplement naturally occurring big game browse or hiding cover, while providing nesting sites for songbirds
- Wildlife trees signed for protection along roads that are open to public motorized use
- Browse enhancement in conjunction with hazardous fuels reduction treatments and/or slashing for prescribed fires.

Alternative 3

This alternative was developed to address several comments associated with the key issues identified above. Neighbors in the Holbrook area were concerned with certain trails proposed in that location. There were several concerns about trail impacts related to wildlife/human interaction and impacts to wildlife habitat. Concerns about trail density and impacts to riparian areas were also addressed in this alternative. All fuel reduction, wildlife habitat improvement, fuel break and vegetation treatments as well as road construction are the same as described for Alternative 2. Recreational proposals other than trail construction are also the same in all action alternatives. Trail lengths and locations have changed and are summarized below in Table 2- 6.

Table 2-6. Trail Proposals for Alternative 3.

Trails Proposed Action					
Trail #	Description of Location	Type	Trail Class	Managed use	Miles
1	WT – Haskill Basin to Hellroaring	Standard Trail	4	Pedestrians, Bicycles	1.06

3	WT – Main Hellroaring Trail - South Access	Standard Trail	3/4	Pedestrians, Bicycles	.25
4*	WT - Main Hellroaring Trail	Standard Trail	3/4	Pedestrians, Bicycles, Equestrian	.76
5	WT - Main Hellroaring Trail – West Access	Standard Trail	3/4	Pedestrians, Bicycles, Equestrian	.31
C2	WF Face - Lower Loop connector	Standard Trail	3	Pedestrians, Bicycles, Equestrian	0.07
C5	Taylor Hellroaring connection to State & possible WT Alternate	Standard Trail	3	Pedestrians, Bicycles, Equestrian	2.31
L1 A	WF Face – Holbrook Entry Loop - ADA	Standard Trail	4/5	Pedestrians, Bicycles	.51
L1 B	WF Face - Holbrook West Loop 1	Standard Trail	4	Pedestrians, Bicycles	1.22
L1 C	WF Face - Holbrook East Loop 2	Standard Trail	4	Pedestrians, Bicycles	0.59
L3	WF Face - Lower West 2 - East Side	Standard Trail	3	Pedestrians, Bicycles, Equestrian	1.46
L4	WF Face - Lower West 1 - West Side	Standard Trail	3	Pedestrians, Bicycles, Equestrian	1.55
L6	WF Face - West 2 (West side of the loop)	Standard Trail	3	Pedestrians, Bicycles, Equestrian	2.55
L7	WF Face - West 3 (East)	Standard Trail	2	Pedestrians, Bicycles, Equestrian	1.76
L8	WF Face - West 4 (West)	Standard Trail	2	Pedestrians, Bicycles, Equestrian	3.28
R1**	WF Face - Ridgeline	Standard Trail	2/3	Pedestrians, Bicycles, Equestrian	8.24
				New Trail Construction Total	25.92
M1** *	1658 Werner Divide (Tally Lake RD)	Existing Road	0	Open road with trail overlay	1.82
M2** *	1658 Werner Divide (Glacier View RD)	Existing Road	0	Open road with trail overlay	2.59
M3** *	9790 Taylor Hellroaring Rd	Existing Road	0	Open road with trail overlay	2.39
M4** *	9790 Taylor Hellroaring Rd on State	Existing Road	0	Open road with trail overlay	1.50
M5** *	WT Alternate - Taylor Hellroaring Road	Existing Road	0	Open road with trail overlay	6.55
				Road with Trail Overlay Total	14.85

Comparison of Alternatives

Table 2-7 shows a comparison of alternatives by miles (rounded) of trails proposed. All fuel reduction, wildlife habitat improvement, fuel break and vegetation treatments as well as road construction are the same for both action alternatives. Recreational proposals other than trail construction are also the same in both action alternatives. Table 2-8 describes in detail the difference in trail miles and descriptions between the two action alternatives.

Table 2-7. Proposed Alternatives Comparisons.

Proposed Activities	Alt 2	Alt 3
Miles of Trails	40 miles	26

Table 2-8: Summary Comparison of how the Alternatives Address the Key Issues.

Trail #	Trail Location	Alt 2 Miles and Description	Alt 3 Miles and Description
1	Holbrook Area. Part of the Whitefish Trail.	1.06 This trail segment leaves the already establish Haskill Basin / Reservoir Road WT, would cross WSI land and continue on the north side of the Big Mountain Road, cross the road, continue to the newly created Holbrook Trailhead and continue west to Hellroaring Creek. There would be trailheads on both the east and west sides of Big Mt road to reduce pedestrians crossing of the road, increase traffic safety and help facilitate seasonally appropriate use at each trailhead.	1.06 Trail segment would remain the same, except the northern portion would reroute around a seasonal wetland instead of building boardwalk through it if feasible.
L1A	Holbrook Area.	.51 Would be an accessible, Americans with Disabilities Act (ADA) loop.	.51 Location may change but length will remain the same. Also ADA.
L1B	Holbrook Area.	1.97 West side loop.	1.22 Trail segment west of Trail 1 removed due to concerns from adjacent landowners during scoping.
L1C	Holbrook Area.	.59 East side loop.	.59 Segment remains the same as Alternative 2.
C1	Holbrook Area.	.47 Short trail segment to connect Holbrook Area trails to the Ptarmigan Village.	0 Trail segment dropped due to concerns from Ptarmigan Village Homeowners during scoping.
2	Hellroaring – Whitefish Trail.	2.11 Alternate access for WT from WMR. Segment would only be built if access through private land cannot be obtained.	0 Trail segment would not be built in this Alternative due to wildlife concerns and multiple switchbacks. If not built, the Whitefish Trail would not be connected.
3	Hellroaring – Whitefish Trail.	.25 Southern access for the WT if easements through private land is obtained.	.25 Segment remains the same as in Alternative 2.

Trail #	Trail Location	Alt 2 Miles and Description	Alt 3 Miles and Description
4	Hellroaring – Whitefish Trail.	.76 Main WT that will cross Hellroaring Creek with an engineered bridge.	.76 Segment remains the same as in Alternative 2.
5	Hellroaring – Whitefish Trail.	.31 Western access for the WT.	.31 Segment remains the same as in Alternative 2.
L3	Whitefish Face	1.46 Lower West 2 - East Side. Provides a loop opportunity from the WT	1.46 Segment remains the same as in Alternative 2. Additional length added to incorporate a portion of L5 which was removed.
L4	Whitefish Face	1.55 Lower West 1 - West Side. Provides a loop opportunity from the WT	1.55 Segment remains the same as in Alternative 2.
C2	Whitefish Face	.07 Small connector between L3 and L4 to provide a low elevation loop opportunity.	.07 Segment remains the same as in Alternative 2.
L5	Whitefish Face	2.6 West 1 – East side of the loop. Provides a loop opportunity from the lower elevation loop created by L3 and L4.	0 Trail segment would not be built in this Alternative due to trail density and access to Ridge Trail from L6.
L6	Whitefish Face	2.55 West 2 – West side of the loop. Provides a loop opportunity from the lower elevation loop created by L3 and L4. Connects to L7 at Taylor Creek Road. Continues to Ridge Trail R1.	2.55 Segment remains the same as in Alternative 2.
L7	Whitefish Face	2.12 West 3 – East side. Trail provides access in the northwestern part of the project area.	1.76 Segment remains the same as in Alternative 2 except rerouted in Section 27 to avoid wetland area in fork of Smith Creek and to contour with topography to avoid switchbacks.
L8	Whitefish Face	5.54 West 4 – West side. Trail provides access in the northwestern part of the project area.	3.28 Segment remains the same as in Alternative 2 except mileage is reduced by deleting segment below Taylor Road and to reroute around King Creek.

Trail #	Trail Location	Alt 2 Miles and Description	Alt 3 Miles and Description
C5	Whitefish Face	2.3 Connection to State & possible WT future proposal providing access from the Taylor Road NFSR 9790.	2.3 Segment remains the same as in Alternative 2
L9	Whitefish Face	4.3 West 5. Trail provides access to the Ralph Thayer Trail #26.	0 Trail segment would not be built in this Alternative due to trail density as there is already access to Ralph Thayer from the Ridge Trail R1.
R1	Ridge Trail	8.24 This trail provides access between the Ralph Thayer Trail #26 and the WMR permit boundary area. Upon completion, would become an extension of Trail #26.	8.24 Segment remains the same as in Alternative 2
C3	Off Ridge Trail	.73 Backside Loop East Connector Trail segment would provide access over the back side from the Ridge Trail onto GV/HH to provide a loop opportunity and access to Smoky Range Trail #270.	0 Trail segment would not be built in this Alternative due to wildlife concerns and trail density.
C4	Off Ridge Trail	.56 Backside Loop West Connector Trail segment would provide access over the back side from the Ridge Trail onto GV/HH to provide a loop opportunity and access to Smoky Range Trail #270.	0 Trail segment would not be built in this Alternative due to wildlife concerns and trail density. If not built, access to the backside and Smoky Ridge would not be available which would not fully meet the purpose and need of the project...

Alternative 1 is not shown in the table since no trails are proposed.

Design Features

Many concerns expressed during the public involvement processes are best addressed through development of design features specific to action alternatives (Alternatives 2, and 3) that specifically avoid or reduce potential environmental impacts. These design features are an integral part of each action alternative, and are considered requirements should an action alternative be selected. They are listed here to avoid repeating them in each alternative description.

Trails

National Trail Management Classes are general categories identified for Forest System trails that prescribe development scale, intended design and management standards. There are five trail classes, ranging from least developed (Trail Class 1) to most developed (Trail Class 5). For the purposes of this project, trails within the action area are considered “moderately developed,” “developed” or “highly developed” or Trail Class 2, 3 and 4 respectively. Trail Class 5 may be

used on Trail L1A in the Holbrook area to create ADA access. *Appendix B* summarizes the attributes typical of Trail Classes 1-5, as provided in the *Trails Management Handbook*, Forest Service Handbook (FSH) 2309.18.

Trail Classes also refer to the Recreation Opportunity Spectrum (ROS) and is the method used by the Forest Service to inventory and manage outdoor recreation settings and to ensure that a broad mix of these settings remain available to provide the recreating public with experiences ranging from high challenge and remoteness (i.e., Primitive) to highly developed and managed settings found in some Forest Service recreation areas (i.e., Urban) (USDA Forest Service 1979, 1982). The six classes in the ROS (Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural and Urban) are arranged along a continuum and describe recreation opportunities found in an area based on activities, settings and experience. Most of the project area is considered Roaded Natural.

Trail Network Design Features in FSH 2309.18

- Trails would be built at an average width of two feet (24"). Depending on the terrain, in some locations trails may be built at an average width of up to four feet (48") to accommodate the type of use.
- All trails would be designed with approximately 10% average grade over the length of the trail. A 10% grade is generally considered sustainable in terms of resistance to erosion and damage. Moderately graded trails under 10% work with most soil types, minimize erosion, and allow for a flexible design.

Design Features and Best Management Practices Common to Trails Network

- Flexibility of exact trail location is incorporated within the design to address issues such as topography, soils, available materials, degree of trail difficulty, and to avoid sensitive areas such as seeps, springs and sensitive plant and wildlife species.
- Trails will be located, designed, constructed and maintained to reduce the likelihood of human/bear conflict. These may include increased vegetation clearing to increase sight distance, layout and design to reduce speed, particularly for mountain bikes, locations outside of concentrations of known preferred food sources and information and educational materials at trailheads and other off-site locations. (BOR, 2017, *Project File Exhibit L-6*)
- All trails would be constructed to minimize erosion and avoid natural water courses and sensitive riparian areas and plants to the greatest extent possible.
- Trails would be designed to minimize sustained steep pitches. Grade reversals will be used to reduce the chance for water to gain enough speed to recruit and encourage erosion. Rock needed for trail stabilization, sediment traps, and erosion control would be from on-site sources.
- Forest clearing in the proposed trail corridors would be reduced to the extent practical through careful trail design and layout.
- All trails would be laid out to minimize removal of trees with a diameter at breast height (DBH) greater than six inches.
- Trail location will avoid whitebark pine where ever practical. Tread will be located a minimum of 6 feet from the stem of any whitebark pine 6 inches diameter at breast height to minimize soil compaction and root damage to potential cone bearing trees. Exceptions may be granted on a case by case basis by of a Forest Service Officer.
- Trail tread would be cleared of all organic material down to mineral soil. When

- practical, all removed vegetation would be used to revegetate off-trail disturbed areas.
- All water courses (if encountered) would be avoided or spanned by bridges or similar man-made features. Bridges would be built by using a combination of treated and untreated wood or steel and composite materials. Any use of treated wood must be in accordance with Western Wood Preservers Institute (WWPI) "Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments."
 - In watercourses where seasonal flow is expected, but permanent water is not present, culverts or bridges (site specific) would be used. In any areas where water is not expected, but possible due to rainfall, culverts could be used.
 - Revegetation, where applicable, may include topsoil replacement, planting, seeding, and would occur as per Forest Service botanist prescriptions.

Vegetation

- Western larch, rust-resistant western white pine, whitebark pine (where appropriate) and ponderosa pine will be the preferred species to plant within regeneration harvest units in order to increase resilience to root disease, forest insects, white pine blister rust and wildland fire.
- Slash sapling size trees within 200 feet of whitebark pine trees (in units that contain trees identified for cone/scion/pollen collection, or show signs of rust resistance), to make whitebark pine more likely to survive fire, more resistant to mountain pine beetle attack, and more likely to persist in future environments.
- Protection of whitebark pine trees that are cone bearing that exhibit potential rust resistant should be protected from prescribed burning. Firing will attempt to not ignite under whitebark pine trees. Aerial ignitions will avoid groups of whitebark pine.

Fire / Fuels / Air Quality

- When site conditions allow and in the absence of fire suppression actions, avoid burning more than the maximum number of acres identified in individual ignition polygons in any one year period.
- In harvest units trees designated for removal will be whole tree yarded to one or more landings where the non-merchantable portion of the trees and limbs will be piled for fall burning. The merchantable portion will be utilized for wood fiber at a local mill. Non-saw material would be removed and or yarded to landings for disposal if above 10-15 tons per acres of fuel would be left on site. To provide hiding cover for wildlife 1 pile should be left unburnt per 1-2 acres of treatment.
- **Broadcast Burning for Site Preparation/Brush Disposal:** Prescribed fire ignited within regeneration harvest units would not be allowed to burn outside of the unit boundary except where natural barriers or adequate changes in fuel moisture limit and/or stop fire spread without causing resource damage. Exceptions would also be made for mid slope over slung or under slung lines where holding would cause excessive firefighter exposure to smoke, rolling material and/or snag hazards. These exceptions would be addressed in the individual burn plan and complexity analysis. Containment/suppression actions would be taken if necessary to not impact wildlife habitat, tree regeneration, pre-commercial thinning stands, high valued stands of timber or other highly valued resources and assets.

Regeneration harvest would not be broadcast burned, but would be excavator piled and burned for one of or a combination of the following reasons.

- Excessive leave tree or residual stand damage
 - Delay in meeting restocking requirements
 - Excessive damage to adjacent stands
 - Natural regeneration of desired species
 - Fuels reduction objectives met through other means without need for site preparation
- **Landing & Machine Piles:** It is preferable to grind, chip or remove landing piles from the site if feasible. Landing piles would not be driven on by any machinery for any reason or used to shore up roads or landings on steep slopes. Only tracked excavators with a grapple or bucket with thumb would be used to build piles to reduce the likelihood of compacting fuels or mixing in dirt. Once a landing pile has been completed an excavator should encircle the pile pulling up 4-5 feet of slash along the edge of the pile and shaking all dirt out of the slash prior to placing it on top of the pile. All piles will be built in a fashion to facilitate full consumption. Dome shaped piles are preferred in the shape of a hay stack. Slash and coarse woody debris in machine piles should be piled in a parallel configuration to the extent feasible similar to pencils in a box.
 - **Temporary Roads:** When reclaiming temporary roads no more than 10-15 tons per acre of woody material should added after re-contouring to meet down wood requirements and keep fuel loading to a minimum.
 - **Air Quality:** Pile burning or prescribed burning should only occur during period of good to excellent smoke dispersion forecast. Prescribed burning requires a permit from the Montana DEQ and the burn must be implemented within the regulatory framework. This includes daily approval from the Flathead County Air Quality hotline and the Montana/Idaho Airshed Group (*Project File Exhibit O-4*). More information on the Montana/Idaho Airshed Group can be found online at www.smokemu.org.

Rare Plants and Invasive Plant Species

- Equipment associated with timber harvest and road maintenance would be power scrubbed or steam cleaned on the undercarriage and chassis before transport to the project area. "Off-road equipment" includes all logging and construction machinery, except for log trucks, chip vans, service vehicles, water trucks, pickup trucks, cars, and similar vehicles. This cleaning shall remove all soil, plant parts, seeds, vegetative matter, or other debris that could contain or hold seeds. All subsequent entries of equipment from outside the project area back to the project area shall be treated in the same manner as the initial entry. Contractors will be required to adhere to C6.351#- Washing Equipment, or similar contract provision which specifies the above washing criteria.
- Herbicides would be sprayed within the road prism along designated haul routes before log hauling begins and after all purchaser activities are completed. Treatments would only occur during the periods from June 1 to July 15 or September 1 to September 30. Treatment of invasive plants would be consistent with the strategy outlined in the Noxious and Invasive Weed Control Environmental Assessment and Finding of No significant Impact (May 2001). Specific roads and mileage would be prepared in consultation with the Forest Weeds Coordinator.

- Vegetation will be re-established on bare ground created by timber harvest activity. Seed landings, temporary roads (new and historic), and disturbed roadsides with a certified weed-free grass ground cover, a seed mix of native plants will be specified by the Forest Botanist. This will occur in either in the spring or the late fall, when conditions are suitable for germination and retention, after disturbance to provide for site protection until native species are established.
- If populations of sensitive plants, other than whitebark pine, are found during project surveys or implementation, they would be evaluated and protected as necessary to retain population viability. See Vegetation design features for whitebark pine. A contract provision would incorporate this into any timber sale contract and would specify that the contract would be modified to protect these plants if located.

Wildlife – Threatened, Endangered, and Sensitive Species

- Fuel treatment projects within the WUI would be designed considering Lynx NRLMD vegetation management standards.
- Regeneration units would be designed so that no point within the unit is more than 600 feet from cover; in other words, a grizzly bear in the unit would be able to find cover within 600 feet or less in at least one direction from any point within the unit.
- Harvest units located adjacent to natural or manmade openings would maintain hiding cover on approximately 75 percent of the opening's perimeter.
- Most project activities would **not** occur from April 1st to June 30th, to minimize effects to grizzly bears during the critical spring period. Acceptable activities during the spring period include prescribed burning, sale preparation, planting, and noxious weed spraying activities. Road treatments (including BMPs), slash burning, and pile burning may occur during the spring period if located along open or seasonal roads.
- Helicopter ignition in Burn Units B1, B2, and B3 would be limited to 1-3 days per year generally over the next 10 years.
- The following units should not be implemented during the winter to project grizzly bear denning habitat (December 1 – March 30):
Burn: B1, B2, B3
Commercial harvest: 22, 34, 41, 42, 43, 51, 52, 53
HFR: 37, 38, 103, 104, 105, 106, 107, 141, 143, 145, 146
- All temporary roads constructed for project activities would be closed by barrier or gate to public motorized use while being used for project activities and would be reclaimed after project completion.
- All roads that will be placed in Intermittent Stored Service (ISS) would be made impassable. Generally, the first 50 to 300 feet would be treated to make it inaccessible to wheeled motorized vehicles during the non-denning season. Roads may become impassable as a result of a variety of means, including but not limited to one or more of the following: natural vegetation growth, road entrance obliteration, scarified ground, fallen trees, boulders, culvert or bridge removal, etc.
- All contractors and others implementing the project would be required to comply with the Grizzly Bear Food Storage Order.
- If any of the following are found within or close to any vegetation management or burn unit or road location, operations within that unit or on that road would cease activities until the wildlife biologist is notified, and activities are modified if necessary:
 - Active denning sites used by grizzly bears, wolves, lynx, fishers, or wolverines,

- Active nesting sites used by bald eagles, northern goshawks, black-backed woodpeckers, or flammulated owls, and
- Active rendezvous (pup-rearing) sites used by wolves.

Wildlife – Old-Growth, Snags, and Downed Wood

The Forest Plan specifies the minimum number of snags, snag replacement trees, and pieces of downed wood to be left in each potential vegetation group (PVG). Although the minimum diameters are not always present in a given stand, wherever they exist, these components would be retained to meet or exceed the intent of the Forest Plan under all alternatives. To provide for these snag and downed wood retention needs, as well as living tree canopy and large trees, the following would be prescribed:

- Retain the following standing unless leaving them would a) compromise safety, b) conflict with objectives for recreation management, or c) allow dwarf mistletoe, root disease, or bark beetles to increase to unacceptable levels:
 - All live or dead standing whitebark pine, western white pine, ponderosa pine and hardwood trees,
 - All dead Douglas-fir and western larch 12 inches and greater diameter breast height (DBH),
 - All live western larch 18 inches and greater DBH,
 - All live Douglas-fir 25 inches and greater DBH, and
 - Dwarf mistletoe infected larch may be girdled to retain these trees as snags.
- Leave on site as downed wood all snags greater than nine inches DBH that are felled for safety concerns.
- Wherever present, leave at least 32 downed logs per acre that are nine to 20 inches in diameter and at least 20 feet long, distributed across the units. If there are too few large enough logs, substitute logs six to nine inches in diameter to reach this number of pieces.
- Wherever present, leave at least 15 downed logs per acre greater than 20 inches in diameter and at least six feet long, distributed across the units.
- Leave piles of unburned slash throughout the units at a density of approximately one pile per every 1-2 acres.
- Leave only largest diameter snags and downed wood in areas within 50 feet of cone-bearing whitebark pine to ensure effective protection during future wildland fire.

Wildlife Security

- Visual screening would be maintained along perimeter of regeneration units located along roads open to public access, where feasible. Leaving vegetation would not be practicable in some areas, such as, where landings and skid trails intersect or are adjacent to roads, in localized fuel reduction areas, in skyline units, or in prescribed burn units where the open roads serve as the control boundary.
- Hunting, transporting of hunters, and transporting of game would be prohibited by contractors and others associated with the project while working on or off roads closed to motorized vehicle use by the public.
- Personal use firewood gathering would be prohibited by contractors and others associated with the project on newly constructed roads or any other roads closed to motorized use by the public.

- All newly constructed roads would be closed by barrier or gate to public motorized use during and after road building and other activities. All existing roads currently closed to public motorized use would remain closed during implementation of all proposed activities.
- Motorized public access would remain restricted on closed roads on NFS lands during administrative use. If berms are removed to access treatment units, the purchaser would install temporary gates or effective barriers as needed and berms would be reinstalled once project activities are complete.
- Activities would be restricted during the winter use period for ungulates in units 101, 44 and 48.

Scenic Quality

The following design criteria and objectives are developed to meet the intent of scenery management within the project area. These design features are included to prevent or reduce negative effects to scenery resources by reducing the contrast in edge, form, line, color and texture resulting from ground disturbance and vegetation removal. Implementation of these design criteria would ensure the project meets the Forest Plan and Visual Quality Objectives (VQOs). The VQOs for the project area are Retention, Partial Retention and Modification and are viewed primarily from the middleground and background from the valley, lake and adjacent Whitefish Mountain Resort. There are a foreground viewsheds on the primary road (FR9790) through the project area. This road is used by many types of visitors, including those seeking recreational and scenic opportunities. Viewshed analyses from the community of Whitefish, private properties adjacent to Whitefish Lake, Whitefish Lake itself and travel routes off forest (Farm to Market Road and Big Mountain Road) indicate some project units are more highly visible than others. Combining the viewshed analyses results and the Forest Plan directed VQOs justifies the following design features to meet the Forest Plan and VQOs.

All Units:

- Shape individual units, to the extent feasible (economically and technically), to create a natural appearing unit. Treatment units should avoid symmetrical shapes, straight lines and angles, disproportionate (to surrounding untreated units) opening and cluster sizes, and artificial lines and patterns. Additionally treatments should follow natural topographic breaks and changes in vegetation, treat the entire landform and along roadways vary unit sizes, widths, shapes and distances from center lines as much as possible.
- In created openings, use irregular shaped openings with grouped leave tree islands to reduce visual contrast to untreated areas. Feather edges to minimize introducing straight lines or corners within treatment units and between treated untreated areas. Use irregular clumping and blending of unit edges to avoid introducing dominating lines that could result from creating small patch openings. Mimic natural density changes around created openings and retain the natural variances within the stand rather than evening out the spacing of trees. The intent is to reduce the obvious character changes occurring in the overall landscape.
- Additional ways to soften the edges of units, include treating adjacent to existing openings or other units; removing taller, older trees and favoring younger ones; and shifting location or shape of unit boundaries. All these practices will help reduce a vertical wall effect.

- In units along FR9790 and Big Mountain Road, minimize opening/landing locations and sizes, vary distance between openings/landings and retain route-side vegetative screening where it exists to the extent possible. If landings are located outside of treatment units they will be approved by sale administrator and the Landscape Architect (or designee) can assist in identifying landing locations to minimize visual impacts. Use existing landings as much as possible. Landing clean up should be sufficient to ensure minimal to no poorly burned material remains. Adjacent to these roads, stumps should be cut to 8 inches or less in height. Slash, root wads and other debris will be removed, buried, burned, chipped or lopped and scattered to a height no greater than two feet within 50 feet of these roads. Avoid creating a straight edge of trees by saving clumps of trees and single trees with varied spacing along these roadways. Log landings, roads, gravel pits, borrow areas, and bladed skid trails should be minimized adjacent to these roadways.

Unit Specific:

- When using cable logging systems, keep cable/skyline corridors as narrow as possible and vary the spacing between corridors to reduce contrasting liner effects. Minimize the number of skyline corridors in units where leave trees will be greater than 10% and areas are visually sensitive. Select skyline systems with lateral yarding capabilities. In these units to the extent practical designate skyline corridors after felling trees (avoid regular spaced widths between corridors) and/or, avoid skyline corridors on alignments perpendicular to Farm to Market Road, private properties on Whitefish Lake, Whitefish Lake. This applies to the following cable units: (1, 5, 8, 11, 14, 19, 22, 29, 30-33, 37, 38, 41, 42 and 49).
- To the extent possible (economically and feasibly) use irregular clumping to create mosaic landscape character on edges of units and use open areas adjacent to units to assist in varying or feathering the edge of the unit. This applies to the following cable units: (1, 2, 5-8, 11, 14, 19, 22-24, 29-34, 37, 38, 41, 42, and 49).
- In units adjacent to untreated areas or contrasting treatment types, provide a transition zone along the unit's edges. Progressively increase or decrease leave tree density from the unit center towards the unit edge, depending on whether the adjacent stand is a dense uncut forest (increase) or in an existing open condition (decrease). In addition, vary the width of the transition zone based on the surrounding unit's openness.
- Methods used to control prescribed burns should not dominate naturally established form, line, color and texture of the area. Utilize natural features as fire breaks to the extent possible.
- In units along private land boundaries, use irregular clumping and blending of unit edges to avoid introducing dominating lines that could result from introducing unnatural appearing edges. Thinning would be designed with special markings with variable spacing of leave trees, clumping of a variety and diversity of tree species for textures to mosaic under-burning and emulate a natural appearing forest environment. This applies to the following cable units: (31, 32, 37, and 38, 44-49 and 108-110).
- In units 46 and 48, post-treatment mask (black out) any painted boundary trees or leave tree marking that is clearly visible from Holbrook private properties if requested by landowners. This work will be accomplished post sale activities. It is not necessary to extend this treatment further than 100 feet from these locations. This applies to the following units: (46 and 48).

Road Specific:

- Maintain the existing vegetation below constructed and temporary roads as much as possible for screening to help blend mosaic landscape character along the corridors. Where feasible, retain screening trees one tree-height below roads and landings (include cable landings) when viewed from below. Any major changes during implementation in the temporary road locations from the mapped proposed action would need to be verified to ensure that scenic integrity is maintained.
- When constructing temporary roads, minimize visual impact as much as possible, design with minimal cut and fill following natural landform as much as feasible, minimize vegetation clearing limits, and soften linear clearing edges by feathering or using irregular clearing limits to reduce introduced lines in the landscape. Cut and fill banks will be sloped to accommodate natural revegetation. Cut and fill slopes will be vegetated with native species wherever possible.

Other Road Design Features:

- Designated intermittent stored service (ISS) roads will be thoroughly treated after the completion of project activities so that they are completely impassable to motorized vehicles. ISS roads will receive the following treatments: The entire road will receive treatment such that maintenance or entries to maintain road drainage is not needed. Culverts aligned with stream channels will be removed. Road related sediment sources will be repaired and road reworked to eliminate ditch water flow without the aid of cross drain culverts. Typically this is achieved by cutting waterbars into the ditch line every 200 feet. Waterbars can be placed closer or further apart depending on site specific conditions and are typically installed 50ft above grade or near existing cross drains. Rock barriers or berms and placement of natural debris will be used to make the road junction unattractive as travel way and preclude motorized use. The first portion of the road (50 to 300 feet) will be recontoured to the original hillslope. In level topography where recontouring is not feasible rock barriers or berms and placement of natural debris will be used to make the road junction unattractive as travel way and preclude motorized use.
- Best Management Practices may be updated to all NFS roads identified for haul prior to timber harvest. Most BMPs were implemented in 2016. Best management practices are defined by Soil & Water Conservation Practices in FSH 2509.22.
- Remove all debris from existing road ditches and cross drain culvert inlet and outlets within harvest and burn units after operations are complete to maintain positive drainage and prevent culvert plugging.

Aquatics

No harvest or ignition of prescribed fire would occur in Riparian Management Zones (RMZs) which are defined as:

Category 1 Fish-bearing streams: Riparian management zones consist of the stream and the area on either side of the stream extending from the edges of the active channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

Category 2 Permanently flowing non-fish-bearing streams: Riparian management zones consist of the stream and the area on either side of the stream extending from the edges of the active channel to the top of the inner gorge, or to the outer edges of the riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.

Category 3 Seasonally flowing or intermittent streams and lands identified as potentially unstable or landslide prone: This category includes features with high variability in size and site-specific characteristics. At a minimum, the riparian management zone must include (1) the intermittent stream channel and the area to the top of the inner gorge; (2) the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation; (3) the area from the edges of the stream channel, wetland, or landslide-prone terrain to a distance equal to the height of one site-potential tree or 100 feet slope distance, whichever is greatest; or (4) the extent of unstable and potentially unstable areas (including earthflows).

Category 4a Ponds, lakes, reservoirs, and wetlands greater than 0.5 acre and all sizes of howellia ponds and fens/peatlands: Riparian management zones consist of the body of water or wetland and the area to the outer edges of the riparian vegetation; or to the extent of the seasonally saturated soil; or to the distance of the height of one site-potential tree; or 300 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond, or lake—whichever is greatest.

Category 4b Ponds, lakes, reservoirs, and wetlands less than 0.5 acre (except howellia ponds and fens/peatlands; see category 4a): Riparian management zones consist of the body of water or wetland and the area to the outer edges of the riparian vegetation; or to the extent of the seasonally saturated soil; or to the distance of the height of one site-potential tree; or 100 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond, or lake—

- Additional riparian habitats beyond those already identified through RMZs may be identified through on site verification during layout.
- All applicable BMPs will be implemented in harvest units and haul roads.
- Ignition for prescribed fires will be limited to areas outside RMZs but any fire that spreads into buffers would not be suppressed.
- Hand ignite along buffer zones to limit drift of any aerial ignition.
- If Hand line is constructed outside of buffers this line should be rehabilitated following Rx fire activities
- Spill blankets or containment will be required when utilizing pumps.
- Designate specific locations away from surface waters and outside of RHCAs for refuel drip torches and other fueling activities.
- Temporary road construction/reclamation will occur during dry conditions, as determined by the Forest Service, to allow effective implementation of required BMPs to reduce or eliminate effects to water quality. Reclamation of temporary roads would occur as soon as practicable.
- Culvert replacement or removal would occur during low flow periods and be restricted to the operating period July 15 – November 1 to protect spawning westslope cutthroat trout.

Soils

- All mechanized units that remove commercial products will be logged using designated skid trails. Equipment would occasionally leave the trails to access trees or accomplish other activities.
- Skid trail spacing width must average at least 75 feet except where converging, in all tractor harvest units. The goal is to occupy less than 15 percent of the treatment area including soil disturbance from skid trails, temporary roads and landings associated with past and proposed activities.
- Temporary road construction/reclamation will occur during dry conditions, as determined by the Forest Soil Scientist, to allow effective implementation of required BMPs to reduce or eliminate effects to water quality. Reclamation of temporary roads would occur as soon as practicable
- All temporary roads (unless on proposed trail location) and extended log skidding corridors constructed for this project will be rehabilitated by any site-appropriate combination of the following:
 - Treating for noxious weeds two weeks prior to road rehabilitation activities.
 - Removing any installed culverts or temporary bridges
 - Recontouring the entire template to natural ground contour
 - Where recontouring is not appropriate because of potential resource impacts, scarify with excavator teeth to a depth equally sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches).
 - Seeding with the native plant mix as specified by the Forest Botanist
 - Placing woody material on the template
 - Planting native shrubs/trees to augment natural vegetation
- All existing roads and skid trails will be reused to the extent feasible unless doing so would adversely affect soil, water or other resources. If roads or trails cannot be reused, their extent and location must be considered when laying out additional skid trails.
- Logging will occur when soils are dry as determined by the hand feel method (*Project File Exhibit H-21*).
- Sale administrators will monitor soil moisture conditions prior to allowing equipment to begin operations. This monitoring must be documented in the Timber Sale Daily Report.
- All mechanical fuel reduction will be accomplished with excavators. Excavators will, to the extent feasible, remain on skid trails.
- Prescribed burning prescriptions will be prepared and implemented to not exceed moderate burn severity conditions (Parsons, Robichaud, Lewis, Napper and Clark, 2010).
- Unit 9 would be logged with a cut to length/forwarder system to reduce potential detrimental soil disturbance.
- Units 3, 9, 25 and 28 would not have any post-harvest site preparation or fuel treatment to reduce potential detrimental soil disturbance.

Heritage Resources

- If sites are found during project activities, they will be assessed and protected if needed.

- Known, significant cultural resource sites on the Forest will be protected from inadvertent or intentional damage or destruction by requiring the avoidance of a 30 m (100 foot) buffer during implementation of the proposed actions.

Monitoring Activities

Monitoring is the process of periodically and systematically gathering and analyzing data to understand trends over time. The most common monitoring is related to implementation (did we do what we said we were going to do?) and effectiveness (did we achieve our desired results?).

Project-level monitoring

If the proposed action is selected for implementation in the Taylor Hellroaring Area, standard timber sale contract provisions will be used to direct how sale activities are conducted. Other activities performed under contract (fuel work), are monitored by a contracting officer's representative (COR) to ensure activities are implemented as designed. For example, sale administrators and other contracting representatives would monitor all timber sales to ensure that activities are conducted in accordance with contract specifications (that activities occur where and when they should to protect resources such as soils and wildlife, that yarding is accomplished as planned and specified in the contract to protect soils, that seedlings are planted at the appropriate spacing, etc.). Some aspects of the project, such as regeneration, are monitored for years after implementation to ensure objectives are met.

In addition, best management practices (BMPs) would be incorporated into many different phases of the project. The forest hydrologist (or designated representative) and sale administrator would review the location of all proposed temporary roads to assure compliance with BMPs. A sale administrator would visit each active cutting unit at a frequency necessary to assure compliance with the BMPs and the timber sale contract. Minor contract changes or contract modifications would be agreed upon and enacted, when necessary, to meet objectives and standards on the ground. Results from the 2014 Montana BMP Monitoring Report (MDNRC 2014) show that across all ownerships, BMPs were effective in protecting soil and water resources 98 percent of the time which means that eroded material does not reach draws, channels, or floodplains.

In addition to those monitoring measures outlined under soils resources (which provide direct and indirect benefits to water resources), activities authorized under the proposed action would be included in the Forest Service Nonpoint Source Strategy using programmatic monitoring to evaluate BMP implementation and effectiveness (USDA 2012).

Post-implementation monitoring would be performed to determine if selected units meet Region 1 Soil Quality Standards. The Sale Administrator would monitor all units during management activities to assure that skid trails meet specified spacing requirements and that operating conditions are adequate to minimize effects to the soil resource.

Vegetation/Timber Management

Reforestation surveys will be conducted for each regeneration harvest unit. Surveys will occur at a minimum during the first, third, and fifth year following completion of the initiating activity for reforestation (site preparation or planting). This monitoring is necessary to assure adequate stocking levels for stand certification (Forest Plan, Appendix I, 1985).

Compliance surveys will be conducted on all units after harvest activities are accomplished. These surveys will meet the dual purpose of determining whether stand treatment, fuel management, and/or site preparation objectives are met and to gather data on the current condition of stands for planting or other future management needs.

All harvest and thinning activities will be monitored to ensure compliance with contract specifications. Minor contract changes or contract modifications will be enacted, when necessary, to meet objectives and standards on the ground. Treatment unit layout, prescriptions, and contract provisions will be reviewed by a district management team to determine compliance with Forest Plan goals, objectives, and standards prior to contract award.

Fire and Fuels

Evaluate erosion and vegetation response (particularly on steep slopes and near surface waters) relative to treatment effectiveness to better direct future application of prescribed fire.

Post treatment fuels management exams will evaluate stand conditions to determine if resource objectives were met and direct future application of prescribed fire.

Forest Plan monitoring

The Forest Plan (1985) documents a system to monitor and evaluate Forest activities, addressing the most critical components for informed management of the Forest's resources within the financial and technical capability of the agency. Monitoring is conducted over the entire Forest on a periodic basis, and the monitoring results are used to guide future projects. The Taylor Hellroaring project would be consistent with monitoring requirements identified by the Forest Plan.

This page intentionally left blank.

Chapter 3 – Affected Environment and Environmental Consequences

Introduction

This chapter presents the existing environment of the Taylor Hellroaring Project area and the potential consequences to that environment that may be caused by implementing any of the alternatives described in Chapter 2. Within each resource section, the boundaries of the area used for the resource analysis is disclosed. The discussions of resources and potential effects take advantage of existing information included in the Forest Plan, other project documents, project-specific resource reports and related information, and other sources as indicated. Where applicable, such information is briefly summarized and reference to minimize duplication. The project file includes all additional project-specific information, including resource reports and results of field investigations.

Existing Condition / Affected Environment

Discussions of current conditions describe the physical, biological, and social environment for each potentially affected resource. The resource information provided in the Affected Environment narratives includes the effects of past actions that are now assessed as part of the existing condition of the landscape. For instance, if there were hypothetically a timber sale in 1980, which harvested 150 acres of forest and constructed two miles of new road, the effects of the harvest, road construction, vegetation re-growth, and roadbed stabilization occurring over past 37 years would be accounted for in the resource assessments of the affected environment. For example:

- The change in forest structure within this harvest area to an early successional sapling stage of development would be reflected in the disclosure of the existing forest vegetation in the EA. This information on the existing forest condition would also be used in the discussion of habitat conditions in the wildlife section.
- Stream channel surveys assessing stream conditions in the project area would reflect any remaining physical and biological effects of the past timber sale and road construction. The present contribution of sediment and increased stream flow from the two miles of road construction would also be accounted for in the calculation of existing watershed conditions, as road segments and their construction dates are entered into the water yield models. Field examinations and verification of current road conditions would provide a basis for proposed BMP projects for improved drainage, if needed. The two miles of open road would also be included in the open and total motorized route densities and reflected in the level of core security habitat presently provided for grizzly bears.

Specific past actions considered in the Affected Environment analysis for each resource area are summarized in Tables 3-1, 3-2, and 3-3. The list of past actions is not necessarily exhaustive, as records may not exist for all past activities by project. The effects of all past actions are fully accounted for in the assessment of existing conditions as this assessment would automatically reflect the impact of past actions to the extent that they are still influencing the particular resource considered.

Environmental Consequences

This section details the environmental effects that would occur for each alternative. These discussions form the scientific and analytic basis for comparing the alternatives (40 CFR 1502.16) and helps to determine whether the effects are significant and require the preparation of an environmental impact

statement (EIS) or if they will support the finding of no significant impact (FONSI). The effects of the No Action Alternative (Alternative 1) form a baseline against which the Action Alternatives are evaluated for significance, as defined in 40 CFR 1508.27.

Each resource narrative begins with a brief explanation of how effects were analyzed, their association with issues or concerns as described in Chapter 2, and the methods or models used. Included at the end of each resource narrative is a description of the regulatory framework associated with the resource. Environmental laws such as the National Forest Management Act (NFMA), Endangered Species Act (ESA), Clean Water Act, and Clean Air Act provide the direction to the Forest Service for management of forest resources. These laws are interpreted and defined through the Code of Federal Regulations (CFR), Land and Resource Management Plan (also known as a Forest Plan) direction, Forest Service Manual (FSM) direction, and Forest Service policy. The regulatory framework associated with each resource is helpful in relating national and forest direction to resource analysis procedures.

Environmental effects can be direct, indirect, or cumulative. They can be of long or short duration. Effects can be quantitative or qualitative, adverse or beneficial, actual or potential. It is important to consider timing and location of effects. Direct effects are caused by the action and they occur at the same time and place. Indirect effects are caused by the action and are later in time, or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8) In most cases, direct and indirect effects are discussed together. Cumulative effects are those that result from the incremental impact of the action when added to the other past, present, and reasonable foreseeable future actions (40 CFR 1508.7) Effects of past actions are already included in the disclosure of existing conditions for each resource area. The cumulative effects analysis builds upon this existing condition by considering the incremental addition of direct and indirect effects of the proposal. Therefore, the discussion of effects first considers the direct and indirect effects of each alternative and does not consider cumulative effects unless direct and indirect effects exist.

The evaluation of direct, indirect, and cumulative effects uses the best available scientific information, as well as data related to past, present, and reasonably foreseeable events that have occurred or may occur in the individual analysis areas. Tables 3-1, 3-2, and 3-3 provides a summary of the actions considered in the cumulative effects analysis for the Taylor Hellroaring Project area. Each action was evaluated by the resource specialist to determine whether it would have a cumulative impact on the resource or not. These determinations are documented on a cumulative effect worksheet found in the project file. All actions that were determined to have a cumulative impact are disclosed in the discussions in this chapter under each resource area. Many resources have larger cumulative effects analysis areas that would include activities outside of the project area.

3-1. Cumulative Effects Summary on All Ownerships in Project Area.

Actions on All Ownerships	Past	Present (Fall 2016 – Fall 2017)	Reasonably Foreseeable
Wildland Fire Suppression		There is evidence of wildland fire in and near the project area over the last several hundred years. The majority of forest stands within the National Forest lands of project area originated from fire. Since about 1930, wildland fires have been actively suppressed by the Forest Service and other agencies. Wildland fires will continue to be suppressed. There is one recent large wildland fire within the project area boundary otherwise all fires have typically been less than one acre and were suppressed using hand crews. The Montana DNRC and USFS share wildland fire protection responsibilities within the project area. Private landowners such as F.H. Stoltze, also all have their own contracted fire protection resources.	

Hunting, Trapping, and Predator Control	These activities have been and continue to be popular uses of National Forest System land and other ownerships. Popular hunted species include white-tailed deer, mule deer, elk, and moose. Some species that are now currently listed as threatened, such as grizzly bears and Canada lynx, were hunted and trapped in the past. Some predator populations, such as gray wolves and coyotes, were reduced in numbers from the project area in the early part of the last century.
Fishing	Fishing within the project area is not a common activity.
Firewood and Other Miscellaneous Forest Product Gathering	Firewood gathering has occurred and will continue in the future; recent higher than historic energy costs may increase the public's desire to obtain firewood but air quality concerns may also reduce reliance on this source of fuel in the future. Other products gathered in small quantities in the area include posts and poles, mushrooms, berries, and Christmas trees. Limited access to Forest Service lands has restricted the accessibility to harvesting firewood.
Snowmobiling	Snowmobiling is a popular winter activity within the project area when conditions allow. Within the project area, snowmobiling is allowed only on designated open groomed routes. These open NFS trails and areas as identified by the Tally Lake and HH/GV Over Snow Map. Routes include Upper Whitefish Lake road on DNRC lands, NFSR 9790 which access the back side of WMR and NFSR 316 in Canyon Creek which is a designated groomed over snow trail.
Camping	There are no developed camp sites in the project area. Dispersed camping is allowed throughout the project area and vehicles may travel up to 300 feet from an open road to access dispersed camp sites.
Driving	Driving for pleasure, sightseeing, and wildlife viewing on open Forest, State, and private roads is popular and will continue.
Hiking, Mountain Biking, and Horseback Riding	These activities have occurred on open roads and trails in the project area and Whitefish Mountain Resort (WMR) permit area and have increased in popularity. Off-trail hiking also occurs and is generally associated with hunting, berry picking or other minor forest product collecting.
Motorcycle and ATV Riding	Motorcycles and ATV riding are limited to open forest roads only. Very minor off road use occurs due to terrain and vegetation.
Road Maintenance and BMPs	Records show that there are approximately 6.5 miles of non-Forest Service maintained road within the project area including state, private, county, and special use roads administered by the Forest Service. Roads on all ownerships will be maintained for use either by all users or for just the individual landowners. Roads used for the transport of forest products are generally maintained to meet Montana Best Management Practices (BMP). Road work to improve surface drainage, stabilize slopes, and reduce erosion and stream sedimentation has occurred on roads used by the Forest Service.

3-2. Cumulative Effects Summary on National Forest System Lands.

Actions on National Forest System land only	Past	Present (Fall 2016– Fall 2017)	Reasonably Foreseeable
Timber Harvest	Approximately 418 acres of timber were harvested to some degree on National Forest System land during the 1960s within the project area.	The Whitefish Municipal Watershed project is outside the project area but immediately adjacent. This project is expected to be implemented in 2018. Specific cumulative effects are listed under each appropriate resource.	
Thinning for Hazardous Fuels Reduction	Approximately 200 acres of National Forest land within the project area experienced hazardous fuels thinning during the 2000s and 2010s		
Prescribed Burning	Prescribed fire will continue to be used in the future as a management tool.		
Road Construction	The project area has approximately 10 miles of road open to motorized use, 7.6 miles open seasonally to motorized use, and approximately 2.7 miles of road closed year long. These roads built on federal land were completed between 1960 and the mid 1970's. In 2014, The Forest Service authorized an easement to the DNRC allowing for construction of two segments of permanent road through NFS lands totaling .84 miles.	WMR will be realigning a service road near the top on the mountain in the Hell Roaring Drainage.	
Road Maintenance and BMP	NFSR # 9790 and 9860 were improved to meet current BMP standards during the summer of 2016. The first 5.5 miles of NFSR # 9570 was improved through roto-milling the road surface.	Roads designated for motorized use by the public are maintained with safety as a high priority. This primarily involves repairing drainage features and clearing of live and down vegetation. Some roads have been closed and are maintained at a lower level. There are currently approximately 20.3 miles of road under USFS jurisdiction within the project area; of which 10 miles are open year-long, 7.6 miles are open seasonally, and 2.7 are closed yearlong.	
Trail Construction / Maintenance	The Ralph Thayer Memorial NFS Trail 26, or the Whitefish Divide trail, is a National Recreation Trail and the Smoky Range NFS Trail 270 are in and adjacent to the project area. Both trails have been maintained in recent years.		

Noxious Weed Control	Noxious weed control as outlined in the 2001 Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment and Decision Notice will continue to take place in the project area.

3-3. Cumulative Effects Summary on State and Private Lands.

Actions on State and Private Ownership Only	Past	Present (Fall 2016 – Fall 2017)	Reasonably Foreseeable
Private Land Development	Some amount of construction of driveways, buildings, and other improvements on private land adjacent to the project area has been occurring for decades and will continue.		
Noxious Weed Control	Noxious weed control on state and private ownership will continue to take place in the project area and is expected to increase in the future. Individual landowners will continue to control weeds with primarily spot applications on their property.		
Timber Harvest	Timber harvesting has occurred in the past on private property surrounding the project area owned by DNRC and F.H. Stoltze. The King Hemlock Sale on DNRC is currently active immediately adjacent to the project area	Timber harvesting amounts occurring on private property is currently unknown. Lands owned by DNRC are expected	
Treatments Specific to Forest Fuels Reduction	Removal of live and dead vegetation for the purpose of reducing wildland fire intensity has been accomplished on private and state property within the project area. This activity is expected to continue. The extent of fuel reduction on private property is not known but is primarily limited to areas immediately adjacent to structures.		
Dispersed Recreational Use	Dispersed, hiking, hunting, biking, and ORV activities are expected to increase in popularity on adjacent lands in the area. DNRC has a lookout cabin on Werner Peak which is accessed by the Taylor Road NFSR 9790. A proposed trail addition to the Whitefish Trails system will occur with a trailhead in the Haskill Basin area which could eventually link to FS lands. The DNRC is also evaluating the Whitefish Legacy Partners Proposal adjacent to the project area that would linked the Whitefish Trail near Smith Lake to portions of proposed trail in this project in the Hellroaring drainage.		

This page intentionally left blank.

Forest Vegetation

Introduction

This section describes the existing forest vegetation conditions in the Taylor Hellroaring Project area and how the alternatives would affect the various components of this resource. Forest vegetation directly related to the following project purpose and need statements:

- Increase forest resilience to insect infestation and disease infection and wildland fire disturbances while maintaining a natural-appearing forested setting viewed from the surrounding area
- Restore rust-resistant whitebark and western white pine.

Refer to the *Threatened and Sensitive Plant Species*; *Invasive Plant Species*; *Fire, Fuels and Air Quality*; and *Neotropical Migratory Birds and Riparian Habitat, Old-Growth, Snags and Downed Wood Habitats* sections of this chapter for further information on those particular aspects of forest vegetation are affected by the proposed action.

Background and supporting documentation is provided in Section P of the Project File and in individual stand files located at the Tally Lake Ranger District.

Information Sources and Methodology Used for Analysis

Indicators and Measures

The following indicator was used to evaluate each alternative's ability to address the purpose and needs statements related to forest vegetation:

- Acres of resilient, early seral species forest cover types. These forest cover types are defined as ponderosa pine, western larch and whitebark pine. The western larch forest cover type includes the resilient species ponderosa pine and western white pine as associates. These species are also expected to be more resilient to disturbance considering climate change (Scott et al. 2013).
- Forested acres with less than 40 percent canopy cover. The susceptibility of a forest to insects and diseases is heavily influenced by density and its impact on tree vigor. As the density increases, a deficit of soil moisture develops and trees lose their ability to withstand attacks by insects and disease agents (Powell 1999, Amman et al. 1977). *Project File Exhibit P-2* discusses insect and disease disturbance agents within the analysis area. Insect and disease agents currently affecting the analysis area include root disease, Douglas-fir beetle, western balsam bark beetle, dwarf mistletoe and white pine blister rust.

Table 3-4. Resource Indicators and Measures for Assessing Effects.

Resource Element	Resource Indicator	Measure	Used to address: Purpose and Need, or key issue?
Forest Resilience	Ponderosa Pine, Western Larch Mixed Conifer and Whitebark Pine Cover Types	Acres	Purpose and Need
Forest Resilience	Forested areas with less than 40% canopy cover	Acres	Purpose and Need

Information Sources

The primary data sources used to describe existing vegetation conditions on National Forest System (NFS) lands include site visits, the Natural Resource Information System (NRIS) FSVeg database, the Forest Service Activities Tracking System (FACTS) database, and R1 Vegetation Map (R1 VMP) (Brown and Barber 2012). More detailed documentation on all these sources and analysis methodology is provided in *Project File Exhibit P-3*. Satellite image photography accessed through ArcGIS online and field visits (*Project File Exhibit P-4*) were used to verify or update stand exam and remotely-sensed data. All of the stands proposed for treatment were field reviewed by a silviculturist, fuels specialist, and/or timber sale preparation specialist to verify the vegetation data and diagnose treatment needs.

Analysis Area

The analysis area used to examine the impacts of the alternatives on vegetation resources is displayed on the Vicinity Map, *Figure 1-1* in Chapter 1 and Map 1 in Appendix A. The area directly, indirectly and cumulatively affected by the alternatives is defined by the NFS lands within the Taylor Hellroaring project area. The time frame for this analysis is focused on the period immediately after implementation of activities. Immediate effects will last approximately 20 to 30 years until shrubs and trees are established enough to form a forested canopy layer in areas disturbed by regeneration harvests and mixed-severity prescribed fire. Some effects of treatments may last longer 100 years or until the next stand-altering disturbance. These disturbances include thinning, timber harvest, or wildland fire.

Affected Environment / Existing Condition

Forest Cover Types

Forest cover type refers to the dominant tree species that currently occupy a forested stand. Nearly all of the forest stands in the analysis area are composed of mixed species in different proportions. The determination of forest cover type for the Taylor Hellroaring analysis is based off of USFS Region 1 classification for existing vegetation (Milburn et al. 2015) Table 3-5 displays the cover types present within the Taylor Hellroaring analysis area. Refer to *Project File Exhibit P-4* for a map showing these cover types.

Table 3-5. Existing Cover Types.

Cover Type	Acres	Percent of Analysis Area
Dry Douglas-fir	256	3
Lodgepole Pine	259	3
Mixed Mesic Conifer	2371	31
Ponderosa Pine	0	0

Spruce/Fir	4108	52
Western Larch Mixed Conifer	193	3
Whitebark Pine	206	3
Non-Forest	415	5

Acres are approximate due to rounding and small errors introduced by GIS data analysis.

The Western Larch Mixed Conifer and Whitebark Pine cover types currently comprise approximately six percent of the analysis area. The following paragraphs briefly discuss the forest types used as indicators in the Taylor Hellroaring analysis area.

Ponderosa Pine Cover Type

The ponderosa pine cover type provides important wildlife habitat as late successional forest on the warm dry and warm moist sites. Ponderosa pine (*Pinus ponderosa*) is best suited to warmer, drier sites where it competes most successfully with associated species. Historically wildfires were relatively frequent and of low to mixed severity on these types of sites. Ponderosa pine is very resistant to fire, even at a young age, while associated species, mainly Douglas-fir, are less resistant. Frequent fires maintained more open forest conditions with higher proportion of ponderosa pine. Fire suppression and timber harvest practices have favored the expansion of Douglas-fir, which is able to tolerate and survive under more densely forested shaded environments compared to ponderosa pine. The lower elevation sites favored by ponderosa pine are also where access for logging and development activities is most prevalent. The ponderosa pine cover type is not currently present in the analysis area.

Western Larch Mixed Conifer Cover Type

Western larch (*Larix occidentalis*) plant communities are considered at risk in the Northern Rockies Zone due to fire suppression altering mix-severity fire regimes into high-severity fire regimes (USDA Forest Service 1998). Western larch is an important component of mid and low elevation stands in the analysis area and is the dominant species in stands on only 3 percent of the analysis area. Other species found in these stands include lodgepole pine in the younger stands which is replaced by subalpine fir, grand fir and Engelmann spruce in older stands. Douglas-fir is a component in most western larch stands regardless of age. Western larch is present throughout the analysis area in minor amounts in other forest types. Western larch is a long-lived species resilient to fire, insect and disease disturbance agents. Western larch provides large diameter trees and large diameter, long lasting snags utilized by many wildlife species as feeding or nesting habitat.

Fire plays a primary role in establishment and perpetuation of the western larch communities. Western larch is less drought tolerant than Douglas-fir and is restricted to more productive sites. It is the most fire resistant species within the northern Rockies due to its thick bark and a high branching habit. It is very long lived and is able to maintain its presence within a stand and on the landscape for many years. It is very shade intolerant and requires high amounts of light to survive and grow. Seedling and saplings are readily outcompeted in situations with even light tree or shrub cover. It very dependent on bare mineral soil conditions for seed germination and seedling establishment (Schmidt and Shearer 1990).

Whitebark Pine

The whitebark pine cover type currently comprises approximately three percent of the analysis area. Additionally, scattered individuals exist within the analysis area and this species was likely an important component of the high elevation areas within the analysis area prior to the

introduction of white pine blister rust. Whitebark pine (*Pinus albicaulis*) has substantially declined in northwest Montana over the past century. Smith and others (2008) found that populations in nearby Glacier National Park have declined by approximately 60 percent. Three factors are primarily responsible for the decline of whitebark pine. These are the exotic fungus white pine blister rust, mountain pine beetle and fire suppression (Keane et. al 2012). Whitebark pine seeds are an important food source for red squirrels, bears and Clark's nutcracker.

Forest Density

Table 3-6 below and *Project File Exhibit P-6* display the proportion of forest canopy cover classes in the analysis area. Forest canopy cover reflects the amount of ground overlain by tree canopies as if viewed from directly overhead and considers all size classes of trees in the determination. It is used as an assessment of tree density. It also provides information of how fully a site may be occupied by trees versus other types of plants. The degree of tree canopy cover will influence the amount of light that reaches the ground and thus can affect understory plant abundance, vigor, and species. Stands with greater than 40 percent canopy cover are considered dense with closed forest canopies. Very little light reaches the forest floor in very dense stands with greater than 60 percent canopy cover. Stands in the less than 25 percent range are very open canopied forest with considerable distance between tree crowns. Stands in the 25 to 40 percent canopy cover range appear partially open. These stands can have a clumpy distribution of trees interspersed with small openings. The majority of the land in the analysis area consists of forest with greater than 40 percent canopy cover. This is a result of successful fire suppression and a lack of timber harvesting within the majority of the analysis area. The majority of the acres with canopy cover less than 25% are within the 2001 Warner Peak Fire area.

Table 3-6. Canopy Cover.

Canopy Cover	Existing Acres	Percent of Analysis Area
<10%	545	7
10-25%	144	2
25-40%	489	6
40-60%	3231	41
>60%	2959	38
N/A	439	6

Acres are approximate due to rounding and small errors introduced by GIS data analysis.

Climate Change

Climate change is affecting forest stands in the analysis area and will continue to impact forests in the Rocky Mountains (Funk et al. 2014). Forests are in continual flux, emitting carbon into the atmosphere, removing carbon from the atmosphere, and storing carbon as biomass (sequestration). The importance of carbon storage capacity of the world's forests is tied to their role globally in removing atmospheric carbon that is contributing to ongoing global warming. Over the long-term, through one or more cycles of disturbance and regrowth (assuming the forest regenerates after the disturbance), net carbon storage is often zero because re-growth of trees recovers the carbon lost in the disturbance and decomposition of vegetation killed by the disturbance (McKinley et al. 2011; Ryan et al. 2010; Kashian et al. 2006).

The analysis area can be characterized as a patchwork of stands ranging from pole-sized stands regenerated in the 1960s to mature stands. Generally most of these areas are stocked more heavily than desired and competition for water and nutrients is high and the trees in the area are more susceptible to drought, insects, disease, and fire. At this stage of their development, these stands are estimated to be net carbon sinks. That is, they are likely sequestering carbon faster than they are releasing it to the atmosphere. The strength of that sink has likely been weakened in some stands due to recent scattered tree mortality from Douglas-fir beetle in Douglas-fir.

Environmental Consequences

Introduction

This section describes the effects on forest vegetation from implementation of the alternatives as described in *Chapter 2*. The potential effects described below are the result of analysis based on research, field data, monitoring, experience, and best professional judgment of the Silviculturist and others on the interdisciplinary team.

Direct and Indirect Effects

No Action Alternative

The No Action Alternative provides a baseline for comparison of effects from the action alternatives. The effects of the No Action Alternative represent potential natural changes over time.

No vegetation management would occur on NFS land within the project area under this alternative. Forest Service policy to suppress wildland fires would continue. There would be no immediate effects on vegetation and natural processes such as tree growth and mortality would continue over time. This effects analysis assumes that all wildland fires will be successfully suppressed during the timeframe covered by the analysis. This alternative would result in the continuing change of forest composition to denser stands comprised of more shade tolerant tree species.

Forest Cover Types

Forest cover types would be expected to continue shifting to the shade tolerant types (Mixed Mesic Conifer and Spruce/Fir) as Douglas-fir, grand fir and Engelmann spruce/subalpine fir continue to successfully regenerate in stand understories. The shade intolerant western larch forest type would decrease across the analysis area over time. Whitebark pine would be expected to decrease across the high elevation stands due to competition from subalpine fir and mortality caused by white pine blister rust. This alternative would not provide conditions necessary to regenerate the long-lived, seral species western larch, western white pine or whitebark pine until a stand replacement fire event occurred.

Forest Density

Forest density would be expected to increase acreage in the greater than 40 percent classes as shade tolerant species continue to grow within the understory of stands. Shade intolerant tree species presence would be expected to decrease without adequate sunlight for reproduction. Grass, forb and shrub species would decrease in forest stands as trees prevent sunlight from reaching the forest floor.

Climate Change

There would be no direct human-induced emissions of carbon into the atmosphere under the No Action alternative. Forest stands would likely continue as carbon sinks until the next disturbance event (fire, wind, insect infestation, etc.) occurs. For at least the short term, on-site carbon stocks would remain higher under the No Action alternative than under the Action Alternatives (*Project File Exhibit P-1*).

Action Alternatives

The Action Alternatives would have short and long term effects on the vegetation within the proposed treatment areas. The residual species composition and stand density would vary by treatment type and existing stand condition. Table 2-2 in Chapter 2 provides a brief description of the retention levels and stand densities for the various proposed treatment types.

Forest Cover Types

Species composition in untreated areas is expected to be the same as in the No Action Alternative. Treatments in the Action Alternatives are expected to shift the overall species composition of the area slightly towards a greater proportion of early seral species. The western larch mixed conifer and whitebark pine forest cover types are expected to increase with a corresponding decrease in the Mesic Mixed Conifer and Spruce/Fir cover types. The ponderosa pine cover type would be established in the analysis area through regeneration harvest and planting on approximately 27 acres. Regeneration harvests (seedtree, shelterwood and clearcut) would be expected to provide the full sunlight and exposed mineral soil needed to establish stands of western larch, ponderosa pine, western white pine and whitebark pine. Commercial thinning would be expected to shift species composition towards western larch and western white pine through the removal of Douglas-fir and other shade tolerant conifers. Prescribed burning is expected to create a mosaic of forest structure including openings suitable for the establishment of whitebark pine (Keane et. al 2012). Table 3-7 and *Project File Exhibit P-5* display the expected changes to forest cover types.

Table 3-7. Expected Cover Types.

Cover Type	Existing/No Action Alternative Acres	Action Alternatives Acres	Action Alternatives Percent	Change (Acres)
Dry Douglas-fir	256	238	3	-18
Lodgepole Pine	259	169	2	-90
Mixed Mesic Conifer	2371	1989	25	-382
Ponderosa Pine	0	27	<1	+27
Spruce/Fir	4108	3869	50	-239
Western Larch Mixed Conifer	193	824	11	+631
Whitebark Pine	206	259	3	+53
Non-Forest	415	432	5	+17

Acres are approximate due to rounding and small errors introduced by GIS data analysis.

Trail construction proposed in the action alternatives is not expected to have an effect on forest cover types. Minimal amounts of individual trees may be removed during trail construction. Project design criteria detailed in *Chapter 2* would be expected to adequately protect the majority of trees.

Forest Density

Canopy cover is expected to decrease in treated units as trees are either removed through timber harvest or killed and left in the fuel reduction treatments and prescribed burning (Table 3-8, *Project File Exhibit P-7*).

Table 3-8. Expected Canopy Cover.

Canopy Cover	Existing Acres	Action Alternatives Acres	Action Alternatives Percent	Change (Acres)
<10%	545	965	12	+420
10-25%	144	136	2	-8
25-40%	489	1648	21	+1159
40-60%	3231	2445	31	-786
>60%	2959	2155	28	-804
N/A	439	458	6	+19

Acres are approximate due to rounding and small errors introduced by GIS data analysis.

Climate Change

In the short term, the action alternatives would remove and release some carbon currently stored within treatment area biomass through harvest of live and dead trees and other fuel reduction activities, including prescribed burning. A portion of the carbon removed would remain stored for a period of time in wood products (US EPA 2013; Depro et al. 2008). Additionally, motorized equipment used during any of the proposed activities will emit greenhouse gasses.

For at least the short term, on site carbon stocks would be lower under the Action Alternatives than under No Action. Actions such as those proposed here may, in some cases, increase long term carbon storage over time (Finkral and Evans 2008; North et al. 2009; Mitchell et al. 2009) but current research in this field shows highly variable and situational results (McKinley et al. 2011; Mitchell et al. 2009; Reinhardt and Holsinger 2010; Ryan et al. 2010).

Summary

The action alternative will increase the acreage of early seral, resilient tree species by approximately 711 acres through the use of seedtree, commercial thin, understory removal and prescribed burning treatments followed by tree planting of ponderosa pine, western larch, western white pine and whitebark pine. This would increase the percentage of the ponderosa pine, western larch mixed conifer and whitebark pine forest cover types from five percent to approximately 14 percent of the analysis area (Table 3-9). Forested areas with less than 40% canopy cover would be expected to increase by approximately 1571 acres in the analysis area (the difference between No Action and Action Alternatives). These treatments would increase the resiliency to insect and disease disturbances of the treated stands by shifting species composition away from Douglas-fir and true firs to ponderosa pine, western larch and rust resistant western white pine and whitebark pine. The proposed construction of trails would have minimal effects on forest vegetation within the larger scope of the analysis area.

Table 3-9. Comparison of Alternatives.

Indicator 1. Ponderosa Pine, Western Larch Mixed Conifer and Whitebark Pine Cover Types	Alternative	Acres	Percent of Analysis Area
	No Action	399	5
	Action Alternatives	1110	14
Indicator 2. Forested areas with less than 40% canopy cover			
	No Action	1178	15
	Action Alternatives	2749	35

Acres are approximate due to rounding and small errors introduced by GIS data analysis.

Cumulative Effects

Forest Cover Types and Density

Past harvest on Forest Service land consisted of approximately 418 acres of clearcut and selection harvest that took place in the 1960's. Approximately 176 of these acres utilizing a selection treatment impacted the forest cover types by increasing the proportion of shade tolerant species in these stands through the removal of large-diameter western larch. The 242 acres of regeneration harvest in the 1960's converted those acres to the western larch mixed conifer and lodgepole pine cover types and the seedling/sapling size class. Both types of treatments reduced the stand density to below 40 percent canopy cover based on historic aerial photographs of the area. Approximately 55 years of forest development increased the density in these stands above 40 percent canopy cover.

Climate Change

Neither the No Action alternative or the Proposed Action would have a discernable impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted within these few affected forest acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities globally contributing to that pool.

Regulatory Framework and Consistency

Flathead National Forest Land and Resource Management Plan (Forest Plan)

Forest Plan goals include maintaining a diversity of vegetation and habitats across the forest to meet the needs of a variety of wildlife species, and to provide for a sustained yield of timber products (Forest Plan, p. II-5). Amendment 21 to the Forest Plan has updated and modified some of the goals, objectives, standards, and guidelines regarding vegetation management on the Flathead National Forest, particularly regarding old growth forest. The Forest Plan further defines timber management goals of providing a sustained yield of timber products that is cost effective, responsive to the needs of the local economy, and is consistent with other Forest management goals (Forest Plan, p. II-5). These goals are discussed in Forest-wide timber management objectives described on pages II-7 to II-9 of the Forest Plan. The project proposal and its alternative were designed by the interdisciplinary team to meet these goals and objectives, and address plant and animal community needs. All planned activities are consistent with Forest-wide and MA direction.

Northern Region Guidelines

FSM 2470 Supplement R1 2400-2016-1 of the Northern Region clarifies and describes the restrictions on the size of harvest openings created by even-aged silvicultural methods (clearcut, seedtree and shelter-wood harvests), as required by FSM 1921.12. The Proposed Action Alternative would create five even-aged regeneration openings exceeding 40 acres.

Increasing resilience to insects and disease is the primary vegetation management objective. Root disease is very active in the stands proposed for regeneration harvest. It is affecting primarily Douglas-fir, subalpine fir and grand fir. The stands in the lower elevations of the project area are currently comprised of mostly Douglas-fir and grand fir. The higher-elevation forests of the project area are primarily comprised of mature lodgepole pine and subalpine fir. (Project File Exhibit P-2). Intermediate treatments in the five proposed even-age openings would encourage advance regeneration Douglas-fir and true firs. These species are very susceptible to root disease. These stands do not currently contain a sufficient proportion of root disease tolerant species to manage them using an intermediate treatment. Douglas-fir weakened by root disease is very susceptible to Douglas-fir beetle. Regenerating the entire stand or affected area with less susceptible species would reduce the effect of root disease and Douglas-fir beetle.

The public was notified during scoping that the Taylor Hellroaring Project proposed action included regeneration harvest units greater than 40 acres in accordance with 36 CFR 219.27 (d) (2) (ii). The initial 30-day comment period (public scoping) began on March 28, 2017 with a letter to interested people and adjacent landowners; and a notice in the Daily Interlake newspaper. Public comments were used to help develop the proposed action. Additionally, a public meeting was held informing the public of the openings on April 6, 2017. The required authorization from the Regional Forester was received on October 4, 2017 (*Project File Exhibit P-9*).

The National Forest Management Act (NFMA) (16 USC 1604)

The NFMA and accompanying regulations provide direction that pertain to vegetation management on National Forest lands. They address a wide range of vegetation management, including the consideration and protection of other resources when managing vegetation; the appropriateness of even-aged management systems and adequate site reforestation following such harvests; and the proper consideration of the economic aspects of the project. These provisions, and others, are described in the Forest Service Manual (FSM) at 1921.12.

Appropriateness of Even-Aged Management and Optimality of Clearcutting

The NFMA directs that clearcutting be used only where “it is determined to be the optimum method.” Other even-aged methods can be used where “determined to be appropriate.”

The Proposed Action Alternative proposes even-aged silvicultural methods (clearcut, seedtree and shelterwood harvests) on 415 acres. Even aged methods are appropriate for this landscape, which has been shaped by fire, as have most of the Northern Rocky Mountain ecosystems. Mixed severity fire regimes dominate in the project area – fires that would burn both at low and high severity in a complex patch pattern across the landscape, creating the kind of stand structures and species compositions created by even-aged harvest methods.

Even-aged methods are appropriate to reduce the effects of root disease present in these stands by regenerating tree species tolerant of root disease (western larch, western white pine and ponderosa pine). The stands are currently comprised of mostly Douglas-fir, subalpine fir

and grand fir. Intermediate treatments would encourage advance regeneration of these three species susceptible to root disease. These stands do not currently contain a sufficient proportion of root disease tolerant species to manage using an intermediate treatment (*Project File Exhibit P-2*). Clearcutting is prescribed in five units. It is the optimal method in units 7 and 8 due to the lack tree species tolerant of root disease and windfirm species. Clearcutting in units 43, 52 and 53 is the optimal method to produce the open conditions needed to establish whitebark pine and slow the encroachment of competing subalpine fir.

Suitability for Timber Production

The National Forest Management Act (NFMA) of 1976 requires that no timber harvesting shall occur on areas classified as not suited for timber production, except salvage sales, sales necessary to protect other multiple-use values, or activities that meet other objectives on such lands, if the Forest Plan established that such actions are appropriate. The Forest Plan Management Area (MA) proposed for treatment is MA 7 that emphasizes timber management that compliments and protects high scenic values. Lands in MA 7 are classified as suitable for timber management.

The vegetation management objectives for the Taylor Hellroaring project are to:

- Increase forest resilience to insect infestation and disease infection and wildland fire disturbances while maintaining a natural-appearing forested setting viewed from the surrounding area
- Restore rust-resistant whitebark and western white pine.

The silvicultural diagnosis process and the Forest Plan were used to determine that all areas associated with this project are suitable for timber harvest using the following criteria:

- Meet the definition of forestland. All stands proposed for harvest are in a fully forested condition.
- Technological feasibility exists to protect soil productivity and watershed protection. Forest Plan standards, project Design Features in *Chapter 2*, and applicable BMPs would be used to protect these resource values.
- There is reasonable assurance that lands can be restocked within 5 years of final harvest. Flathead National Forest monitoring report, Item #39, indicate the forest is very successful at regenerating stands after harvest, with stands certified stocked an average of 2.9 years after harvest (*Project File Exhibit P-8*).

NFMA Findings for Vegetation Manipulation

All proposals involving vegetation manipulation of tree cover for any purpose must comply with the following requirements:

- Best suited to the multiple-use goals stated in the Forest Plan for the area with impact. All proposed treatments are consistent with multiple-use Forest Plan direction and address the project Purpose and Need.
- Assure that the lands can be adequately restocked within 5 years. Previous regeneration harvests in the analysis area have been successfully stocked within 5 years. Forest Plan Monitoring Reports indicate that the Flathead National Forest is consistently successful

at regenerating stands after harvest in the desired timeframe and with the desired number and species of trees (*Project File Exhibit P-8*).

- Not chosen because they will give the greatest dollar return. Although timber harvest associated with this project will generate revenue, all treatments have been designed to meet project objectives, which include cost efficiency, but are not solely designed to generate revenue.
- Be selected to avoid permanent impairment of site productivity and to ensure conservation of soil and water resources. The *Soils* and *Aquatics* Sections of this EA and the Design Features in Chapter 2 for the proposed actions would include protection and enhancement actions sufficient to ensure conservation of the resources.
- Be selected to provide beneficial effects to water quality and quantity, wildlife and fish habitat, regeneration of desired tree species, forage production, recreation uses, aesthetic values, and other resource yields. Following Forest Plan and MA direction, an ID Team considered all of these resources in the context of the surrounding landscape and this project as documented in the EA.
- Be practical in terms of transportation and harvesting requirements and total costs of preparation, logging, and administration. Treatments were designed by interdisciplinary team to be practical and cost efficient to the extent possible.

This page intentionally left blank.

Fire, Fuels & Air Quality

Introduction

Fire has historically been the dominant disturbance factor in forests across the northern Rocky Mountains. Most forests have evolved with the continual influence of fire, and forest ecosystems depend on this type of disturbance regime for their continued perpetuation on the landscape (Habeck and Mutch, 1973).

Information Sources and Methodology used for Analysis

The analysis of the historical fire regime and vegetation condition class used data from the Vegetation Models developed for The Landscape Fire and Resource Management Tool (LANDFIRE), the Biophysical setting (BpS), and succession class (SCLASS) layers developed by LANDFIRE (www.landfire.gov) (*Project File Exhibit O-4 and O-5*).

The following information sources were used for this analysis:

- Montana/Idaho Airshed Group Operating Guide, June 2010 (*Project File Exhibit O-6*).
- United States EPA, Department of the interior and USDA, Wild fire and Air Quality, January 19, 2016, summary document intended for resource managers (*Project File Exhibit O-7*).
- Flathead Fuel Hazard Prioritization Analysis, Andre Du Lac and Chip Fisher, 25 Feb 2016, updated 26 Aug 2016 (*Project File Exhibits O-8 thru O-12*). The Flathead National Forest fuel hazard analysis was done to assess values, hazards, and risks for fuels on the forest and generate priority scores fuels treatments. National Fire Policy direction supports a risk based assessment process. The Flammap model (*Project File Exhibit O-9*) was used to generate fire behavior risk elements: flame length and fire type.

Analysis Area

Spatial Bounds

The area evaluated includes the entire Taylor Hellroaring project area and the maximum manageable area (MMA) (*Appendix A-Map1*) for prescribed fire treatments. This analysis area was selected because it is where the effects of implementing the proposed activities would occur. The effects of the prescribed fire may extend beyond the units proposed for treatment but not exceed the maximum manageable area where fire may be allowed to burn.

Temporal Bounds

The temporal bounds for the fire and fuel resource analysis are considered to be within 20-30 years post treatment for short-term impacts and up to 100+ years or until the next prescribed fire, wildfire, insect / disease outbreak, timber harvest or other relatively large forest altering disturbance for long-term impacts. Hazardous fuel treatments would occur as funding becomes available but likely in the next 2-5 years.

Additional Spatial and Temporal Bounds Specific to Prescribed Fire

The intent of the project is to use prescribed fire through time to create and maintain desired conditions within and adjacent to ignition polygons within the MMA. When site conditions

allow and in the absence of fire suppression actions, avoid burning more than the maximum number of acres identified in individual ignition polygons in any one year period. This would not restrict fire to these polygons but cap the total number of acres burned in any given year associated with ignition from each polygon in the project area. Evaluation of erosion and vegetation response (particularly on steep slopes and near surface waters) relative to treatment effectiveness to better direct future application of prescribed fire.

Portions of prescribed fire polygons may be ignited simultaneously to capitalize on optimum weather parameters to achieve the desired mosaic effect, however, not all units will be ignited during one season. Multiple overlapping entries staged in time and space over an approx. 20+ year time period are needed to meet the intent of the prescribed fire treatments.

Additional Spatial and Temporal Bounds Specific to Air Quality

The Montana Air Quality Bureau divides the State of Montana into ten Airsheds. Airshed 2 is the primary analysis area for assessing the influence of the Taylor Hellroaring Project activities on air quality because it encompasses the effects of any activities undertaken in the project area (as defined by the Montana/Idaho Airshed Group). Airshed 2 is comprised of Flathead, Lake, Sanders, and the northern portions of Missoula and Powell counties. A fire in the project area would could have an impact on the Kalispell Impact Zone and Glacier National Parks class 1 Airshed due to close proximity, diurnal and prevailing winds.

The temporal scale of the analysis ranges from a few days to weeks or the time in which it is necessary for smoke from the project activities to dissipate each year over the life of the project (*Project File Exhibit O-14*).

Affected Environment / Existing Condition

Fire History

The majority of forest stands within the NFS lands of the project area originated from fire 160-200 years ago. There were two large fires in 1910 and one in 2001 which originated stands. Limited timber harvest in the 1950's and 1960's originated a minority of stands within the project area (*Project File Exhibits O-15 and O-22*).

Fire Regime & Vegetation Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human intervention but including the possible influence of aboriginal fire use. Five fire regime groups have been defined, ranging from high frequency-low severity regimes to low frequency-high severity regimes (*Project File Exhibit O-4*).

- 1. **0-35 years.** Low/mixed, generally low-severity fires replacing less than 25 percent of the dominant over story vegetation; can include mixed-severity fires that replace up to 75 percent of the over story.
- 2. **0-35 years.** Replacement, high-severity fires replacing greater than 75 percent of the dominant over story vegetation.
- 3. **35-200 years.** Mixed/low, generally mixed-severity: can also include low severity fires.

- 4. **35-200 years**. Replacement, high-severity fires.
- 5. **200+ years**. Replacement/any severity, generally replacement severity; can include any severity type in this frequency range.

Vegetation Condition Classes (VCC) reflect the current conditions degree of departure from reference conditions in terms of two main ecosystem components: fire regime and associated vegetation. Three fire regime vegetation condition classes have been defined based on the following criteria:

- **VCC 1** represents ecosystems with low (<33 percent) departure from reference conditions and that are still within the estimated historical range of variation of a specifically defined reference period.
- **VCC2** indicates ecosystems with moderate (33 to 66 percent) departure.
- **VCC3** indicates ecosystems with high (>66 percent) departure.

Vegetation condition classes measure the amount of characteristic versus uncharacteristic conditions that exist in the current landscape. VCC is not a fire hazard metric; rather, it is a tool for measuring ecological trends. (Interagency Fire Regime Condition Class (referred here as VCC=FRCC)) (*Project File Exhibit O-23*).

The majority of the project area on NFS lands historically experienced infrequent replacement (high) severity fires (fire regime 4, 35-200 year fire return interval). These areas are currently experiencing low (VCC1) to moderate (VCC2) departure from reference condition. The remainder of the project area on National Forest lands historically experienced infrequent mixed severity fires; fire regime 3, 35-200 year fire return interval. These areas are currently experiencing moderate (VCC2) departure from reference condition. (*Project File Exhibit O-5*).

Fuel

A combination of dead vegetation and continuous live vegetation from the forest floor to the upper forest canopy creates a complex of fuel that, when ignited under severe fire conditions, may leave little or no surviving above-ground vegetation. High mortality in subalpine fir and whitebark pine at upper elevations has resulted in dead standing and heavy down fuels within that portion of the watershed. These down fuels, within the dense subalpine fir, present the greatest hazard when the area dries out sufficiently to burn. (Whitefish CWPP, 2009)(*Project File Exhibit O-2*).

The lower south facing slopes are generally drier and have natural openings created and maintained by past fires and other natural disturbances, Douglas-fir and subalpine fir are encroaching and growing into these openings. Shrubs that provide browse for wildlife are losing vigor becoming decadent in the absence of fire. Large fire resistant western larch and Douglas-fir trees with scars from surviving numerous past mixed severity fires are present in and around these openings, shade tolerant trees are growing into the under and mid-story of these trees creating ladder fuels that threaten the perpetuation of these large trees on the landscape.

Weather

This area is one of the highest precipitation zones on the forest. Near the Whitefish divide, the average annual precipitation is 65 inches. The lower slopes receive 30 inches annually (*Project File Exhibit O-16*). The project area is generally cool and moist which is evident by the vegetation present on the more moist sites, devils club, alder, pacific yew, and fools huckleberry. Due to the high amount of annual precipitation in this area and associated dense vegetation of a relatively moist climate, the area should only experience a large stand replacement fire during periods of very high to extreme fire danger with low humidity and high temperatures similar to the summer of 2015. Prevailing winds during fire season are generally out of the southwest. Thermal belts at night during fire season are common within the mid slopes of the project area which promotes active fire at night.

Topography

The drainages of the Taylor Hellroaring project area are orientated southwest to northeast which aligns with the prevailing winds. The slopes vary from gentle too steep within the project area which has limited access and past management in some areas.

Under less than severe fire weather conditions changes in percent slope and aspect can significantly alter fire behavior or can be barriers to fire spread altogether. North aspects tend to be the coolest since they receive very little if any direct sunlight during the day, for that reason fuel on this aspect tends to only be available for fires during periods of drought and peak fire danger. East aspects receive direct sunlight early in the day for that reason they tend to be cooler than West and South aspects. South aspects receive the most direct sunlight throughout the day, these sites are generally the driest making fuel more readily available to burn. West aspects receive direct sunlight later during the hottest part of the day tending to make them dry and fuel available to burn for longer periods of time. Changes in percent slope and aspect change the type of vegetation (fuel) on a site. The sheltered, shaded, cooler locations have vegetation less available as fuel. The unshaded, unsheltered areas have vegetation (fuel) that is more available to a fire. This helps shape the mosaic pattern of a forest by modifying fire behavior. During periods of extreme fire danger fuel on all aspects become available to burn.

Fire Behavior

Fire behavior depends on the location of ignition, fuel condition, fire weather, topography and suppression actions. Given the generally heavy fuel load, alignment of topography, the southwest prevailing winds, and steep slopes, fire behavior would most likely be fairly dramatic under extreme fire weather conditions. Some version of crown fire should be expected over a majority of the project area not dissimilar to fire effects still evident from the 2001 Werner Peak Fire (*Project File Exhibit O-15*). This type of fire behavior is not out of the historic range of variability due to the stand replacement nature of the historic fire regime and current condition class. This area is becoming overdue for this type of event. The mixed severity fire regime is converting to a more lethal situation due to the lack of fire and or fuel management. Shade tolerant trees are encroaching in the under story and natural openings. The majority of adjacent private and state lands have had some type of past vegetation management and are actively managed resulting in a more desirable low to mixed severity surface fire condition.

Combinations of certain factors can greatly increase fire behavior (Fire Danger Pocket Card Tally Lake & Stillwater State Forest, NWCG Fire Danger Working Team) see *Project File Exhibit O-17* for more information.

Fire Suppression

The Montana Department of Natural Resources and Conservation (MT DNRC) has wildland fire protection responsibility over a portion of the project area from Hellroaring Basin east. (*Project File Exhibit O-18*). The State of Montana is self-mandated to suppress all wildland fires within their fire protection regardless of ownership. In the event a fire does escape initial response actions most likely some kind of more indirect confine/contain strategy would be used. There is no wildfire plan in place specific to this area however there are more general fire management plans in place for the Forest Service and MT DNRC.

Fire suppression has been effective in the project area since approximately the 1930's and will continue to be suppressed into the future. Human caused fires generally occur at the more readily accessible lower elevations (*Project File Exhibit O-12*). Private and state lands adjacent to the project area have a fair amount of road access which is desirable from a fire suppression effectiveness stand point since increased access reduces response time and increases the number and type of resources available to suppress a fire. The active forest management and associated fuels reduction activities on adjacent private and state lands also make aerial, mechanized and ground firefighters more effective.

The higher elevations have limited access, steeper slopes, significant snag hazard, heavy fuel with no safety zones or a good way in or out for firefighters or the public. Travel by foot in these areas is very arduous and slow, incident management personnel could be reluctant to engage a fire in this area with ground crews once a fire became established exceeding a few acres in size and displaying resistance to control. Fires in this type of situation can have great resistance to control, the heavy canopy and fuel loading tend to make aerial firefighting less effective, steep slopes limit mechanized firefighting, and flame lengths greater than four feet make ground crews less effective (*Project File Exhibit O-10 and O-11*). A response to a large fire in this area could negatively affect a variety of resources. Severely burned slopes, heavy equipment, retardant and other emergency suppression actions should be expected.

Retardant avoidance areas have previously been identified in the project area, maps are provided to initial response incident commanders, dispatch, and forest/district duty officers. Avoidance areas are generally 300 foot buffers from riparian areas, wet areas, streams, and lakes etc. (*Project File Exhibit O-19*).

Air Quality

According to air quality reports from the EPA, the air quality of the Flathead River Valley is considered to be good to excellent throughout the year, and meets Montana air quality laws and the Clean Air Act.

Wildland fire has historically influenced the Northern Rockies as evidenced by the burn mosaics of the surrounding forested lands. Wildland fires continue to be a part of the natural forest ecosystem and produce local short-term impairment of air quality.

Climate Change

Wildfires are increasing in both numbers and intensity as result of past fire suppression practices and climate change. In the past decade (2005-2014), wildfires burned on average nearly 9.4 million acres annually, and the U.S. Government spent \$16 billion on wildfire suppression. Past practices of extinguishing every fire combined with impacts related to climate change are leading to larger, more intense, more frequent wildfires, threatening life, safety, and

property. These fires can impair air quality and harm ecosystems in the U.S. that provide a wealth of goods and services such as timber, wildlife habitat, erosion management, water quality and supply, recreation, and aesthetic value (Wildfire and Air Quality January 19, 2016, *Project File Exhibit O-7*). Refer also to the *Vegetation* section of this EA.

Wildland Urban Interface

The Whitefish Area CWPP (*Project File Exhibit O-2*) was delineated by taking the following factors into account. This meets the intent of the Healthy Forest Restoration Act of 2003.

- Inhabited areas at potential risk to wildfires in the area and the range of other factors, including critical weather patterns that could contribute to the probability of fire ignitions and/or extreme fire behavior.
- Hazardous vegetative fuels on federal and non-federal lands within or near Whitefish that, if ignited, would pose a significant threat to the community or essential community infrastructure.
- Specific improvements such as homes, businesses, and essential infrastructure (e.g., escape routes, municipal water supply structures, and major power and communication lines) that would be adversely impacted by wildfire. The improvements on Whitefish Mountain Resort and the two electronic sites within the project area are considered essential infrastructure. Fuel treatments have been designed to reduce potential impacts to this infrastructure.
- Other areas of community importance, such as critical wildlife habitat; significant recreation and scenic areas; and landscapes of historical, economic, or cultural value that community members believed would benefit from treatment to reduce wildfire risks.

Maximum Manageable Areas for Prescribed Fire (MMA)

Prescribed fire would be ignited within the units; however, once ignited, fire would be allowed to burn outside of unit boundaries but would be kept within the MMA.

Containment/suppression actions would be taken if necessary to limit impacts to wildlife habitat, regeneration, pre-commercial thinning stands, or high valued stands of timber within the MMA. Prescribed fire would be implemented over a 10-20 year or longer time period. Over the course of time units could be treated multiple times to achieve the desired results. Burn timing and ignition patterns would be staggered to create a mosaic vegetation pattern on the landscape partly to reduce impacts. Prescribed fires would most likely occur in September or October; however, there is a chance of a spring burn on some of the more exposed sites. These entries would most likely not occur every year due to air quality constraints, potential for escape, high fire danger, or too much precipitation. Aerial ignition would be limited to those areas greater than 300 feet from surface water and hand ignition would be required adjacent to stream as listed in Chapter 2 Design Features for Aquatics. Fire would be allowed to back or flank into designated stream buffers on its own. There would be no effort made to stop fire from entering stream buffers. Spill containment would be utilized for all pumps within the project area. Burn plan(s) and complexity analysis would be completed prior to prescribe fire implementation.

Environmental Consequences

Direct and Indirect Effects

No Action

Fires would most likely continue to be suppressed however, eventually a fire could overwhelm initial responders. A changing climate could result in an uncharacteristically severe fire as compared to historic conditions. In a worst case scenario a fire could consume vast amounts of acreage leaving very little surviving above-ground vegetation. The Half Moon Fire in 1929 started 6 miles east of Whitefish, and consumed 100,000 acres burning east approximately 18 miles to Nyack near the Middle Fork of the Flathead River. Firefighters would be put at risk attempting to suppress and or manage a large fire. Another more recent example of extreme fire behavior on the Flathead National Forest was the 2015 Bear Creek fire on the Spotted Bear Ranger District that consumed approximately 17,000 acres in one afternoon and evening in similar fuel types (*Project File Exhibit O-21*).

Large-diameter Douglas-fir and western larch, in the mixed severity fire regimes, would continue to lose vigor due to competition from dense understories of shade-tolerant tree species. This would perpetuate a denser understory. This understory also would serve as ladder fuel that would permit a surface fire to expand into the canopy, thereby killing many of the existing large-diameter trees that would have otherwise survived a surface fire. Natural openings would continue to grow in with conifer encroachment, shrubs would continue to lose vigor and remain decadent. Eventually after missing more fire return intervals these stands would move from moderate departure VCC2 to high departure from reference conditions VCC3.

There would be no direct effects to the air quality or human health from no action. No prescribed burning would occur, therefore no prescribed burning smoke emissions would be produced. However, the potential of a large-scale wildland fire could be greatest with no action, and a large-scale fire could have far greater impacts on air quality than any action alternative.

Access for firefighters to respond to a wildfire and or manage a wildfire would remain the same because no trails would be built and or roads improved with no action. Limited access increases response time and decreases firefighter effectiveness.

Proposed Action

Project Design Features

Specific design feature are included to ensure the project objectives are met while retaining a natural appearing setting and not exceeding air quality standards. Project design features are located in *Chapter 2*.

Treatment Effectiveness / Fire Behavior Modeling

Treatments are intended to reduce fire line intensity by converting fire type from crown fire to surface fire and reduce flame length to < 8 feet and ideally < 4 feet by reducing canopy density, surface, ground fuels and increasing canopy base height. Prescribed fire areas will most likely need multiple entries to achieve the desired results to reduce down fuel accumulations and regeneration from the earlier burns. Although future fire intensity will be reduced rate of spread can increase in the post treatment environment due to a reduction in shading from the

sun and sheltering from the wind. Faster moving lower intensity surface fires tend to have more desirable fire effects than a slow moving really intense fire due to the fact that fire adapted/resistance tree species are more likely to survive thus creating a more resilient forest. Treatments will also reduce the risk and severity of a large scale stand-replacing fire by breaking up the continuity of continuous heavy fuel across the landscape and give future fire managers more options to manage and/or control a fire in the future. (*Project File Exhibit O-8 thru O-12*).

Commercial Thin

This fuels reduction and silvicultural treatment activity is designed to mimic a low to mixed severity fire leaving an intact overstory of the largest, healthiest, long lived, fire resistant trees primarily Douglas-fir and western larch. This treatment is designed to reduce the likelihood of crown fire by removing ladder fuels and thinning crown fuels. Surface fuels and ground fuels will be slightly altered by slashing small damaged trees and breaking up the continuity of ground fuels with skid trails

Seed Tree / Shelter Wood / Clear Cut

This fuels reduction activity and silvicultural treatment is designed to mimic a stand replacement fire where over 75 percent of the over story is replaced by young shade intolerant fire resistant tree species. Ladder fuels will be reduced, the continuity of crown fuel is interrupted, surface fuels will be machine piled/burned and or broadcast burned, the continuity of ground fuel will also be broken up by skid trails.

Hazardous Fuel Reduction

This fuel treatment is designed to minimize hazardous fuel accumulation and ladder fuels. Small trees <7" diameter at breast height and down <9" diameter will be cut, slash would be lopped/scattered, hand or excavator piled and burned, masticated. The majority of overstory trees and large snags in these stands would remain. Hand treatment will be utilized on slopes >35 percent, where access is limited otherwise mechanical treatments may be utilized.

Shaded Fuel Break / Fire Line / P-Line

This is intended to keep prescribed fire from spreading in an undesirable direction, it will tie in natural barriers to fire spread (brush fields, riparian areas, rock outcroppings or aspects where vegetation is less available to burn in the spring/fall). Fuel breaks do not need to be built in the exact location identified on the map, variations are acceptable to provide for safety and greater flexibility during implementation, and as long as effects are within those documented in this EA. Fuel breaks will be designed to prevent unauthorized OHV use. The entire length is approximately 1 mile in length on either side of burn Unit 3. Where constructed it would be up to 30 feet wide with primarily smaller trees <6" diameter at breast height and shrubs removed. Large snags within 2 ½ tree lengths that pose a risk to implementation personnel may be felled after alternative methods such as relocating the fuel break or scraping around the tree to mineral soil. Wetting the tree down with water have been ruled out as effective means to save the tree for wildlife. Portions of this fuel break may not be constructed until after ignition of prescribed fire on an as needed basis. Wet lines and other minimum impact suppression tactics should be used in riparian areas to the extent practical, in the event fire line is constructed to mineral soil it will be rehabilitated once it is not needed for containment efforts. P-line may be created adjacent to streams no closer than 100 feet to provide for firefighter ingress and egress before, during or after prescribed fire implementation. P-line is a linear feature cleared of brush, blow down and small trees generally less than 5 inch diameter at breast height for a width of 6-8 feet. This facilitates safe ingress/egress for ignition personnel and firefighters

transporting pumps, hoses and other firefighting equipment. P-line also facilitates emergency egress in the event someone is injured.

Prescribed Fire / Broadcast Burning / Slashing

These treatments will return fire to the project area and reduce the risk and impacts of a relatively large stand replacement fire in the future. Using prescribed fire combined with slashing (trees and shrubs <7" diameter at breast height) will reduce and break up the continuity of fuel at a landscape level. Prescribed fire and broadcast burns will be ignited within the areas identified and regeneration harvests however will be allowed to burn outside of those areas within the maximum manageable area (MMA). Prescribed fires from adjacent Montana Department of Natural Resources and Conservation (MT DNRC) may be allowed to burn into the project area within the MMA as long as activities are coordinated with district fire management personnel and other district/forest specialist. These treatments should be implemented over a 5-20 year or longer time period because areas may need to be treated multiple time to achieve the desired results. Burn timing and ignition patterns will be staggered to create a mosaic vegetation pattern on the landscape partly to reduce visual and smoke impacts. Prescribed fires will most likely occur in the fall September or October, there is a chance of a spring burn on some of the more exposed sites. These entries will most likely not occur every year due to air quality constraints, potential for escape, high fire danger, or too much precipitation. Other benefits include increased huckleberry production, improved wildlife winter/spring range and site preparation for planting blister rust resistant white bark pine. Aerial ignition will be limited to those areas >300' from surface water, hand ignition adjacent to stream buffers (Refer to *Chapter 2 Design Features*). Fire may be allowed to back or flank into designated stream buffers on its own, no effort need be made to stop fire from entering stream buffers. Spill containment will be utilized for all pumps within the project area. Burn plan(s) and complexity analysis will be completed prior to prescribe fire implementation.

Air Quality

Pile burning or prescribed burning should only occur during period of good to excellent smoke dispersion forecast. Prescribed burning requires a permit from the Montana DEQ and the burn must be implemented within the regulatory framework. This includes daily approval from the Flathead County Air Quality hotline and the Montana/Idaho Airshed Group (*Project File Exhibit O-6*). More information on the Montana/Idaho Airshed Group can be found online at www.smokemu.org.

Wildfires pose a direct threat to air quality and public safety, a threat that can be mitigated through management of wildland vegetation. Attempts to suppress all wildfires in the past have resulted in unintended consequences, including increased risks to both people and ecosystems. Wildfire smoke can result in significant air quality impacts to public health, particularly for at-risk groups, and impacts to safety and transportation though diminished visibility on roads and aviation corridors. In contrast, prescribed fires provide an opportunity to adjust the timing of fire and some ability to manage the amount of smoke and its path, thereby reducing the impacts of fire emissions. Prescribed fire, managed using basic smoke management practices, can reduce the impacts on air quality while meeting fire-related objectives (*Project File Exhibit O-7*)

Duration of Effects

The time frame for this fire and fuels analysis is focused on the period during and immediately after implementation of initial, reentry and maintenance activities. Immediate effects will last

approximately 20 to 30 years until shrubs and trees are established as a canopy layer in areas disturbed by treatments. Some effects of treatments may last longer 100 years or until the next stand-altering disturbance, such as thinning, timber harvest, or wildland fire.

The time frame for this air quality analysis is focused on the period during implementation of activities approximately 2018 thru 2038. Over this approx. 20+ year time period effects will tend to be concentrated to 24 hour or less periods during and after ignition. The larger landscape level prescribed fires may have residual smoke for days or weeks post ignition.

Cumulative Effects

The project area boundary was selected to include the potential cumulative effects to fire and fuels.

The area of consideration for air quality would be MT/ID air shed group, Air Shed 2, which includes Whitefish and Columbia Falls. This is based on prevailing wind direction and distance from the project area. Within Air Shed 2 is the Kalispell Impact Zone which may be affected by projected activities. Glacier National Park and the Bob Marshall Wilderness Complex are both Class 1 Airsheds and may be affected by projected activities due to their proximity to the project area.

No Action Alternative

This alternative would not meet the purpose and need of the Taylor Hellroaring Project. Eventually a wildfire could impact the area and firefighters could be put at greater risk during a wildfire response/

All Action Alternatives

All action alternatives should reduce and break up the continuity of fuel on a landscape level increasing firefighter safety if a wildfire occurs. Access for firefighter to respond to and manage a wildfire would improve with increased access.

Contrasting Effects of Proposed Action with Past Actions

The Forest Service has taken somewhat limited past action in this area other than improvements for Whitefish Mountain Resort and limited timber harvest in the 1950 and 1960's's. The management direction for this area since our current forest plan was published in 1986 has been an emphasis on scenic and recreational values. Little vegetation management on NFS lands combined with fire suppression has allowed fuel to accumulate to a point where there is a high risk of a large wildfire similar to the fires that burned in the area in 1910 and 2001 (*Project File Exhibit O-15*).

The proposed action would reintroduce fire and treatments designed to mimic fire into the project area. More smoke would be produced than in the past. People in Whitefish and the greater Flathead Valley would see more recent fire scars from our planned prescribed fires and openings from other fuels treatments than they have in the recent past. Firefighters would have a safer work environment than in the past by reducing the potential for crown fire and flame length thus resistance to control (*Project File Exhibit O-8 thru O-12*).

Effects of Ongoing and Reasonably Foreseeable Activities

Fires will continue to be suppressed. A fire could escape initial response actions leading to a large wildfire. People will continue to frequent the area for a variety of recreational and other

reasons which will continue to pose a risk of human caused fires. State and private forests should continue to be managed for timber production with associated fuel reduction activities. Homes will continue to be built in the area increasing the number at risk from wildfire. The City of Whitefish should continue to use the area for its municipal water supply.

Combined Effects from Past, Proposed, Ongoing and Foreseeable Activities

Regardless of what happened in the past, what we are proposing, ongoing or foreseeable at some point the area is likely to experience a relatively large wildfire not dissimilar to what happened in 1910 and 2001. The fuels treatments and trails we are proposing should give us more options on how we manage wildfire and a safer more effective work environment. The proposed treatments should give the residual fire resistant trees a better chance of surviving this inevitable event thus reducing the future visual impact by leaving some surviving above ground vegetation for the community to view. The proposed treatments break up the continuity of heavy fuel across this landscape and reduce crown fire to surface fire however these will have to be maintained by multiple entries over time.

Monitoring

Post treatment effectiveness monitoring by district fire management personnel should be completed within 1-2 years after each treatment. Permanent plots to compare before and after photos and long term monitoring could be implemented. Web cameras and portable smoke/air quality monitors before, during and after prescribed fire implementation may be installed. Effective monitoring should help inform maintenance needs and additional prescribed fire entries. All of these treatments will need to be maintained mechanically or by prescribed fire at some point in the future to remain effective.

Regulatory Framework and Consistency

Federal Laws

Forest wide standards for maintaining air quality are "Coordinate all Forest Service management activities to meet the requirements of the State Implementation Plan, State Smoke Management Plan, and Federal air quality standards" (FNF LRMP, page II-64). There are no specific Forest Plan directions by Management Area for air quality. Whenever prescribed fire is used, Forest Plan Appendix G states, "Esthetic, visual, soil, air, and water quality concerns will dictate fire management direction in some areas."

The Clean Air Act of 1955, as amended (42 U.S.C. 7401 et seq), provides direction to protect and enhance the quality of the nation's air resources and to protect public health and welfare. Section 109 of the Clean Air Act requires the EPA to develop primary air pollution standards to protect human health and secondary standards to protect public welfare. Section 110 requires states to develop State Implementation Plans that identify how the state will attain and maintain national ambient air quality standards and other federal air quality regulations. The State Implementation Plan is made known through the Montana Clean Air Act and implementing regulations. The regulations provide specific guidance on maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). The act created the Montana Air Quality Bureau and provides its regulatory authority to implement and enforce the codified regulations.

To maintain compliance with the various regulations concerning maintenance of air quality, Region One of the Forest Service participates in the Montana/Idaho Airshed Group. The Group

is comprised of timber companies and government agencies that commonly conduct prescribed burning, and federal, state, and local air regulators.

The Group has developed a set of smoke management practices intended to maintain compliance with the State air quality standards through a monitoring system for the months of the open burning season that extends from March 1 through November 30. The Montana/Idaho Airshed Group recognizes the current smoke management practices and the Montana airshed coordinating process as Best Available Control Technology for prescribed burning. The Montana/Idaho Airshed Group shares information and coordinates activities to assure cumulative actions do not result in unacceptable effects on air quality in Montana. By participating in the Montana/Idaho Airshed Group, complying with the Montana Air Quality Bureau, and meeting the requirements of the State Implementation Plan and the Smoke Management Plan, the proposed activities would comply with the Forest Plan and the Clean Air Act (*Project File Exhibits O-5 and O-9*).

By treating both natural and activity generated fuels, the proposed activities would meet the objectives of the Forest Plan in which the fuels management program intends to treat fuels to the degree needed to facilitate implementation of the fire protection program and other activities of the Forest Plan. The proposed activities are also consistent with State laws requiring the treatment of slash to reduce the effects of high intensity fires.

Forest Plan

The Action Alternatives are consistent with the following Forest Plan Fire Management Direction (Appendix G, Forest Plan 2001) and fire and fuels direction for all affected Management Areas:

- Use existing fire management literature as reference documents to guide project development, execution, and evaluation.
- Integrate an understanding of the role fire plays in regulating stand structure into the development of silvicultural prescriptions.
- Use existing fire behavior predictive techniques to evaluate prescribed fire application and evaluate emerging wildland fire ignitions.
- Evaluate prescribed fire alternatives from a risk of escape and economic cost/benefit analysis when complex applications are planned.
- Assure that the appropriate suppression response is applied to each wildland fire ignition.
- MA 2A - Prescribed fire may be used to enhance resource values and reduce hazardous fuel accumulations.
- MA 7 – Follow Forest-wide standards for fire management
- MA 20- Follow Forest-wide standards for fire management
- Hazard reduction will utilize tactics that will least alter the landscape.

Scenic Quality

Introduction

Research has shown that public acceptance of forest management practices is heavily based on the visual appearance of the forest (Ribe, 2002). Scenery provides the setting, identity and sense of place for local communities. It serves as a backdrop and backyard to residents as well as a unique experience for visitors seeking something different from their own backyards. Each forest setting is comprised of scenic attributes that are derived from the environmental context of topography, geology, and climate. Therefore scenery, just as any other resource, must be cared for and managed for future generations both in the local community and those visiting from farther afield. The activities proposed by the Taylor Hellroaring Project (hereafter, THP) potentially affect the current and future condition of these valued scenic resources. Managing scenery resources involves the process of analyzing effects, implementing scenic character goals and applying scenic conservation design criteria to achieve the Flathead National Forest (FNF) Plan desired conditions and direction for scenery resources.

The scenery resource is not a purpose and need for the project, but the purpose and need of THP does note that proposed activities will occur “while maintaining a natural-appearing forested setting.” All naturally established existing landscape patterns throughout the forest are to be maintained with changes that will not degrade the existing scenic character. Areas where unnatural scenic character exists from past management practices can be improved through rehabilitation or enhancement to promote scenic character that is scenically and ecologically attractive. Ecologically sound landscapes are often not only sustainable but also aesthetically pleasing. They reflect the inherent natural disturbance regimes—in scale to the appropriate vegetative type—whether it is the natural role of fire, insects and/or disease. If the amount of disturbance exceeds the natural ecosystem parameters, the risk of unnatural catastrophic level disturbances increases. This destabilizes not only the ecological balance but can cause a dramatic change to the existing scenery and scenic character. Vegetation conditions support the long term sustainability of these benefits to people by reducing the risk of undesirable fire effects, disease and mortality, which may interrupt or eliminate forest benefits. For these reasons as well as public comments received, maintaining the scenic resources within the project area is desirable.

This analysis focuses on the impacts of the vegetation management activities including associated road building activities on the scenery resource. Alternatives 2 and 3 have the same vegetation treatments and are therefore discussed together. The alternatives do vary in the number of miles proposed trail construction. The purpose and need for trails within the project area will not substantially impact the scenery resource but the addition of trails in the area may increase the sensitivity of the scenery resource in the project area by increasing number of visitors and increasing expectations of experiencing a natural landscape. The proposed trails are also analyzed within this section with regards to cumulative effects of the project on the scenery resource.

Information Sources

Scenery management is based on the classic aesthetic factors of form, line, color and texture, as well as the principles of sense of place. The USDA Forest Service has developed and refined guidance and methodologies to analyze these aesthetic principles and captured them in the

following handbooks and manuals which have been applied to the THP assessment of the scenery resource:

- Visual Management System (VMS) as described in: The Visual Management System volumes 1 and 2 (United States. Forest Service, 1973) and (United States. Forest Service, 1974)
 - o VMS Roads Handbook 483 (United States. Forest Service., 1976)
 - o VMS Timber Handbook 559 (United States. Forest Service, 1980)
 - o VMS Fire Handbook 608 (United States. Forest Service., 1985)
- Scenery Management System (SMS) as described in: Landscape Aesthetics, Handbook for Scenery Management, USDA Handbook 701 (United States. Forest Service, 1995)
 - o Appendix J: Recommended SMS Refinements. (United States. Forest Service, 2006)
- Forest Service Manual 2300-Recreation, Wilderness, and Related Resource Management Chapter 2380-Landscape Management (United States. Forest Service, 2003)

Resource Indicators and Measures

Terminology used in this analysis follows the SMS with references made to the VMS. The indicators by which to assess the scenery resource and ensure the scenic character is intact are: scenic integrity and scenic stability which are defined in the SMS and Appendix J.

Scenic integrity: The degree to which a landscape is free from visible disturbances that detract from the natural or socially valued appearance. Generally the result of human activities, but can result from natural events which exceed the landscape's historic range of variability (HRV). The exception to this is direct human alterations that have become accepted over time as positive scenic character attributes, (United States, Forest Service, 2006, p 6). (United States. Forest Service, 2006, p. 6).

Scenic stability: The degree to which the valued scenic character and its scenery attributes can be sustained through time and ecological progression, (United States. Forest Service, 2006, p. 6).

The scenic integrity of the scenic character is assessed through visual quality objectives (VQOs) as assigned across the forest in the *Flathead National Forest Land and Resource Management Plan* (United States. Flathead National Forest, 1985). VQOs and the visual absorption capability (VAC) analysis contribute to evaluating the scenic stability of the project. These analyses including a field-based visual quality analysis and visibility GIS inventory were conducted in the summer of 2017. The visual quality is a measure of scenic disturbance and is determined by analyzing the natural scale, edge, form, line, color and texture of the landscape currently. This will be a baseline to compare alternative proposed management activities to and is expressed by the no action alternative (Alternative 1). The visibility of the project area and units is determined by GIS modeling and field verification. This analysis identifies areas / travelways of high, moderate and low concern levels. This helps prioritize the importance of visual quality across the landscape. Those THP units (partially or fully) in management area 7 (MA 7) had an additional VAC analysis completed as directed by the Forest Plan. The VAC is determined by

examining the topography, vegetation screening, vegetation diversity and soil/geology and the ability of those features to blend deviations into the landscape.

Table 3-10. Scenery Resource Indicators and Measures for Assessing Scenery Effects.

Resource Element	Resource Indicator	Measure	Source
Scenic integrity	Previous and proposed management activity deviations from the scenic character	Number of units meeting their VQO	FNF Standard C1, SMS and VMS
Scenic stability	Sustainability (over time and ecological progression) of the scenic character to management activity alterations	Number of scenically stable units	FNF, SMS and VMS

Methodology

To determine THP's impacts on the scenery resource, the scenic integrity and scenic stability are measured to determine whether or not the scenic character will be maintained. Failure to achieve a VQO, in its assigned timeframe—as specified in the Forest Plan—would result in an **adverse** effect. Achievement of or meeting the specified VQO would result in **no effect** finding, and meeting a VQO higher than specified would be a **beneficial** effect. Additional terms used to describe intensity of impacts include:

- **Negligible:** A majority of all visitors would not notice any effects or changes to the landscape. Design criteria would not be necessary.
- **Minor:** The desired scenic character of the landscape would be changed, but is not evident. Long-term deviations repeat form, line, and color and the effects on the valued landscape remain the same or *appear* intact; or effects would be short-term. If Design criteria are necessary to offset adverse effects on scenery resources, they would be relatively simple and effective.
- **Moderate:** Effects would slightly alter the scenic character, but long-term deviations would be subordinate to the scenic character. Short-term effects could have a greater deviation but would need to recover to express intactness and natural appearance in a 5-year or less timeframe based on VQO. Design criteria would reduce long-term impacts.
- **Major:** Effects would dominate the scenic character. There would be substantial consequences to Scenic resources. Effects would be very obvious, widespread, and long-term. Intactness of the landscape would be greatly altered. Design criteria may help reduce impact but impacts would remain evident or even dominant.

Spatial and Temporal Context of Analysis Area

The total treatment unit acreage is approximately 1,815. The project boundary and surroundings, visible from the sensitive areas, make up the seen area spatial boundary for assessing direct, indirect and cumulative effects.

The effects are measured in three time periods: upon project completion (immediate), 5 years (short-term), more than 5-50 years (long-term). Cumulative effects are analyzed for a 25-year period, which is the approximate time necessary for sufficient vegetation regrowth to be non-

discernable by the general viewer. Effects that are eliminated by the natural course of a single growing season are not considered effects because they are so short lived. Most intermediate treatments (commercial thinning, prescribed burning, and hazardous fuels reduction) have short-term effects when conducted by most logging systems (yarding, skidding and slash burning) because 5 years of regrowth will make these impacts visibly indiscernible. Skyline logging systems in intermediate harvests and regeneration harvests (seedtree, shelterwood and clear cuts) will have long-term effects because they will require more than 5 years of regrowth to become indiscernible. The criteria below are used to determine whether the VQO duration of impact is met, post management activity implementation.

- Retention VQO - "**Immediate** reduction in form, line and color, texture contrast... ...during operations or immediately after..." (United States. Forest Service, 1973, p. 30).
- Partial Retention VQO - "**As soon** after project completion **as possible** or at a **minimum** within the **first year**" (United States. Forest Service, 1973, p. 32).
- Modification VQO - "Reduction in the form, line, color, and texture should be accomplished in the **first year** or at a minimum should meet existing regional guideline" (United States. Forest Service, 1973, p. 34).

Affected Environment / Existing Condition

Scenic Character

The scenic character of the THP is predominantly a naturally appearing to slightly altered forests environment. The landscape is characteristic of a forest that has not had natural disturbance (primarily wildfire) for a long period of time (100+ years). Fire suppression activities, vegetation management and associated road building, and developed year round recreation have been a dominant influence on the existing landscape character of the THP area. A lack of fire activity has created a lack of vegetation diversity such that the project area is becoming visually homogenous. Mature forest stands in the THP do not match the historic range of variability in part because of ongoing white pine blister rust which has caused high mortality in whitebark pine stands such that they are almost non-existent in the higher elevations. In addition to root disease and western balsam bark beetle have contributed to mortality in the subalpine fire and Engelmann spruce stands. These insect and disease infestations are changing the landscape character from a healthy green canopy to one that is becoming brown in areas of the viewsheds. The combination of lack of fire and increase in disease has created an abundance of ladder fuels, high surface fuel loadings and overstocked stands that contribute to a more unstable scenic character and scenic stability for fire behavior.

The ecological scenic character of the project area is defined by it being within the Salish Mountains geographic area. It encompasses the southwest flank of Whitefish Mountain Range and is notable for its steepening topography rising out of the Flathead valley and dissected by creeks and streams flowing off the north-south trending ridgeline. These riparian areas include Taylor, Hemlock, Trail, Anchor, Bear, King, Smith and Hellroaring Creeks. There is little exposed rock and most of the project area is currently heavily vegetated. Alpine ridge-top trees in the Whitefish Range are slow-growing and have a short growing season. Trees are much thicker in the valley and lower slopes than in the sub-alpine and alpine. Common trees include western larch, lodgepole pine, Douglas-fir, and Engelmann spruce. The area's scenic vegetation is expressed most aesthetically by pockets of western larch and deciduous vegetation which provide impressive fall color.

The social scenic character of the project area is a result of its location just north of the town of Whitefish and Whitefish Lake and is most closely associated with and influenced by the community of Whitefish. Whitefish's economy is largely driven by its recreational tourism industry. In the summer tourism is oriented toward Whitefish Lake, and in the winter toward Whitefish Mountain Resort. There is a high concern for preserving and improving the recreational and aesthetic opportunities that are essential to their tourism economy.

The scenic character of the project area can be divided into two distinct areas, the Whitefish Mountain Resort area and the Greater Whitefish Mountain Range area. These two areas are defined by differences in topographic orientation as well as the social expectations differences. The Whitefish Mountain Resort area encompasses the project area from Smith Creek south where the dominate scenic character is best described by the recreational opportunities of Whitefish Mountain Resort. This area is visible to from portions of the community of Whitefish and Whitefish Lake as well as from within the boundaries of Whitefish Mountain Resort and the private properties adjacent to the Holbrook area. The remainder of the project area part of the Greater Whitefish Mountain Range area lies north of Smith Creek and is defined primarily by the ecological aspects of the steep hillsides bisected by east-west running drainages. This area is not visible directly from the community of Whitefish or Whitefish Lake and is primarily viewed from private properties along and drivers of Hwy. 93 and Farm-to-Market Road.

The Whitefish Mountain Resort area is defined by the heavily recreation influenced landscape. This established winter area (resort built in 1947) infrastructure creates discernable lines, edges and textures but has become a part of the expected and accepted scenic character of the area. This ski area was developed in part due to a stand replacing fire in 1910 that created openings perfect for skiing. As a result the influence of the naturally created linear features as well as the enhancement by management activities has created this scenic character as one that accepts more linear, managed components. Aside from the ski runs there is little other discernable management activity in this area, so that the overall scenic integrity of this area is high as a resort setting scenic character. The scenic stability of the area is however moderate due to a lack of fire activity since the early 1900s. Therefore while the scenic character and scenic integrity are high, the scenic stability is at risk and is moderate.

The Greater Whitefish Mountain Range area has moderate scenic integrity based on the low amount of discernable management driven deviation. Exceptions are along the western forest boundary with private and state lands. Here vegetation management off NFS lands creates visible lines and edges. The uniformity of vegetation type and age in this area due to influences discussed above has created a moderately unstable scenic stability for this area due to risk of a large fire, insect or disease infestations to severely alter the scenic character. Overall this area has a moderate expression of its scenic character and moderate scenic integrity and scenic stability.

The degree of scenic altered condition depends on the amount of changes seen from the Whitefish Mountain Resort area and the Greater Whitefish Mountain Range. Altered scenic condition in the landscape will be the greatest when most of the trees are removed in a given unit or area. Consequently, the least change to scenic character would occur when the existing trees are not removed. Therefore a series of and diversity of vegetation treatments approach to move the homogenous, aged, dense forest stands that are out of their historic range of variability towards a more diverse species pattern and composition, would improve the scenic character, scenic integrity and scenic stability of both the Whitefish Mountain Resort and Greater Whitefish Mountain Range areas. This project presents an opportunity to increase

landscape variety by creating and maintaining a spectrum of plant stages that leave a diversity of different age classes and a variety of natural appearing open spaces moving the entire THP area towards a more desirable scenic character.

Scenic Integrity

Every landscape changes over time, in turn, the landscape vegetative character continues to change whether it is actively managed or allowed to naturally evolve. In the THP the changes are mainly attributed to past timber sales and fire exclusion contributing to the vegetation characteristics. In a majority of the area, the resulting patterns are less sustainable due to high risk of future wildfires and existing insect or disease outbreaks that contribute to degrading the scenic character and the scenic viewshed of Whitefish Mountain Resort area and Greater Whitefish Mountain area. The majority of forest stands within the THP project area originated from fire activity over 120-200 years ago. There was only one large fire in the last century. A high severity stand replacement fire burned within both portions of the project area in 1910. Limited timber harvest in the 1960's originated a minority of stands in the project area.

Scenic integrity serves as a frame of reference for measuring scenic integrity levels based on the valued attributes of the existing scenic character being viewed. Scenic integrity is measured through VQO levels defined by the VMS and Forest Plan. Within the forest plan, VQOs are identified geographically by management area and described in narrative form. The VQOs assigned to lands within the project area are shown Figure 3-1. The following table displays the 3 scenic integrity levels with their associated VQOs, perceived conditions and time to achieve the VQO for each VQO assigned within the THP project and as defined in National Forest Landscape Management (United States. Forest Service, 1974):

Table 3-11. Scenic Integrity, VQO, Condition and Time to Achieve the VQO.

Scenic Integrity Level (VQO)	Scenic Character Condition and Visual Description	Time to Achieve Post Implementation
HIGH (Retention)	Mosaic or natural landscape patterns with less uniformity. High diversity of structures and variety of spaces. Minimal skyline corridors, visible roads, and little mechanical disturbances. Open spaces with variety of patterns. Areas of dense, mosaic, and clumpy arrangement of textural patterns. Interesting landscapes. Appears Unaltered.	Immediately
MODERATE (Partial Retention)	Combination of mosaic and uniform landscape patterns with some natural patterns intact. Some diversity of structure. Moderate variety of spaces and treatment on the landscape. Appears Slightly Altered	As Soon As Possible
LOW (Modification)	Combination of some mosaic but more uniform landscape patterns. Some diversity of structure. Some variety of spaces. A variety of natural to slightly altered to altered conditions. A variation of natural texture and pattern. Appears Moderately Altered.	1-5 Years

(USDA FS 1995, Landscape Aesthetics, p A-1, 2-4)

The existing scenic integrity of the THP is primarily in the HIGH scenic integrity level. There is limited evidence of past activities in most of the project area, so it appears natural. All areas of

the THP currently meet or exceed their assigned VQOs. The scenic integrity levels meet the Forest Plan for a natural appearing foreground, middleground and background from the designated travel routes and viewsheds.

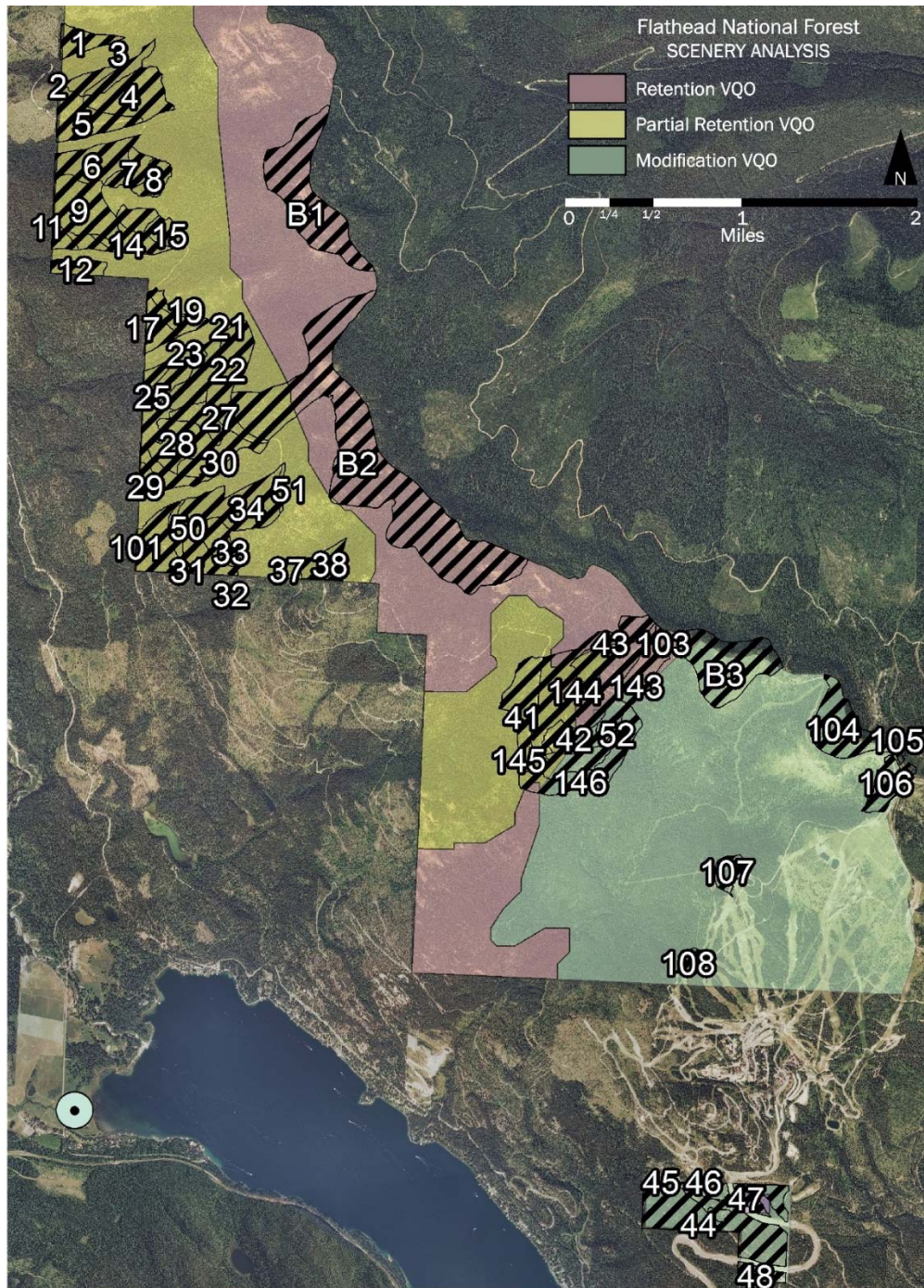


Figure 3-1. Visual quality objectives for Taylor Hellroaring Project area.

Scenic Stability

Scenic stability is the degree to which the desired scenic character can be sustained through time and ecological progression (United States. Forest Service, 2006). For the THP, 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 data 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 area's scenic character, since these changes are relatively stable over time regardless 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 changes in the scenic character that are beyond the historic scale. As previously discussed the current stand conditions within THP are overly mature and overstocked. A dense understory of shade tolerant Douglas-fir, subalpine fir and grand fir exists and provides ladder fuels and higher root disease susceptibility. Western white pine and whitebark pine are not present in the same densities as historically further indicating the desired scenic character and stability of the THP area is not being fully realized.

The project area lands historically experienced infrequent lethal severity fires or infrequent moderate severity fires on a 35-200 year fire return interval. These areas are currently experiencing moderate departure from this reference condition based on the lack of fire in any portion of the THP since 1910 (107 years). The Whitefish Resort area mostly burned during the 1910 fires but the remainder of the project area has not seen fire since at least 1885, except for the Werner Peak fire (See *Fire, Fuels and Air Quality* section for more information). This moderate departure indicates that fire regimes are moderately altered to near the historical ranges and the risk of losing the ecosystem components is moderate. Fire regime departure analysis is inversely correlated to scenery stability. As the likelihood of ecosystem loss due to fire is reduced the scenery stability increases. Therefore the scenery stability for the THP is also moderate. The high fuel loading and densely stocked canopies of the current THP condition indicates that a relatively large stand replacement fire could occur anytime and it would likely dramatically alter the scenery of the area.

Table 3-12. Scenery Resource Indicators and Measures for the Existing Condition.

Resource Element	Resource Indicator	Measure	Existing Condition
Scenic integrity	Previous and proposed management activity deviations from the scenic character	Number of units meeting their VQO	All units within project area contribute are meeting VQOs. Note: Management actions on state lands adjacent to units 1, 2 and 5 have created visible edge effects along the forest boundary.
Scenic stability	Sustainability (over time and ecological progression) of the scenic character to management activity alterations	Number of scenically stable units	All units within project area are moderately stable but moving towards low stability.

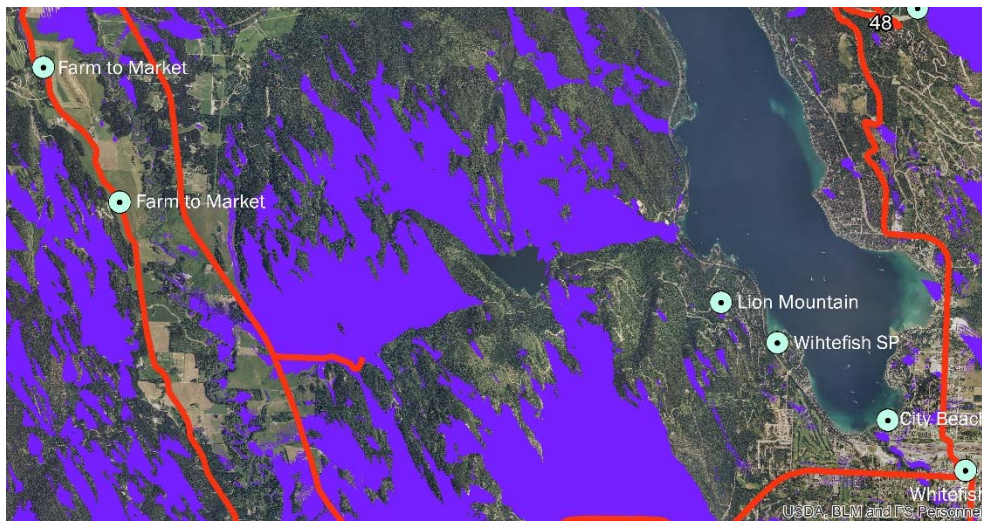
Visibility and Concern Levels

This section addresses the relative importance and sensitivity of what is seen and perceived in the landscape. Viewshed visibility consists of assessing three elements from chosen observer

points: 1) concern levels, 2) distance zones, and 3) visibility of travel-ways and use areas. The process for identifying these is outlined below.

Concern levels are a measure of the degree of importance the public places, on a landscape being viewed from a particular travel-way (i.e. roads, trails, waterways etc.) or use area (i.e. campground, picnic area, boat launch, vistas etc.). Three concern levels are used and they are a function of the context of the viewer and number of viewers.

- **Level 1** routes and areas are associated with: primary transportation systems of international and/or national importance, primary recreational areas, specially designated areas, regionally important special areas and any other recreational opportunities identified as important. Viewers have a high concern level for scenery.
- **Level 2** routes and areas are associated with: all secondary transportation systems, secondary recreational areas, secondary specially designated areas and those of only local importance. Viewers have a moderate concern level for scenery.
- **Level 3** routes and areas are low use areas and transportation systems with minor importance on a personal only level. Viewers have a low concern level for scenery.



the
ly blend in
here an
el 1). Figure
always due to
ound views
nd and
s area is
90 which are
eration as
g this road
diversity
ened from

Figure identifies units that are highly visible and focuses the analysis on these units with higher potential scenery resource impacts.

Whitefish Lake and the city of Whitefish have the highest potential concern for views, due to the high expectation of visitors and residents for an intact and natural landscape but the visibility into the project area from these locations is partially screened and/or at an oblique angle towards most units, reducing the overall discernibility of the treatments. These two locations primarily view the Whitefish Resort area. The location with the potential for the most visibility into the project area is along the Farm-to-Market road and portions of Hwy. 93. These two travelways have more direct views of the Whitefish Mountain Range area of the project. Various portions of these roadways have unobstructed views into the project area. These roads parallel the valley bottom so units are seen at an oblique *over the shoulder* angle and of a short viewing duration as one is passing by. This reduces the concern level for units seen only from the roadways. *Project File Exhibit I-1* shows visual assessments from these viewpoints.

Distance zones are an important part of scenery analysis because as the distance increases, the level of visible detail decreases. Also, as distance increases, the opportunity to minimize the impacts also increases. Distance zones are measured from the observer points and are divided into four categories:

- **Immediate Foreground (IFg)**, 0 to 300 feet
- **Foreground (Fg)**, 300 feet to ½ mile
- **Middleground (Mg)**, ½ to 4 miles
- **Background (Bg)**, 4 miles to horizon

Table 3-13. Units by Distance Zone from High Concern Level Locations.

Distance	Units	High Concern Level Location
IFg	44-49	Whitefish Mountain Road
Fg	44-49	Whitefish Mountain Road
Mg	17, 19, 21, 22, 25, 28-31, 33, 34, 38, 41, 42, 44-49, 51-53, 143-145, 101, 103-107, B2 and B3	Whitefish Lake and Whitefish Mountain Rd.
Bg	All units; except the following units which are not visible from any high concern locations: 3, 6, 7, 12-14, 23, 24, 43 and 108	Hwy. 93 and Farm-to-Market Rd.

Visibility is assessed through observer points chosen along travel-ways or in use areas (outlined in Table 3-14. It is affected by topography (steep terrain and ridges etc.) and vegetation (type, density and maturity) which influence sightlines into the project area. Three levels of screening are considered for visibility based on intervening terrain, vegetation, and or structures.

- **Open views:** Exhibit minimal to no screening.
- **Partially screened:** Areas where viewing opportunities are intermittent.
- **Screened:** Areas where terrain, vegetation, or buildings obscure views.

The level of screening (and in turn visibility) within the project area varies greatly. Figure 3-2 identifies areas screened by topography using GIS and 10 meter Digital Elevation Models. Map areas in purple are completely screened (i.e., a standing individual at one of the observer points would not have a view of any proposed treatment units in the purple areas). However, areas not screened by topography may be partially or entirely screened by vegetation or structures.

Table 3-14. Summary of travel-way/use area based observer points and their visual quality objectives, distance zones to project units and concern levels

Observer Point	Primary Area Viewed	Distance	Justification/Visibility	Concern
Whitefish City Beach and Whitefish	Whitefish Resort	Bg	National importance; partially screened; oblique angle	1
Whitefish State Park on Whitefish Lake	Whitefish Resort	Mg, Bg	National importance; open to partially screened; oblique angle	1
Farm-to-Market Road	Whitefish Mountains	Bg	Regional importance; partially screened	1
Lupfer Trailhead	Whitefish Mountains	Bg	Local importance; open to partially screened	3

North end of Whitefish Lake	Both	Mg	Personal importance; partially screened	3
Lion Mountain	Both	Mg, Bg	Personal importance; open; oblique angle	3
Holbrook and Whitefish Mountain Road	Whitefish Resort	IFg, Fg	Regional and personal importance; open to partially screened	2

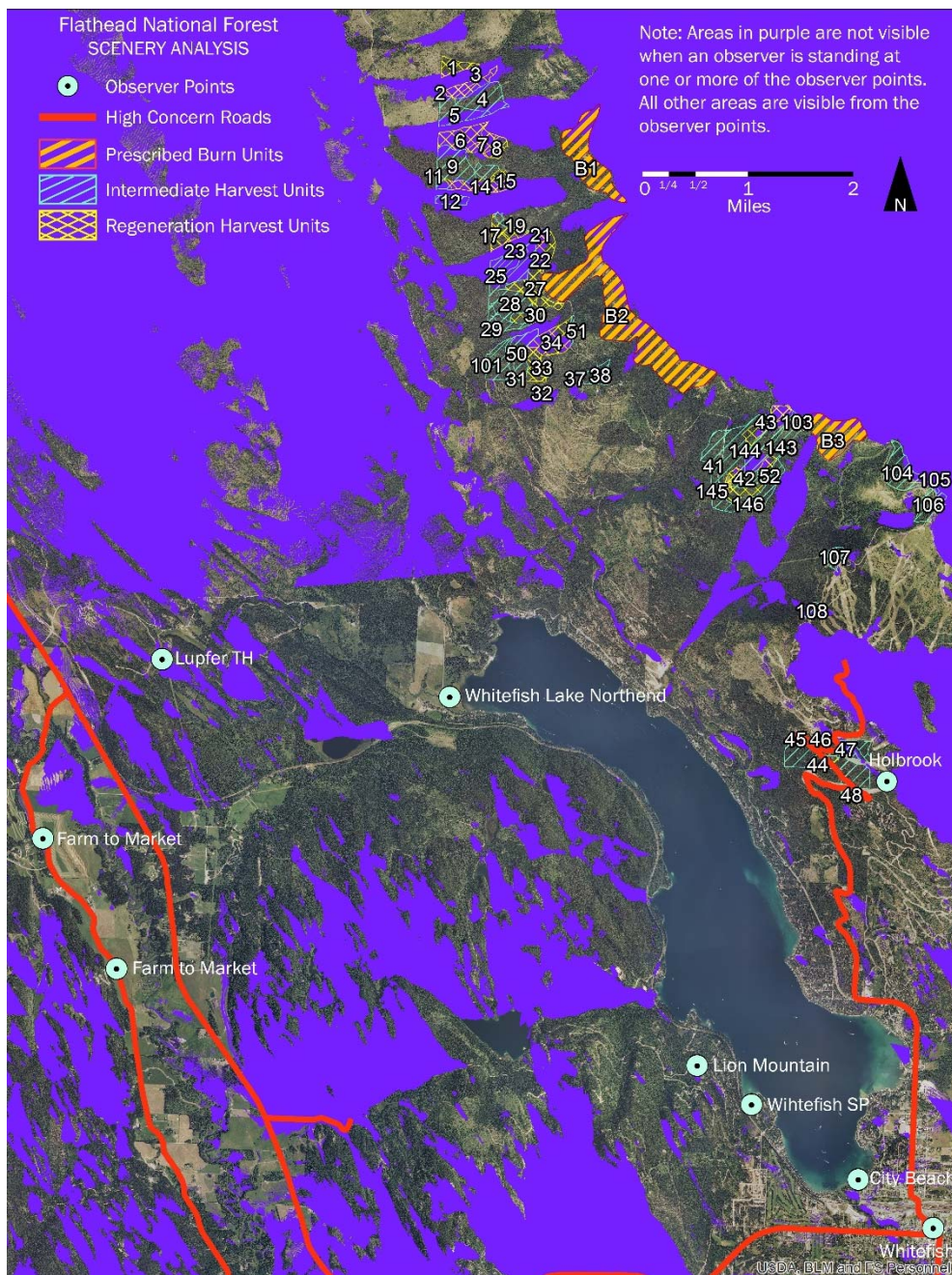


Figure 3-2. Visibility, Concern Level, Prescription and Observer Point Location Map. All units are in the middleground or background view of observer points and high concern level roads and waterbodies except for units 45-48 which are in the foreground view of the Holbrook observer point and Whitefish Mountain Road through Holbrook.

Visual Absorption Capability Analysis

To refine the analysis and assist in predicting future scenic conditions, a visual absorption capability (VAC) assessment was conducted for all MA 7 units. VAC refers to the ability of the landscape to absorb management treatments without a loss of its scenic character. Slope, vegetation screening, vegetation diversity and soil/geology are primary factors incorporated into the determinations. Lower VAC commonly occurs in treatment units with steep slopes, contrasting soil, and monoculture tree species dominance. Higher VAC occurs in flatter terrain, areas with more diverse vegetation, and/or in areas where vegetation and topography provide screening. In the THP the vertical nature of the project area, rising above the primary views in the valley floor, where the landform is steeper the landscape becomes more highly visible (generally >60%). Views from flatter landscapes are more limited where existing vegetation narrows the depth of viewing (generally <35%), except for open areas such as meadows, lakes, marshes, or old stands that were clear-cut in the past.

Topography in the project area is quite steep and the existing vegetation quite dense with the exception of the northernmost portion of the project area (north of Unit 1) where exposed soil and rock is prominent. Exposed soil is significantly lighter in color than dense vegetation. This heightens the contrast and visibility of created openings. The angle of viewing from most high concern use areas is an oblique or fully screened one. These factors make the visual absorption capability (VAC) existing condition for the project area moderate to high for most units. The areas where the VAC is moderate-low are the southwest corner of the project area and the highest elevation burn units. These areas are not screened from Whitefish, Whitefish Lake and private residences on the north-end of Whitefish Lake. The adjacency to Whitefish Mountain Ski Resort to the southern portion of the project area (Hellroaring Basin areas) does provide an overall visual composition of managed forest and an expectation of disturbance in this area which raises the VAC to a moderate-high level.

Table 3-15. MA7 Units and their VAC determinations.

Units	VAC	Rationale
2-8, 11-15, 21, 23, 24, 25 and 143	High	These units are not visible or barely from high concern level locations and / or these units are adjacent to off-forest lands where management activities have revealed soil and/or rock which creates an overall diversity of colors and textures. Other units maybe adjacent to Whitefish Mountain Ski Resort where recreation management activities have created an overall disturbed landscape with swaths of vegetation removed.
1, 9, 10, 17,19, 20, 28, 29, 31, 37, 38, 41-43-50 51-53, 100, 101, 144-146 and B1-B3	Moderate	Maybe visible but at oblique angles to the viewer or topography and/or vegetation screens views. Other units maybe adjacent to Whitefish Mountain Ski Resort where recreation management activities have created an overall disturbed landscape with swaths of vegetation removed.
22, 27, 30, 32-34	Low	Highly visible units where the viewer sees directly into the units. Dense existing vegetation where there is little to no topographic screening and/or existing openings, high contrast in soil color when exposed.

Direct and Indirect Effects

No Action (Alternative 1)

If no action is taken there would be no direct effects to scenic character, scenic integrity or scenic stability. The existing condition of all of the aforementioned would remain the same.

The indirect effects related to the existing conditions and trends could be substantial. The overstocked stands would continue to be under ever greater stress from insects, disease and fuel loading. These conditions would continue to degrade the scenic stability. In the event of a stand replacement fire or insect/disease epidemic the scenic integrity would likely be greatly reduced by results outside of the historic range of variability and condition for the THP area. These large scale alterations to the scenic landscape would most likely be long-term (5+ year) deviations from the scenic character as it would take years for the evidence of a stand replacing fire and/or insect/disease infestation to diminish and be replaced by new vegetation growth. Furthermore the opportunity to enhance scenic quality, improve the forested setting and enhancement of large tree character and white bark pine and western white pine stands would not be accomplished. The opportunity to improve the visual character along the Forest boundary with adjacent state lands (Units 1, 2 and 5) would not be accomplished furthering this deviation from an intact scenic character. The No Action Alternative would meet Forest Plan and VQOs. Therefore while no action on the forest lands would not diminish the VQOs or scenery resource this linear boundary visual effect would continue to detract from the scenic character of the landscape as whole.

Proposed Action (Alternative 2)

Project design features

The project would use a combination of site specific design features to reduce potential adverse impacts to the scenery resource. These features are described in *Chapter 2*.

Direct and Indirect Effects - Alternative 2

Visual effects from Alternative 2 will be described in 3 categories: Prescribed Burning, Intermediate Harvest and Regeneration Harvest. The descriptive categories are separated because the level of potential visual impacts is easily distinguishable between the associated types of treatment. Road and trail impacts will be described in general and in association with specific units as appropriate. This analysis references the representational observer points (See Table 3-14 and Figure 3-2) and is described as a baseline for change in scenic character and for comparison of alternatives. All proposed harvest units were analyzed for potential impacts and assigned design criteria if needed. *Project File Exhibit I-2* has individual unit evaluations.

Prescribed Burn Units: Approximately 500 acres of burn units are proposed. All of these units will be accessed by existing roads, thus no road development will occur with these units.

Direct effects due to the high elevation, against the ridgeline location of these units makes them highly visible from most of the observer points, and the most visible of any units within the project area. These same characteristics mean the burn units are in the distant middleground to background from all observer points. Thus the focus is on ensuring the natural texture of the ridgeline is retained. All of the prescribed burn units except for B3 are in Retention VQO. B3 is in Modification VQO. Prescribed burning may result in blackening of the vegetation and soil. From background observer points the blackening would appear natural and is unlikely to negatively affect the scenic character unless abnormal appearing fire barriers or lines disrupt the overall texture of the landscape. A growing season would reduce the effects to the remaining scorched tree trunks, and dead saplings although there are few opportunities for these foreground view impacts. Overall this treatment can greatly improve a stands resiliency to large stand replacement fire which can affect the scenic quality. With the treatments scattered over a large landscape scale, direct effects to scenery would be minimal and short term.

According to research low intensity burns can actually improve the scenic integrity of an area as an indirect effect (Ryan, 2005). Thus the proposed treatments could improve forest health and have a long-term indirect benefit to scenery. The Retention VQO should be met and possibly enhanced by the added diversity of vegetation type and age. The Modification VQO for unit B3 would also be met through this prescription. No other indirect effects are expected from these prescribed burn units that would impact the scenery resource. Overall the direct and indirect effects from using prescribed fire in a timely manner and in phased treatments, are that it is expected to reduce the future risk of a potential high intensity wildfire that would negatively affect scenic quality.

Intermediate Harvest Units: Approximately 888 acres of intermediate harvest including commercial thin (527 acres) and hazardous fuel reduction (361 acres) are proposed. These units will be treated by a variety of methods: skyline logging, mechanical logging and hand logging on steep slopes. These could include whole tree yarding, yarding of tops, lop and scatter, mastication, and/or piling. Pile burning to address fuel accumulations may also occur.

The direct effects of these treatments are that while a percentage of tree canopies will be retained in these intermediate harvest units, a limited number of units may have short-term (5 years) minor negative visual effects. As regrowth of shrubs and grasses occur these effects would be significantly reduced. Intermediate harvest treatments often do not create openings that are visible from middleground or background distances. Most units are seen from middleground and background views from Farm-to-Market Road, Hwy. 93, Whitefish Mountain Road, Whitefish Lake and private lands around the Holbrook area. The highest concern for intermediate harvests is from the few immediate foreground viewing opportunities around Holbrook.

The only high concern areas with immediate foreground views into units are the private properties around Holbrook (Units 46 and 48). In Units 46 and 48 the removal of understory vegetation which currently acts as screening, may allow visibility farther into the units. This in turn may allow stumps, burned areas and other slash/pile debris to potentially appear unnatural. Leave tree and boundary tree marking in these units could also be potentially unappealing and unnatural to the private property landowners. Both of these units are within the Modification VQO so the treatment does meet forest plan direction, but the social impacts may dictate aiming to achieve a higher VQO such as Partial Retention and working directly with the landowners to limit distasteful views from their properties. Design features including possibly blacking out leave tree markings in these units would achieve the higher Partial Retention VQO.

Units that may have middleground and background impacted sensitive views are: 5, 11, 29, 31, 41, and 45. These units may experience minor short-term impacts, because of the level of sensitivity, distance to viewers and logging methods. Visual impacts along the edge of three of these units (5, 29 and 41) because they are adjacent to untreated areas or units with drastically different treatment types would have potential to contrast in form, line and texture. All of these units are within the Partial Retention VQO where the natural scenic character should dominate the human induced deviation. These units with potential impacts are assigned Design Criteria to ensure they meet or exceed this VQO.

The remaining intermediate harvest units may see minor to negligible visual impacts mainly in the form of discernable vegetation edges. These are most likely to be noticeable in winter because of emphasis created by the snow cover. In limited viewsheds throughout the project area, skid trails would also appear more dominate in the landscape, exposing contrasting soil

disturbance that would delineate unnatural lines and forms. However, as new vegetation grows, the majority of these impacts would lessen and within the first to fifth year it is likely these impacts would not be evident as a visual deviation in the landscape from sensitive areas.

Table 3-16. Summary of Impacts with Views of Moderate Concern from Intermediate Harvest Treatment.

Unit	Description of Visual Impact
46 and 48	These units would potentially have moderate effects because of leave tree markings, stumps, slash piles and removed undergrowth in the immediate foreground views from Holbrook private properties. Within 5 years regrowth of vegetation would reduce the visual deviation compared to the surrounding untreated landscape.
5, 11, 29, 31, 41, and 45	These units and associated temporary roads would potentially have moderate effects because of contrasting line, texture, color, edge and form with the surrounding vegetation for the short-term. Within 5 years regrowth of vegetation would reduce the visual deviation compared to the surrounding untreated landscape.

No indirect effects are expected from these intermediate harvest units that would impact the scenery resource. From a scenery perspective, intermediate harvests would remove understory trees to address uncharacteristic species composition, under-represented stand structures and unsustainable tree densities. These treatments would decrease competition and increase growth rates in the residual stand. Intermediate harvests would also decrease the risk of uncharacteristic disturbance from insects, disease and wildfire by promoting resistant species and increasing crown spacing. Selecting healthy trees for retention would result in openings at naturally random intervals ensuring that a variety of density patterns and species compositions remains. These are benefits that contribute to the improvement of scenic stability when carried out at a landscape scale. Overall the proposed intermediate management activities would begin the transition of moving the forest setting on a landscape scale towards the sustainable scenic character by reducing natural fuels and reducing susceptibility to insect/disease infestations. The effects of this prescription would not reduce the scenic character, scenic integrity or scenic stability of the THP and would meet the Forest Plan and VQOs.

Roads: The development of new road N5 to access units 25 and 28 is the only new road development that will be used to access intermediate harvest units and that will become a system road. This road is at an oblique angle from viewers on the Farm-to-Market Road and Hwy. 93 so while it may be visible it is likely to be seen only for a short duration and integrated into the treatments of units 25 and 28. Therefore the scenic character, scenic integrity and scenic stability will remain intact with the addition of this road.

Regeneration Harvest Units: Approximately 427 acres of harvest units including Seedtree (317 acres), and Shelterwood (28 acres) and Clear-cut (82 acres) are proposed as regeneration harvest. These treatments would include tractor, and skyline harvesting. Visual impacts associated with the above harvesting methods would be potentially greater because of the level of vegetation removed. This would expose more ground disturbance impacts as well as create a stronger scenic contrast to surrounding untreated units.

The direct effects of regeneration harvests on the scenery resource are as follows. There are no regeneration harvest units within the immediate foreground or foreground views of high concern level travelways or areas, with the exception of Unit 49 in the middle of the Holbrook units. This unit is just under 4 acres and is surrounded by intermediate harvest treatment units

which will help reduce the potential visual deviation of this unit by allowing it to mimic a natural opening. This unit is within the Modification VQO and will meet or exceed this VQO and thus meets the forest plan.

The remaining regeneration harvest units are within middleground and background views from the high concern level areas (US Hwy. 93, Farm-to-Market Road, Whitefish Lake and the town of Whitefish). While middleground and background views are generally limited from the town of Whitefish and Whitefish Lake because of topography and vegetation screening there are a few exceptions. These two high concern level areas are more sensitive than the two roadways because the duration of views from these locations is longer; people are more likely to be stationary. The units of concern are 32-34 and 42. All four of these units are skyline logging system units, the first two are shelterwood and the last two are seedtree units. Since some trees will remain in both prescriptions and they are skyline logging, the corridors between leave trees could create shape, texture, edge and form contrasts in the middleground and background viewsheds. These patterns would be uncharacteristic of the landscape as a whole and would be accentuated in winter when snow cover heightens the visual contrast.

Units 32-34 are in Partial Retention VQO where the deviations from the scenic character maybe discernable but may not dominate. These three units are of varying sizes Unit 32 (~8 acres), Unit 33 (~19 acres) and Unit 34 (~44 acres). Together they could create a large (~71 acre) opening depending on the availability of leave trees. Not all of Unit 34 is visible from the high concern level areas, so the visible opening would likely be smaller than ~71 acres. In order to ensure these units individually and collectively are not dominate to the scenic character of an intact steepening heavily forested landscape dissected by riparian areas and with little exposed rock, design criteria are necessary. Design criteria to feather edges, feather corridors, break-up linearity and spacing of corridors and unit edges to the extent possible will improve the VAC of these units and help make the deviations unnoticeable especially along the untreated edges on the south and east.

Unit 42 is in both Partial Retention and Modification VQO with the bulk of the unit in Modification. Noticeable deviations are acceptable within the context of the larger landscape. An effort to reduce the deviations as much as possible (economically and practically) is still good practice due to the higher concern level and sensitivity of the viewers potentially viewing this unit. Unit 146 was added downslope from Unit 42 to better mimic a natural opening by feathering out of the unit and into untreated area downslope of Unit 146. Unit 145 upslope from Unit 42 will also help feather out of the unit. The entire topographic feature is also being treated with different prescriptions but holistically this will assist in making the larger landscape appear cohesive. There are no new roads proposed within this cluster of units and the existing roads while perhaps made more visible in the short-term by the treatments opening up views will be a part of the larger treated landscape and the duration of impact will begin to be diminished within five years as regrowth further blends the roads into the landscape. Overall within five years the unnatural appearing contrasts caused by the proposed units and roads would begin to be reduced as new vegetation growth screens and reduces textural changes. The same design criteria as for Units 32-34 to feather edges, feather corridors, vary corridor spacing and unit edge should be applied. All four of these units, as well as some other units, are also visible from US Hwy. 93 and Farm-to-Market Roads.

The following units (Units 1, 17, 19, 22, 27, 30, 52 and 53) are visible from the higher concern level roadways (US Hwy. 93 and Farm-to-Market Road) where the duration of viewing is short in passing and at an oblique angle.

Units 52 and 53 are clearcut treatments that will individually result in openings of ~12 and ~8 acres respectively. The sizes of these units is small so that they may mimic natural openings. However unit 42 (~24 acres) discussed above is also adjacent to these two units so that the combined potential opening created by all three units could be as much as ~44 acres which would be larger. As discussed with Unit 42 the intermediate harvest units around Units 52 and 53 as well as the treatment of the entire topographic feature does improve the VAC and reduce some of the visual deviation that the units would create individually without surrounding treatments to feather edges and create natural appearing openings. Unit 53 is in Partial Retention VQO and 52 in Modification VQO. With the application of the same design criteria as Unit 42, these units will meet their assigned VQOs and meet forest plan.

Units 1(~18 acres), 19 (~11 acres), 22 (~47 acres) and 30 (~26 acres) are skyline Seedtree units where the openings could be close to the entire size of the units depending on the availability of leave trees. All of these units are within Partial Retention VQO where the deviation maybe evident but not dominate. Units 1 and 19 are relatively small in size and with leave trees to help break up the potential for linear patterns created from the skyline logging system and design criteria applied these units should meet the Partial Retention VQO and forest plan. Units 22 and 30 are adjacent to one another creating the potential for a visible opening of ~90 acres (regeneration harvest unit 27 is also adjacent to these units and is discussed below). Openings of this size are not currently visible on this portion of the larger landscape although they are present on non-forest lands to the north and south of these units. Design criteria to ensure linear lines are not created by the skyline logging system as well as feathering of the edges, especially on the south and east edges will help mitigate these impacts. Burn unit B2 will also help make these units appear to mimic natural openings and disturbance regimes. Application of design criteria will ensure these units meet their Partial Retention VQO and meet forest plan.

Units 17 (~16 acres) and 27 (~17 acres) are Seedtree treatments with mechanical logging systems where there is less likelihood of linear corridor lines created. The leave tree distribution and relatively small size of these units will help them mimic natural openings from middleground and background observation points on the high concern level roadways. Application of design criteria to break up the unit edges and randomize the leave tree clumping will ensure these units meet their Partial Retention VQO and meet forest plan.

In areas where the character of the trees are not healthy removing them would be beneficial to the scenery resource in the long-term, but in the short-term it would be a moderate visual impact. However the proposed harvest units collectively may have short-term (5-10 years) and long-term (greater than 10 year) moderate to major effects to foreground, middleground and background views. The following table identifies those regeneration harvest units (with associated roads) that have the greatest potential for impacting sensitive viewsheds, creating moderate to major effects.

Table 3-17. Summary of Impacts With views of Minor, Moderate and Major Concern from Regeneration Harvest Treatment.

Unit	Description of Visual Impact
49	This unit could potentially have a minor effect in the foreground of private properties in the Holbrook area, because of stumps, slash, edge, texture and color contrast as a result of heavy alteration of vegetation.
32-34 and 42	These units and associated E7 road could potentially have major effects because of contrasting line, texture, color, edge and form with the surrounding vegetation. These impacts would occur

	from middleground and background views from town of Whitefish, Whitefish Lake, US Hwy. 93 and Farm-to-Market Road.
1, 19, 52 and 53	These units could potentially have moderate effects because of contrasting line, texture, color, edge and form with the surrounding vegetation. These impacts would occur from middleground and background views from US Hwy. 93 and Farm-to-Market Road.
22 and 30	These units and associated N2 road could potentially have major effects because of contrasting line, texture, color, edge and form with the surrounding vegetation. These impacts would occur from middleground and background views from town of Whitefish, Whitefish Lake, US Hwy. 93 and Farm-to-Market Road.
17 and 27*	These units and associated E7 road could potentially have minor effects because of texture, color and form with the surrounding vegetation. These impacts would occur from middleground and background views from US Hwy. 93 and Farm-to-Market Road.

*** The combination of unit 27 with units 22 and 30 could create a 90 acre opening which could have a major effect as described above.**

From a scenery perspective, regeneration harvest prescriptions create a more open landscape character, the ground is visually dominating with large scattered over-story trees located in a wide spatial pattern that appears altered in the short and long-term until the understory becomes established. Regeneration units would create a more open disturbed appearing landscape character with varying degrees of visibility and sensitivity due to the proposed activity of removing most of the existing trees in a given unit. With design criteria implemented, some of the short-term visual impacts would be mitigated and over the long-term the regrowth of vegetation would ensure that the overall scenic character, scenic integrity and scenic stability is not diminished. No indirect effects are expected from these regeneration harvest units that would impact the scenery resource. Overall with design criteria the regeneration harvest units will meet the Forest Plan and VQOs.

Roads: The development of three new roads to access regeneration harvest units is proposed. These are N2-4. Two of these are temporary roads (N3 and N4) so post implementation these roads should be rehabilitated and would therefore only have short-term scenery resource impacts. The new road N2 to access Unit 22 is the only new road development that may have long-term impacts as it will become a system road. Unit 22 is a seedtree unit so the large number of openings created by the treatment may mitigate some of the visual impacts created by the road. Likewise burn unit B2 will also tie into this proposed road assisting in reducing the visual discernibility of the road itself and ensuring it appears as part of the broader landscape treatment. Like Unit 22 this road is only visible from Farm-to-Market and Hwy. 93 and is therefore seen at an oblique angle and only for short-duration views. Therefore the scenic character, scenic integrity and scenic stability will remain intact with the addition of this road.

Trails: 40 miles of trail are proposed and are located within the project area. They cover the bulk of the project area and are in Partial Retention VQO. While these trails maybe visible from high concern level travelways and areas, their small size and small opening size would make them difficult to discern as deviations from middleground and background observation points. There are no trails proposed in the immediate foreground or foreground of the high concern level areas. They would therefore not negatively affect the Scenery resource and would meet the assigned VQO and forest plan.

Creation of Openings Over 40 Acres

The proposed action could result in three openings greater than 40 acres in size. These openings would be the result of the proposed regeneration harvests (Units 13-15 and 22, 27, 30

and 33, 34). The openings could range in size from 41 acres to 91 acres. MA7 (which all of these units are within) visual resource guidance furthermore states that even-aged stands should generally not be greater than 10 acres. The large size of these openings are needed to address widespread root disease found across the landscape and affecting Douglas-fir.

From a scenery perspective, regeneration harvest prescriptions create a more open scenic character, the ground is visually dominating with scattered over-story trees located in a wide spatial pattern that appears altered in the short and long-term until the understory becomes established. The first of these large openings (Units 13-15) is not highly visible and it is likely that this opening will not diminish the scenic character, scenic integrity or scenic stability of the landscape. The scenic integrity is diminished in the short-term, as the VQO of Partial Retention will likely not be met within the immediate timeframe prescribed. It is likely that these units will meet the Modification VQO. In the long-term though the scenic integrity will be improved as the diversity and health of the stands improves the overall scenic character of the landscape. The scenic stability of the units would also increase and move from low to moderate or even high. If left untreated the potential for degradation to the scenic resource is high as infected trees die. This area's current low-moderate scenic stability based on historic range of variability and fire regimes would indicate that treatments will bring these areas closer to their natural condition. Therefore short-term loss to the scenic integrity would be offset by the long-term benefit to the scenic stability and in turn the scenic character and scenic integrity. Overall, in areas where the character of the trees are not healthy removing them would be positive for scenic resources in the long-term, in the short term it would be a noticeable visual impact.

Resource Indicator and Measures for Alternative 2

Table 3-18. Scenery Resource Assessment for Alternative 2.

Resource Element	Resource Indicator	Measure	Alternative 2 Direct/Indirect Effects
Scenic integrity	Previous and proposed management activity deviations from the scenic character	Number of units meeting their VQO	All units within project area meet VQOs with design criteria applied. Units 22, 27, 30 and 33, 34 may not meet their VQOs in the short-term due to even-aged stand sizes.
Scenic stability	Sustainability (over time and ecological progression) of the scenic character to management activity alterations	Number of scenically stable units	All units within project area will remain moderately stable but some will move towards high stability. Units 22, 27, 30 and 33, 34 will have long-term scenic stability increases due to improved stand conditions that may outweigh the short-term scenic integrity diminishments
Visibility	Identity of units with impacts from concern level 1 travelways and areas	Number of and identity of units in each distance zone with impacts	*IFg/Fg: 46, 48 and 49 Mg/Bg: 1, 5, 11, 17, 19, 22, 27, 29-34, 41, 42, 45, 52 and 53
Visual absorption capability (MA7)	Topography, geology, vegetation as seen from high concern level areas and travel-ways	Number and location of areas in low, moderate and high VAC as well as locations where these area are visible	Low: 22, 27, 30, 32-34 and 42 Moderate: 1, 5, 11, 17, 18, 29, 31, 41, 45, 46, 48, 49, 52 and 53 High: all others in MA7

Definitions on Page 3-40

As noted within the direct and indirect effects analysis, all units with design criteria applied will meet or exceed their VQO and therefore ensure the scenic character of the landscape remains intact. While some of the units may have low VAC and are highly visible, design criteria should address and mitigate these concerns. This therefore ensures that the forest plan scenery resource requirements are met.

Cumulative Effects – Alternative 2

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

The scenery resource cumulative effects analysis for Alternative 2 includes analysis of the THP and the land area encompassing the viewsheds of the project area from the observer points and concern level travel-ways. There is little to no scenery resource evidence of previous vegetation modification projects within the project area on FS lands. There is however evidence of vegetation modification projects on both private and state lands within the THP viewshed. These projects have created contrasts in color, texture, form and line that are discernable from US Hwy. 93 and Farm-to-Market Roads on the lower elevation terrain west of the project area. These visual disturbances are most evident along the boundary between the state/private lands and the FS lands where the management modifications come to the boundary and therefore the boundary is a linear feature that stands out in contrast to the untreated FS lands. Many of the units within the THP may reduce this edge effect by integrating the vegetation management off NFS into management on the FS lands and therefore this project has a beneficial cumulative effect on these portions of the scenic character. Units 1, 2 and 5 which are adjacent to off-forest lands that have been treated will with design criteria implemented result in this beneficial cumulative effect. Other units while not directly adjacent to off-forest lands may create a better overall mosaic across the landscape again improving, benefiting, the overall scenic character of the project area.

Reasonably foreseeable future actions are a continuation of similar types of treatments within the area. These foreseeable actions may also have short-term impacts to the scenic integrity of the viewshed but these deviations would be reduced over the long-term. Vegetation management treatments to decrease wildland fire intensity is expected to occur in the future which could result in additional acres of reduced stocking levels promoting growth of desirable species, reduction of disease, insect outbreaks, and ladder fuels that increase fire intensity and the occurrence of crown fires. This would also result in a more diverse textural pattern across the scenic landscape and improve scenic stability.

Motorized and non-motorized use of forest roads and trails will continue to occur. The recreation users may see more evidence of a vegetation managed scenic character with varying degrees of visual evidence of stumps, down slash and woody debris, open forest stands and mechanical disturbance to the ground. There is the potential for an increase in use in the area, with the addition of the proposed trails. This may increase area scenery resource sensitivity especially because these visitors may have expectations of intact visual landscapes to recreate in. Therefore careful placement and design of the trails to take advantage of the scenic opportunities provided by vegetation management may help mitigate this potential negative impact.

The proposed management activities, with design criteria implemented would create some short-term dominate-unnatural appearing visual contrast, primarily from Holbrook private properties. However, overall, these impacts would lessen over time and may potentially

enhance the private properties views towards Whitefish Lake and more distant landscape vistas a net benefit to the scenery resource. US Hwy. 93 and Farm-to-Market Road middleground and background views may experience some moderate impacts lasting longer than five years. These travelways have short duration views and at oblique angles reducing the severity of these views. Over time these visible units would become subordinate to the scenic character of the landscape and it is expected that in the long-term (greater than 5 years) the scenery resource and landscape would appear intact. All of the proposed treatments would meet current Forest Plan VQOs if the design criteria are applied and no adverse effects would occur.

Resource Indicator and Measures for Alternative 2

Table 3-19. Resource Indicators and Measures for Alternative 2 Cumulative effects.

Resource Element	Resource Indicator	Measure	Alternative 2 Cumulative Effects
Scenic integrity	Previous and proposed management activity deviations from the scenic character	Number of units meeting their VQO	All units benefit in the long-term; units 1, 2 and 5 improve the scenic character of the entire landscape (off-forest included).
Scenic stability	Sustainability (over time and ecological progression) of the scenic character to management activity alterations	Number of scenically stable units	All units within project area will remain moderately stable but some will move towards high stability.
Visibility	Identity of units with impacts from concern level 1 travelways and areas	Number of and identity of units in each distance zone with impacts	No cumulative effects change.
Visual absorption capability (MA7)	Topography, geology, vegetation as seen from high concern level areas and travel-ways	Number and location of areas in low, moderate and high VAC as well as locations where these area are visible	No cumulative effects change.

As noted above the cumulative effects of the project area are no different than the direct/indirect effects except for the benefit to the scenic character and visual landscape around Units 1, 2 and 5 where treatment of these units will improve the off-forest vegetation manipulation which has occurred.

Alternative 3

Alternative 3 has no changes to the vegetation management portions of the scenery resource. Therefore the direct, indirect and cumulative effects expected are the same.

The reduction in the miles of trail in Alternative 3 (26 miles) will not significantly alter the effects to the scenery resource. There is not expected to be an effect to the scenery resource by the development of the trail regardless of the number of miles of trail.

Required Monitoring

Post implementation, monitoring to assess whether or not the unit's VQOs have been met within the assigned timeframes will occur by the forest landscape architect (or designee).

Summary

The concept of treating different areas with various degrees of leave tree combinations, with the natural existing character provides diversity and variety in the landscape. Scenically, the treatment in the landscape would emulate and blend with nature. The success of the treatment depends on the number of trees left in a mosaic pattern. The structure or size of trees left is critical. In general, larger trees provide a strong vertical structure, creating stronger contrast and emphasizing the character of the area. A variety of openings interwoven throughout the landscape with the mosaic arrangement of leave trees would increase spatial diversity and identity of the area. Scenic quality is highest when a variety of trees and spatial patterns are retained.

The THP is located in a highly visible area on the Flathead National Forest. The following Concern Level 1 observer points and areas combine to make this a visually sensitive project.

- 3 roads: US Hwy. 93, Farm-to-Market Road and Whitefish Mountain Road
- 1 waterbody: Whitefish Lake
- 1 urban area: town of Whitefish
- Many private properties (Holbrook, Lupfer and around Whitefish Lake)

Not all units within the project are sensitive visually. Most are screened by topography and vegetation from the aforementioned sensitive viewing locations.

The scenic character of the project's southern end is dominated by the Whitefish Mountain ski area where the expectation of management and manipulation of the landscape is expected. Views from Whitefish that are not screened by vegetation or topography are of units adjacent to the ski area and thus fit with the scenic character of the area.

Those units at the highest elevations (the prescribed burn units) are visually sensitive due to exposed views at the skyline, but these views are all in the distant middle and background from the sensitive areas. Therefore the highest concern for visuals are the units either directly adjacent to the private properties since the treatments are in the immediate foreground of these areas or areas in the mid-elevation which are seen in the middleground and/or background from the sensitive roadways. In those areas effects are most likely to be noticeable and detracting from the scenic character of the area. The following table shows the units with the highest concern for visual impacts by alternative.

Table 3-20. Units Impacting High Concern Viewsheds. All alternatives besides 1 (no action) would have the same vegetation treatments and therefore the same scenery impacts.

Treatment Category	Alternative ¹	
	1	2 and 3
Prescribed Burn Units (low, short-term impacts)	None	All
Intermediate Harvest Units (moderate, short-term impacts)	None	5, 11, 29, 31, 41, 45, 46 and 48
Regeneration Harvest Units (moderate, short-term impacts)	None	1, 17, 19, 49, 52 and 53
Regeneration Harvest Units ¹ (high, long-term impacts)	None	22, 27, 30 and 32-34

¹ Regeneration harvest units typically have greater visual impacts than intermediate harvest and prescribed burn units.



Figure 3-3 Farm-to-Market Road intersection with Star Meadow Road as it looks currently (top) and visualized post-treatment during both summer (middle) and winter (bottom). Units most visible in center-left of photo are units B1, B2, B3, 22, 27, 30 and 32-34.

The THP will meet Forest Plan VQOs with design criteria implemented. A few of the proposed vegetation treatment units would create visual contrast in several highly visually sensitive areas but these treatments are consistent with the Forest Plan. With design criteria applied, visual impacts would be reduced. Except for Alternative 1 where no units are treated, all alternatives (2 and 3) would be expected to have the same impacts to the scenery resource. Units 22, 27, 30 and 32-34 of Alternatives 2 and 3 would potentially create the highest visual impacts because of the following combination of factors: regeneration treatment harvest units, large sized openings created and high concern level visibility. All of these are also within Partial Retention VQO and MA7. MA7 states the goal of maintaining natural appearing vegetation by limiting even-aged timber management practices to generally units of no more than 10 acres. Furthermore treatment areas are to be designed to reflect the form, line, color or texture common to the scenic character of the area (United States. Flathead National Forest, 1985). These units are individually or combined to be greater than 10 acres in size. Therefore in order to meet the intent of the Forest Plan, every effort should be made to lay-out units so that even-aged openings are as small as possible towards this generally less than or equal to 10 acre goal.

Summary of Environmental Effects

Table 3-21. Summary Comparison of Environmental effects to Scenery Resources.

Resource Element	Resource Indicator	Alternative 1	Alternatives 2 and 3
Scenic integrity	Previous and proposed management activity deviations from the scenic character	No treatments would be implemented, therefore the VQOs of the project area would remain the same. The western forest boundary would remain visually evident due to the management of off-forest lands. This area would not be improved, having a continued adverse effect on scenic character.	All units within project area benefit in the long-term. Units 1, 2 and 5 would enhance the western forest boundary by visually integrating with off-forest land management. This would improve the cohesive scenic character of the landscape.
Scenic stability	Sustainability (over time and ecological progression) of the scenic character to management activity alterations	All units within project area are moderately stable but moving towards low stability.	All units within project area will remain moderately stable but some will move towards high stability.
Visibility	Identity of units with impacts from concern level 1 travelways and areas	Number of and identity of units in each distance zone with impacts	*IFg/Fg: 46, 48 and 49 Mg/Bg: 1, 5, 11, 17, 19, 22, 27, 29-34, 41, 42, 45, 52 and 53.
Visual absorption capability (MA7)	Topography, geology, vegetation as seen from high concern level areas and travel-ways	No treatments would be implemented, therefore the VACs of the project area would remain the same.	Low: 22, 27, 30, 32-34 and 42 Moderate: 1, 5, 11, 17, 18, 29, 31, 41, 45, 46, 48, 49, 52 and 53 High: all others in MA7

Regulatory Framework and Consistency

Federal Laws

The National Environmental Policy Act of 1969 (NEPA) states that it is the “continuing responsibility of the Federal Government to use all practicable means to assure for all Americans, aesthetically and culturally pleasing surroundings.” NEPA also requires “A systematic and interdisciplinary approach which would insure the integrated use of the natural and social sciences and the environmental design arts into planning and decision-making which may have an impact on man’s environment.” To accomplish this, numerous Federal laws require all Federal land management agencies to consider scenery and aesthetic resources in land management planning, resource planning, project design, implementation, and monitoring.

Compliance with the Forest Plan

The Flathead Forest Plan contains direction for managing the scenic resources of the forest in both the Forest-wide and MA specific sections of the Plan. Direction relevant, with respect to scenery, to the proposed treatment units are summarized below.

Forest-wide Scenery Standards

- In each MA, meet or exceed the recommended VQO. Where management area goals and objectives can be fully achieved and a higher VQO met without increased costs or reduced future options, the higher VQO should be achieved (United States. Flathead National Forest, 1985, pp. II-22).
- Visual resource analysis will normally be part of all project planning in the Big Mountain area (United States. Flathead National Forest, 1985, pp. II-17).
- Through the use of proper design and scheduling of activities, potential impacts on the scenery resource will be dispersed and not concentrated within an area or travel corridor within a short time frame. Achieving the long-term visual quality goal on the Forest will work in direct proportion to how well the cumulative effects of time and space are addressed. The time and space principles especially need to be applied to the key areas mentioned above. These areas are not viewed as a whole at one time; however, they are viewed sequentially from primary use areas, travel routes, or recreation sites (United States. Flathead National Forest, 1985, pp. II-23).

Management Area Scenery Standards and Goals

- MA 2A Retention (prescribed burning may depart from VQO)
- MA 2C Retention (prescribed burning may depart from VQO)
- MA 7 Partial Retention (even aged units shall generally not exceed 10 acres in size harvests; visual analysis is to be completed before implementation)
- MA 10 Modification (administrative site)
- MA 20 Modification

The Forest is transitioning to the SMS and Scenic Integrity Objectives (SIO) as part of the ongoing Forest Plan Revision (not final). The 2006 SMS Forest-wide Scenery Inventory was documented as part of this analysis but the existing 1985 VQOs are used for this analysis, as it relates to the current Forest Plan management direction. Application of Design Criteria to address scenic integrity concerns will ensure the proposed SIOs outlined in the Draft Forest Plan Revision are also met.

Handbook Direction pertaining to the Scenic Resources:

In addition to Forest Plan direction, the following handbooks apply to National Forest Service lands under the VMS. Definitions, guidance and procedure for managing the Scenic Resources are contained in the following Forest Service Handbooks:

- Forest Service Manual 2300-Recreation, Wilderness and Related Resource Management, Chapter 2380-Landscape Management. WO Amendment 2300-2003-1.
- Agriculture Handbook 462. National Forest Landscape Management, v. 2, chapter 1: The Visual Management System. 1974.
- Agriculture Handbook 483. National Forest Landscape Management, v. 2, chapter 4: Roads. 1977.
- Agriculture Handbook 559. National Forest Landscape

- Management, v. 2, chapter 5: Timber. 1980.
- Agriculture Handbook 608. National Forest Landscape
- Management, v. 2, chapter 6: Fire. 1985.

Aquatics

Introduction

This report details the cause and effect relationship between the No Action Alternative, action alternatives, and resources where relevant issues exist. Relevant issues were identified through scoping and/or public comment (*Project File Exhibit E-99*) and are listed below with selected *indicators and measures* used to perform effects analysis (Table 3-22). Proposed management actions influencing these relevant issues include timber harvest, mechanical fuels treatments, prescribed fire, construction/maintenance of roads and trails, and removal of stream aligned culverts. The extent to which these activities occur can influence hydrologic processes, water quality, channel morphology, and aquatic species (also see *Project File Exhibit G-7* for Biological Assessments, and exhibit G-11 for the Biological Evaluation). Therefore, analysis of alternatives focuses on these issues.

The purpose and need for the project has no aquatic component although some actions (culvert removal) would benefit aquatic resources.

Information Sources and Methodology used for Analysis

Resource Indicators and Measures

Table 3-22. Resource Indicators and Measures for Assessing Effects.

Resource Element	Resource Indicator	Measure (Quantify if possible)	Used to address: relevant issue?	Source (LRMP S/G; law or policy, BMPs, etc.)?
Hydrologic Processes	Water yield	1. Equivalent Clear-cut Acres (ECA), and associated Water Yield or Peak Flow Increase (PFI). 2. Miles of road/trail interaction with riparian habitats.	Yes	Research -Grant and others (2008); Troendle and others (2009), Kahklen and Mohl (1999), Montana SMZ Law (MDNRC 2006), Kendall 2015, Losensky 1994
Water quality	Sediment delivery/Nutrient loading	3. Sediment delivery (tons). 4. Number of road/trail stream crossings.	Yes	Research - Elliot (2013), Sugden and Woods (2007), National Core BMP Technical Guide (USDA 2012), Montana SMZ Law (MDNRC 2006), MDEQ Circular 12A (MDEQ 2014), MDEQ Circular 7 (MDEQ 2012).
Aquatic Habitat/Stream Morphology, Aquatic Species	Sediment delivery/Nutrient loading, Water Yield	Measures 1-4 are used collectively to quantify possible effects to these resource indicators.	Yes	Same as above

Methodology

Hydrologic Processes: A water yield analysis for affected sub-watersheds was completed following procedures outlined in Kendall (2015) adapted from Montana DNRC. Equivalent Clearcut Area (ECA) model results generally provide insight into potential changes in average annual water yield that result from loss of forest canopy (including permanent land clearing for roads) and associated reductions in evapotranspiration and interception. Model assumptions are detailed in Exhibit G-1. Model outputs are utilized relative to historic variability as presented by Losensky (1994) and are also presented relative to values necessary to create measurable change as detailed in Grant and others (2008), MacDonald and Stednick (2003), Stednick (1996), and Bosch and Hewlett (1982).

Additionally, it is recognized that roads and trails within close proximity to riparian habitats may alter hydrologic processes (e.g. accelerate or re-direct surface flow, modify groundwater recharge). Therefore, the number of road/trail miles within 50 feet of lotic (flowing waters) riparian habitats or 10 meters of lentic (still waters) riparian habitats was also used as a measure of possible effects to hydrologic processes. A 50 foot minimum was used for lotic habitats to be consistent with minimum stream management zone (SMZ widths as defined by the State of Montana (MDNRC 2006), while a 10 meter minimum distances from lentic habitats follows guidance from Kahklen and Moll (1999). In general, less disturbance within these areas equates to less potential effect to hydrologic process.

Water Quality, Aquatic Habitat & Stream Channel Morphology, Aquatic Species:

Increased sediment delivery is used as a surrogate for total suspended sediment (TSS) and nutrient (specifically phosphorus) concentrations in this analysis. Similarly, because sediment delivery is intricately tied to surface runoff, increases in sediment delivery rates and peak flows (low to moderate sized peak flows as described in Grant and others (2008)) are utilized as surrogates for analyzing potential effects on aquatic habitats, channel morphology, and ultimately aquatic species. Background sediment yield is based on estimates of short term annual average sediment delivery for undisturbed forest conditions as presented in Elliot (2013) and is used to compare differences in sediment delivery from the National Forest between alternatives. When changes in streamflow and/or sediment delivery fall within the range of historic variation, effects to habitats, channel morphology and aquatic species are also anticipated to fall within those historic ranges.

Sediment delivery estimates associated with roads and vegetation management are based on a 50 year climate simulation using the Water Erosion Prediction Program (WEPP) Road Batch and Disturbed WEPP Batch interfaces. Therefore, estimated sediment delivery represents the average of what could potentially occur over a 50 year period. Sediment delivery generated through road grading and BMP application (other than culvert removal or installation) are incorporated in the WEPP model outputs under the general assumption these increases (or potential reductions) fall within predicted error for model outputs (plus or minus 50 percent). Roads previously reclaimed are assumed to be zero because they are disconnected from stream channels (unless field inventory determined otherwise). Sediment delivery from proposed intermittent stored service (ISS) roads follows methodology outlined in *Project File Exhibit Aquatics G-2* while delivery associated with culvert installation/removal follows guidance outlined in *Project File Exhibit Aquatics G-3*. Proposed temporary roads are not hydrologically connected and therefore sediment delivery would not occur. Some erosion would occur on the temporary roads as described in the *Soils* section of this EA. The analysis assumes all proposed activities would be completed in 2018 to overlap potential effects in time and space (although

effects are more likely to be distributed over a 3 to 5 year period). Detailed information about the WEPP model are available at <http://forest.moscowfsl.wsu.edu/fswepp/>.

Furthermore, roads have been identified as the primary source of anthropogenic sediment delivery to streams (Sugden and Woods 2007). More specifically, road/stream crossings are estimated to account for 74% of all road sediment delivery to streams (Cissel 2013). Therefore, this analysis also utilizes the number of road/trail stream crossings as an indicator measure for potential water quality effects. In general, fewer stream crossings equate to less potential effect to water quality, aquatic habitat, channel morphology, and aquatic species.

Information Sources

Information for this analysis has been gathered from a variety of sources. Much of this information is in the form of spatial data that is presented and/or analyzed using a Geographic Information System (GIS). Some of the key spatial data includes annual precipitation, digital elevation maps (DEMs), soil inventories, watershed boundaries, transportation systems and the National Hydrography Dataset (NHD) for streams and watershed boundaries. Other information includes data that have recently been collected on the ground within or near the project area. These data include USFS field evaluation of stream channel conditions and photo points (*Project File Exhibit G-4*), Montana Department of Fish, Wildlife and Parks (MFWP) MFISH database (*Project File Exhibit G-10*) and personal communication with MFWP fisheries biologists, Montana Department of Environmental Quality (MDEQ) reports (*Project File Exhibit G-13*, MDEQ 2016, MDEQ 2014, MDEQ 2012), Whitefish Lake Institute (WLI) monitoring and reports (WLI 2015), relevant past National Environmental Policy Act (NEPA) and Montana Environmental Protection Act (MEPA) documents, Natural Resources Conservation Service (NRCS) soil condition surveys, USFS Watershed Condition Framework assessments (*Project File Exhibit G-6*), and WEPP road and culvert surveys (*Project File Exhibit G-2*).

Incomplete and Unavailable Information

Many of the tributary streams to Swift Creek and/or Whitefish Lake lack detailed water quality and fisheries information. Similarly, the extent of riparian habitats on private land are unknown as are the interaction with the transportation system in these areas. Likewise, sediment delivery from private lands is also unknown. This analysis utilizes field observations of stream and riparian habitat conditions on National Forest Lands along with general descriptions detailed in WLI (2015) to portray the existing condition.

Affected Environment / Existing Condition

The project area is primarily situated within the Whitefish Lake and Swift Creek-Hemlock Creek sub-watersheds (HUC12) as illustrated on Map 1 (*Project File Exhibit G-14*). The project area also overlaps a small portion of the Big Creek sub-watershed. However, proposed activities in the Big Creek sub-watershed are limited in scale and/or intensity, isolated to ridge tops, and have no interaction with stream channels or riparian habitats (HFR/Rx fire ~47 acres, new non-motorized trail development ~1.29 miles, clear cut ~1.47 acres). For these reasons, measurable effects to aquatic resources from activity in the Big Creek sub-watershed are not anticipated and dismissed from further evaluation.

Within the Whitefish Lake and Swift Creek-Hemlock Creek sub-watersheds, National Forest system lands represent only 10 and 15 percent of the land base and are situated at higher elevations in the Whitefish Range. Table 3-23 presents principal streams within each analysis area, highlights existing water quality impairments, watershed condition framework (WCF)

ratings, bull trout baseline determinations, and discloses current ECA estimates. Map 1 (*Project File Exhibit G-14*) gives spatial reference to these attributes relative to proposed activities and scale of associated effects analysis. A comprehensive water resource report for the Whitefish Lake watershed area (which includes the Taylor Hell Roaring project area) was completed by Whitefish Lake Institute in 2015, is incorporated herein by reference (WLI 2015), and is publicly available online at <http://www.whitefishlake.org>.

Table 3-23: ECA and Associated PFI in Affected Sub-Watersheds (Measure #1).

HUC12	Principal Streams/Water bodies within the Analysis Area	Watershed Condition Framework (WCF)-Rating	Bull Trout Baseline - Determination	Water Quality Impairment	%ECA	**Low end range of natural Range of Variability	***Potential Low/Moderate Peak Flow Response
Whitefish Lake	Hell Roaring Creek	*Class 1	Functioning at Risk (FAR)	none	10.83	5-24%	below limit of detection (10 % change in peak flow)
	Eagle Creek						
	Smith Creek						
	Whitefish Lake			mercury, polychlorinated biphenyls (PCBs)			
Swift Creek-Hemlock Creek	Swift Creek		Functioning Appropriately (FA)	none	12.9		
	Hemlock Creek						
	Taylor Creek						
	Trail Creek						
	Anchor Creek						
	Bear Creek						
	King Creek						

*ECA values based on guidance from Kendall (2015) and assumptions outlined in *Project File Exhibit G-1*.

**Values computed from Losensky (1994)

***Values computed from Grant and others (2008)

¹As detailed in the Watershed Condition Classification Technical Guide (USDA 2011), a watershed in good condition functions in a manner similar to natural wildland conditions. A watershed is considered to be functioning properly if the physical attributes are adequate to maintain or improve biological integrity. This consideration implies that a Class 1 watershed that is functioning properly has minimal undesirable human impact on its natural, physical, or biological processes, and it is resilient and able to recover to the desired condition when disturbed by large natural disturbances or land management activities.

Hydrologic Processes: Figure 3-4 displays the temporal distribution of ECA over time in relation to past disturbance (both natural and anthropogenic) and project recovery under the existing condition. Equivalent Clearcut Area (ECA) model results generally provide insight into potential changes in average annual water yield and peak flow increases (PFI) that may result from changes to the forest canopy and associated changes in evapotranspiration and interception. Peak ECA values for both sub-watersheds correspond to canopy reduction associated with wildfire.

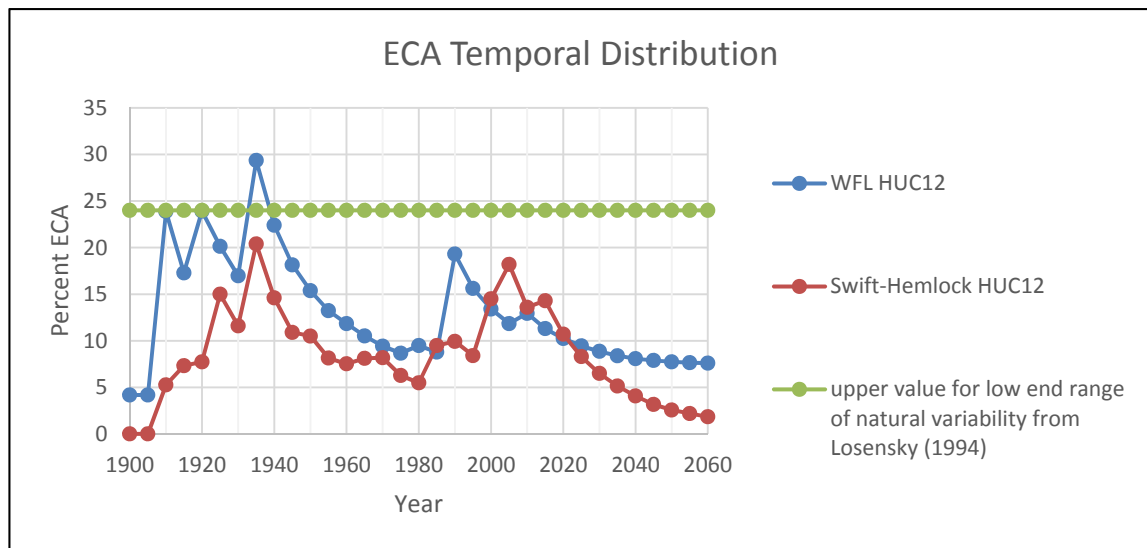


Figure 3-4: Temporal distribution of ECA within affected Sub-watersheds.

Based on model results presented in Table 3-23, ECA values and associated water yield and small to moderate (< 6 year events) peak flow increases are well within the estimated range of natural variability. Larger peak flow events are highly variable and dependent on a number of natural environmental factors including geology, timing/intensity of precipitation events, watershed aspect and slope, watershed drainage efficiency and mosaic of major disturbances (Grant et. al., 2008). Evaluation of stream channel conditions on the National Forest and State Lands above Whitefish Lake Road support these findings (*Project File Exhibit G-4*).

Proximity of roads and trails to riparian habitats within affected subwatersheds is displayed in Table 3-24. These values are further divided by land ownership illustrating the distribution of effects across management boundaries.

Table 3-24: GIS Estimated Lengths for Road/Trail Interaction with Riparian Habitats (Measure #2).

HUC12	Land Ownership	Approx. Length of Road/Trail interaction (miles)		
		Lotic	Lentic	Total
Swift Creek-Hemlock Creek	USFS	0.21	0.01	0.73
	State/County	0.51	0	
	Private	0	unknown	
Whitefish Lake	USFS	0.06	0	1.304
	State/County	0.44	0	
	Private	0.804	unknown	

Water Quality: Surface waters in the Swift Creek-Hemlock Creek and Whitefish Lake subwatersheds are beneficial use classified as A-1 meaning they are suitable for drinking, culinary, and food processing purposes after conventional treatment for removal of naturally present impurities (*Project File Exhibit G-13*, MDEQ 2016). Additionally, the State has assigned individual waterbodies unique water quality assessment categories. Swift Creek has been assigned water quality category 1 meaning all applicable beneficial uses have been assessed and all uses are determined to be fully supported. Whitefish Lake has been assigned water

quality category 5 meaning one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat (Table 3-23). For Whitefish Lake, aquatic life is the threatened beneficial use, the cause is mercury and polychlorinated biphenyls (PCBs), and probable sources are unknown (*Project File Exhibit G-13*, MDEQ 2016). As detailed in WLI (2015), anthropogenic sources of mercury include fuels, raw materials, and waste from industrial processes while PCBs can be released into the environment from a variety of sources including leaks from PCB-containing electrical transformers, improper disposal of PCB-containing consumer products into municipal facilities not designated to handle hazardous waste, and from poorly maintained hazardous waste sites. These sources are generally not related to any activities associated with management on the National Forest, for more detailed information on mercury and PCB pollutant sources see WLI (2015). The primary water quality contaminants generated from forest lands and relevant to the proposed activities are fine sediment and nutrients (which can be bound to soil particles) produced from hillslopes, forest roads, and stream banks. No streams within the Swift Creek-Hemlock Creek or Whitefish Lake subwatersheds are impaired for sediment or nutrients (*Project File Exhibit G-13*, MDEQ 2016).

Swift Creek represents the largest source of sediment and nutrients (primarily phosphorus) to Whitefish Lake although water quality is considered “good to excellent” based on macroinvertebrate assemblages (WLI 2015, *Project File Exhibit G-13*). A DEQ assessment of Swift Creek concluded that 93 percent of the Swift Creek streambanks are stable, human-caused sediment loads are negligible, and sediment loading from Swift Creek is predominantly the result of natural sources (WLI 2015). Table 3-25 quantifies estimates for anthropogenic sediment sources from National Forest System Roads at the catchment scale for each affected sub-watershed. These estimates are presented only for comparison relative to other WEPP outputs for sediment delivery associated with action alternatives on National Forest.

Table 3-25: Sediment Delivery Estimates for Existing Conditions on National Forest (Measure #3).

HUC12	Catchment	*Background Erosion (tons)	Anthropogenic Sediment Delivery (tons)		Catchment Area (acres)
			WEPP Road	% of Background	
Swift Creek-Hemlock Creek	Taylor Creek	40	0.00	0.00	1114
	Hemlock/Trail Creek	59	0.10	0.00	1652
	Anchor Creek	25	0.10	0.00	696
	Bear Creek	41	0.03	0.00	1158
	King Creek	22	0.00	0.00	612
Whitefish Lake	Smith Creek	48	0.01	0.00	1348
	Hell Roaring Creek	69	0.00	0.00	1938
	Holbrook Area	9	0.00	0.00	245

*Background estimates for sediment delivery follow guidance presented in Elliot (2013) and utilize catchment areas as displayed in *Project File Exhibit G-5*.

Tributaries to Swift Creek and Whitefish Lake, as displayed in *Project File Exhibit G-14* and presented in Table 3-23 are either first, second or third order streams generally characterized by steep gradients, abundant large woody debris, and properly functioning riparian habitat

conditions (WLI 2015, *Project File Exhibit G-4 and G-6*). These attributes support assumptions from WLI (2015) suggesting these streams are probably important sources of cold, clean water to Swift Creek and Whitefish Lake (WLI 2015).

Because road/trail stream crossings are the primary anthropogenic disturbances influencing water quality, aquatic habitat and channel morphology, the number of road/trail stream crossings is also utilized as a measure of potential effects to these elements. Current conditions are presented in Table 3-26 for each sub-watershed. Table 3-26 also includes stream crossings discovered through field reconnaissance on historic road templates which are displayed on *Appendix A Map 1*.

Table 3-26 Road / Trail stream crossings (Measure #4).

HUC12	Catchment	*Road/Trail Stream Crossings			Total
		National Forest	State	Private	
Swift Creek-Hemlock Creek	Taylor Creek	1	7	0	8
	Hemlock/Trail Creek	4	5	0	9
	Anchor Creek	1	2	0	3
	Bear Creek	3	3	0	6
	King Creek	0	2	1	3
Whitefish Lake	Smith Creek	0	1	5	6
	Hell Roaring Creek	0	0	1	1
	Holbrook Area	1	0	0	1

*Values are estimates based on existing roads data set, NHD flow lines, and field inventories.

Aquatic Habitat/Channel Morphology: Evaluation of the historic distribution of ECA and associated PFI indicates current conditions are well within the natural range of variation suggesting channel morphology and aquatic habitat conditions are also operating within this natural range. Likewise, field inventory of streams within the project area did not identify active erosion of stream channels or banks, did not identify imbalances between sediment supply and stream transport capacity indicating sediment delivery is functioning within the natural range of variation, habitat conditions are good, and channel morphology appears to be in equilibrium (*Project File Exhibit G-4*). These findings suggest current levels of interaction between roads and trails with riparian habitats or streams, are not measurably affecting aquatic habitats or channel morphology beyond the hillslope scale. Furthermore, WEPP modeling estimates for anthropogenic sources of sediment delivery support these determinations as do findings from WLI (2015) which conclude anthropogenic sources of sediment within the analysis area to be negligible.

Aquatic Species: Within the project area, no fish bearing stream reaches exist on the National Forest. In general, tributary streams to Swift Creek represent little fisheries value until they reach the forest floor/floodprone area of the main Swift Creek channel (WLI 2015). Koopal at WLI in 2014 found westslope cutthroat from Smith Lake moving into the Smith Creek inlet on State lands, while fisheries and habitat information on Hell Roaring Creek do not exist. Personal communication with Montana Fish Wildlife and Parks (MFWP) Fisheries biologist suggest channel gradients in Hell Roaring Creek above Whitefish Lake may restrict fish movement upstream. Swift Creek and Whitefish Lake are designated bull trout critical habitat and also contain westslope cutthroat trout a U.S. Forest Service sensitive species. Bull trout critical habitat is limited to foraging/migratory/over wintering (FMO) habitats, and no spawning or

rearing (SAR) habitats exist within or are approximate to the analysis area. In order to prioritize bull trout recovery actions, the Forest Service and U.S. Fish and Wildlife Service have categorized every watershed on the Flathead National Forest for their current or “baseline” condition. Initial baseline conditions were developed using a coarse GIS model, and represent a starting point for refinement (based on field data or more detailed assessments). These baselines were developed specifically for SAR habitats and have little meaning in FMO habitats such as those in the project area. As displayed in Table 3-23, baseline conditions in Swift Creek are “functioning appropriately” while baseline conditions in Whitefish Lake are “functioning at risk”. It is important to clarify that the WCF and the bull trout baselines are two very different evaluation tools and the results they yield are often different. Further information on the status of bull trout baselines in the project area are found in *Project File Exhibit G-7* while the Conservation Strategy for Bull Trout on USFS lands in Western Montana (USDA 2013) explains the process for making bull trout baseline determinations.

Because indicators detailed in existing conditions under hydrologic processes, water quality, aquatic habitat and channel morphology are also important to sustaining the health and persistence of downstream aquatic species such as bull trout and westslope cutthroat trout. And because water quality and aquatic habitat are good, channel morphology is stable, and hydrologic processes appear to be functioning within the natural range of variability, the current condition is fully functioning in its support of downstream aquatic species.

Environmental Consequences Analysis Spatial and Temporal Context for Effects Analysis

The spatial bounds of analysis areas are variable, depending on which component of aquatic resource is analyzed. Each component of the analysis describes the scale at which the direct and indirect effects are being predicted.

Temporal bounds for aquatic resources range between short-term (project initiation out approximately 3 years post completion) and long term (greater than 3 years post completion), depending on the type and scale of effects. Each component of the analysis describes the temporal nature of predicted effects.

Direct and Indirect Effects

No Action

Hydrologic Processes: Under the No Action alternative, ECA values presented in Table 3-23 would not be modified. Natural processes would dictate forest canopy cover, associated water yield and PFI. Additionally, no change in the length of road/trail interaction with riparian habitats would occur. However, under the No Action alternative leaving 2 existing (and undersized) stream aligned culverts would preclude opportunity to disconnect 0.038 miles (200 feet) of lotic riparian habitat from anthropogenic disturbance (historic road). Leaving these culverts in place would preserve current hydrologic processes at the hillslope scale which include modification of surface run-off and groundwater recharge patterns. Changes to hydrologic processes beyond the hillslope scale would not be measurable.

Water Quality: Under the No Action alternative sediment delivery from hillslopes would persist at background levels in the absence of natural disturbance. However, the No Action alternative would not remove 2 existing (and undersized) stream aligned culverts discovered on historic roads (*Project File Exhibit G-14*, Table 3-26). Leaving these stream aligned culverts in place

maintains potential risk of failure and associated sediment (and nutrient) delivery to Taylor Creek and Trail Creek (Table 3-27). Under the culvert failure scenario, potential water quality effects would be a temporary exceedance of State water quality standards for turbidity and total suspended sediment (TSS) (MDEQ 2014; MDEQ 2012), however changes to existing beneficial use classifications or water quality categories would not be anticipated. The severity of effects would be variable depending on climate and stream flow conditions following disturbance but primarily limited spatially to the stream reach immediately below the affected crossings (~810 meters on average as measured by Foltz and others (2008)). Water quality changes resulting from potential culvert failure may occur further downstream in Taylor Creek and Trail Creek but are unlikely to be distinguishable from other natural or anthropogenic sources in Swift Creek. Potential effects would be limited temporally by the duration and magnitude of sediment delivery displayed in Table 3-27.

Table 3-27: Sediment Delivery Under the No Action Alternative (Measure #3).

HUC12	Catchment	*Background Erosion (tons)	Anthropogenic Sediment Delivery (tons)		
			**WEPP Road	³Culvert Failure	% of Back-ground
Swift Creek-Hemlock Creek	Taylor Creek	40	0.00	33.7	85
	Hemlock/Trail Creek	59	0.10	28.9	49
	Anchor Creek	25	0.10	0.0	0
	Bear Creek	41	0.03	0.0	0
	King Creek	22	0.00	0.0	0
Whitefish Lake	Smith Creek	48	0.00	0.0	0
	Hell Roaring Creek	69	0.00	0.0	0
	Holbrook Area	9	0.00	0.0	0

*Background estimates for sediment delivery follow guidance presented in Elliot (2013) and utilize catchment areas as displayed in *Project File Exhibit G-5*

**WEPP Road-batch results for ISS and temporary roads utilize methodology presented in *Project File Exhibit G-2*.

³Estimates for maximum potential sediment delivery associated with culvert failure follow guidance outlined in *Project File Exhibit G-3*.

Aquatic Habitat/Channel Morphology: Under the No Action alternative indicator measures #1 through #4 would remain unchanged and the current condition would persist as detailed in the affected environment. However, because the No Action alternative would not remove 2 existing (and undersized) stream aligned culverts, the existing level of risk associated with culvert failure would also remain. In the culvert failure scenario, sediment delivery would be elevated as displayed in Table 3-27 and would temporarily reduce downstream aquatic habitat quality and channel morphologic stability. Potential measurable effects would be most pronounced at the reach scale as detailed in the effects to water quality but are not anticipated to extend to fish bearing stream reaches.

Aquatic Species: Effects to aquatic species draws inference from effects analysis associated with hydrologic processes, water quality, aquatic habitat, and channel morphology. Effects to these elements as quantified through selected measurement indicators are assumed to impact aquatic species when they overlap spatially. Under the No Action alternative, measurable effects to these elements as detailed above would not occur within fish bearing stream reaches. Theoretically, increased sediment delivery to Taylor Creek and Trail Creek could influence water

quality below Whitefish Lake Road although these effects are also unlikely to be measurable or discernable from other natural or anthropogenic sources in Swift Creek. Therefore, effects to aquatic species would also not be measurable.

Proposed Action

Project Design Features

The project would use a combination of site specific design, standard operating procedures and best management practices to reduce potential adverse impacts to aquatic resources. All proposed activities would be in compliance with State and Federal BMP standards which include site-specific practices to minimize hydrologic connectivity with streams and wetland habitats. All site appropriate Riparian Management Zones (RMZs) would apply to streams and wetlands further protecting these sensitive areas hydrologically from proposed treatments. Site appropriate RMZs are generally greater than state required buffers providing additional protection to streams and wetlands. No harvest or fuels treatments are proposed within RMZs. Standard operating procedures and project design features (PDF) specific to aquatic resources are located in Chapter 2.

Direct and Indirect Effects - Alternative 2

Hydrologic Processes

Under Alternative 2, proposed timber harvest, hazardous fuels reduction, and road construction would reduce canopy cover increasing ECA values in affected sub-watersheds (Table 3-28). At the hillslope scale, canopy reduction may contribute towards increased snow accumulation through interception losses (Troendle et.al, 2009) and reductions in evapotranspiration (ET) possibly leading to increased soil moisture and water yield during wet periods. However, these changes would be difficult to detect as remaining vegetation is expected to rapidly exploit availability of additional soil moisture (Callahan 1996) and the mosaic pattern and connectivity of runoff producing hillslopes with streams through application of RMZs would effectively dissipate any runoff energy facilitating infiltration and sediment trapping capabilities (*Project File Exhibit G-8*). Therefore, effects (if any) to water yield or peak flows are unlikely to be measurable beyond the hillslope scale.

Table 3-28: Estimated ECA Values Following Implementation of Proposed Timber Harvest and Road Building.

HUC12	Principal Streams/Waterbodies within the Analysis Area	% ECA (Existing Condition)	% ECA (Alt 2)	% Change ECA	**Low end range of natural Range of Variability	***Potential Low/Moderate Peak Flow Response
Whitefish Lake	Hell Roaring Creek	10.83	11.97	1.14	5-24%	below limit of detection (10 % change in peak flow)
	Eagle Creek					
	Smith Creek					
	Whitefish Lake					
Swift Creek-Hemlock	Swift Creek	12.90	14.95	2.05		
	Hemlock Creek					
	Taylor Creek					
	Trail Creek					

	Anchor Creek					
	Bear Creek					
	King Creek					

*ECA values based on guidance from Kendall (2015) and assumptions outlined in *Project File Exhibit G-1*.

**Values computed from Losensky (1994)

***Values computed from Grant and others (2008)

Additionally, under Alternative 2 the length of road/trail interaction with riparian habitats would change. As depicted in Table 3-29, interaction would be reduced by 0.038 miles (~200 feet) in the Swift Creek-Hemlock Creek sub-watershed while new trail development in the Whitefish Lake sub-watershed is estimated to increase riparian interaction by the same amount. Effects from these changes would be difficult to quantify even at the hillslope scale but may include modification of surface water runoff and ground water recharge patterns relative to undisturbed conditions.

Table 3-29: Road / Trail Riparian Interaction Under Alternative 2.

HUC12	Land Ownership	Approx. Length of Road/Trail interaction (miles)				
		Lotic	change from existing condition	Lentic	Change from existing condition	Total
Swift Creek-Hemlock Creek	USFS	0.17	-0.038	0.01	no change	0.69
	State/County	0.51	no change	0		
	Private	0		unknown		
Whitefish Lake	USFS	0.1	0.038	0		1.344
	State/County	0.44	no change	0		
	Private	0.804		unknown		

Water Quality

Management activities proposed under Alternative 2 would increase sediment delivery to area streams relative to current conditions (Table 3-30). The principal mechanism for sediment delivery is culvert removal from proposed road E6 (Trail Creek), E1 (Taylor Creek), and installation/removal of a temporary bridge from E3 (Trail Creek). Increased sediment delivery is anticipated to be short term (less than 3 years) and where existing culverts are removed (Trail Creek and Taylor Creek) these short term increases are a trade-off for reducing long-term (greater than 3 years) risk associated with potential culvert failure as displayed above in Table 3-27. Potential water quality effects associated with culvert removals would be a temporary exceedance of State water quality standards for turbidity and total suspended sediment (TSS) (MDEQ 2014; MDEQ 2012), however changes to existing beneficial use classifications or water quality categories would not be anticipated. The severity of effects would be variable depending on climate and stream flow conditions following disturbance but primarily limited spatially to the stream reach immediately below the affected crossings (~810 meters on average as measured by Foltz and others (2008)). Water quality changes resulting from increased turbidity and TSS may occur further downstream but are unlikely to be distinguishable from other natural or anthropogenic sources below Whitefish Lake Road. Potential effects would be limited temporally by the duration and magnitude of sediment delivery displayed in Table 3-30.

Table 3-30: Estimated Maximum Annual Anthropogenic Sediment Delivery (Measure #3).

HUC12	Catchment	*Back round Erosion (tons)	Anthropogenic Sediment Delivery (tons)					
			**WEPP Road	³Culvert Removal			*Timber Harvest & Prescrib ed Fire	% of Background (also represents change from existing condition)
				Yr. 1	Yr. 2	Yr. 3		
Swift Creek- Hemlock Creek	Taylor Creek	40	0.03	5.90	2.40	0.00	0	20.9
	Hemlock/Trail Creek	59	0.10	8.39	3.33	0.00		20.0
	Anchor Creek	25	0.10	none identified				0.4
	Bear Creek	41	0.08					0.2
	King Creek	22	0.00					0.0
Whitefish Lake	Smith Creek	48	0.01					0.0
	Hell Roaring Creek	69	0.00	0.0				
	Holbrook Area	9	0.00	0.0				

*Background estimates for sediment delivery follow guidance presented in Elliot (2013) and utilize catchment areas as displayed in *Project File Exhibit G-5*

**WEPP Road-batch results for ISS and temporary roads utilizing methodology presented in *Project File Exhibit G-2*.

³Values based on methods outlined in *Project File Exhibit G-3*. Actual values may be less due to effectiveness of BMPs (Klein 2003; USDA 2012).

¹Values represent average annual sediment delivery based on outputs presented in *Project File Exhibit G-8*.

Furthermore, proposed activities under Alternative 2 would change the number of road/trail stream crossings in both affected sub-watersheds relative to the existing condition as outlined in Table 3-31. In general, fewer stream crossings equates to lower risk of potential effects to water quality, aquatic habitat, channel morphology, and aquatic species because the direct and indirect effects of sediment delivery and channel alteration are less likely to occur.

Table 3-31: Number of Road / Trail Interaction with Streams (Measure #4).

HUC12	Catchment	*Road/Trail Stream Crossings			**Total
		**National Forest	State	Private	
Swift Creek- Hemlock Creek	Taylor Creek	1 (0)	7	0	8 (7)
	Hemlock/Trail Creek	4 (2)	5	0	9 (7)
	Anchor Creek	1	2	0	3
	Bear Creek	3	3	0	6
	King Creek	0	2	1	3
Whitefish Lake	Smith Creek	0	1	5	6
	Hell Roaring Creek	2	0	1	3
	Holbrook Area	1	0	0	1

*Values are estimates based on existing roads data set, NHD flow lines, and field inventories.

** Values in parenthesis represent number of stream crossings remaining after project implementation if any change occurred.

Aquatic Habitat/Channel Morphology

Changes to indicator measures #2, #3, and #4 would result through implementation of Alternative 2 as presented above in Tables 3-29, 3-30 and 3-31. However, sediment delivery associated with culvert removal and temporary bridge installation/removal is the principal measure affecting aquatic habitat and channel morphology. Potential effects to aquatic habitat and channel morphology from adding or removing road/trail stream crossings would be twofold. First, stream channel and banks within the area of disturbance would be directly modified following construction. Second, increased sediment delivery would temporarily alter downstream channel habitat conditions by increasing percent pool tail fines, reducing median substrate particle size, and decreasing residual pool depths. Potential measurable effects would be variable depending on climate and stream flow conditions following disturbance but primarily limited spatially to the stream reach immediately below the affected crossings (~810 meters on average as measured by Foltz and others (2008)). Potential effects would be limited temporally by the duration and magnitude of sediment delivery displayed in Table 3-30. These effects are not anticipated to be measurable in Taylor Creek or Trail Creek below Whitefish Lake Road. Therefore effects in Swift Creek, Whitefish Lake or fish bearing reaches of Taylor Creek or Trail Creek would also not be measurable.

Aquatic Species

Effects to aquatic species draws inference from effects analysis associated with hydrologic processes, water quality, aquatic habitat, and channel morphology. Effects to these elements as quantified through selected measurement indicators are assumed to impact aquatic species when they overlap spatially. Under Alternative 2, measurable effects to these elements as detailed above would not directly or indirectly affect any fish bearing stream reaches. Theoretically, increased sediment delivery to Taylor Creek and Trail Creek could influence water quality below Whitefish Lake Road although these effects are also unlikely to be measurable or distinguishable from other natural or anthropogenic sources. Therefore, effects to aquatic species including bull trout and bull trout critical habitat would also not be measurable.

Cumulative Effects – Alternative 2

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Hydrologic Processes

Under Alternative 2, proposed timber harvest would reduce canopy cover increasing ECA values by 1.14 percent the Whitefish Lake sub-watershed and 2.05 percent in the Swift Creek-Hemlock Creek sub-watershed. Based on findings from MacDonald and Stednick (2003), Stednick (1996), and Bosch and Hewlett (1982), these changes are not substantial enough to result in any measurable increases in water yield or peak flows when compared to the existing condition or estimated low end range of natural variability (Table 3-28). Consequently, ECA changes and associated direct or indirect hydrologic responses would emulate historic variability but these changes are not expected to be measurable at the sub-watershed scale. Predicted ECA values would return to existing conditions within approximately 3 years for the Swift Creek-Hemlock Creek sub-watershed and 5 years for the Whitefish Lake sub-watershed. Hydrologic recovery

from disturbance is depicted in Figure 3-5 relative to estimated low-end range of natural variability.

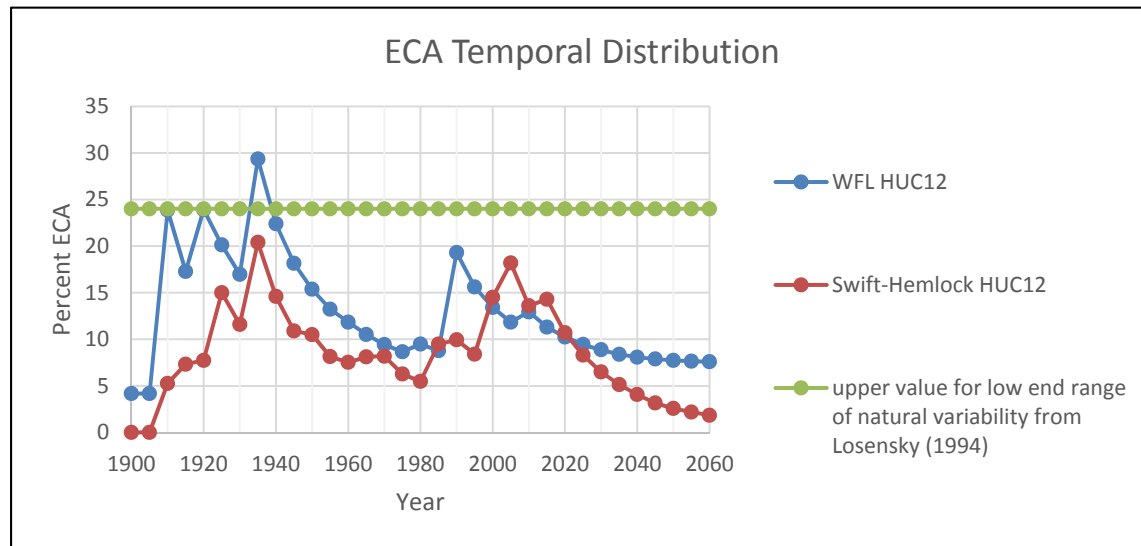


Figure 3-5: Temporal distribution of ECA under Alternative 2

Likewise, effects to hydrologic processes resulting from road/trail interaction with riparian habitats (measure #2) are anticipated to be isolated to the hillslope scale (0.038 mi reduction in Swift Creek-Hemlock Creek subwatershed, 0.038 mi increase in Whitefish Lake sub-watershed). Because effects would not overlap spatially with effects of other past, present or reasonably foreseeable activities, they are not cumulatively additive.

Water Quality, Aquatic Habitat/Channel Morphology, Aquatic Species:

Increased haul traffic and culvert removals from National Forest lands proposed under Alternative 2 are expected to contribute sediment and nutrients to catchments identified within both sub-watersheds (Table 3-30, measure #3) although this increase in sediment delivery is not anticipated to be measurable beyond the reach scale or ~810 meters below culvert replacement sites. Sediment delivery from land management activities on State lands are “not likely to occur” based on environmental review conducted by the State (MDNRC 2009), while potential contributions from private lands would not overlap spatially with any measurable increases from the National Forest. Therefore, cumulative effects to water quality, aquatic habitat/channel morphology and aquatic species associated with increased sediment (and nutrients) delivery are also not anticipated to be measurable (also see exhibits G-7 and G-11).

Alternative 3

Hydrologic Processes, Water Quality, Aquatic Habitat/Channel Morphology, Aquatic Species

Changes to indicator measures under Alternative 3 the same as described for Alternative 2. Therefore direct, indirect and cumulative effects from implementation of these alternatives are also the same as detailed under Alternative 2.

Summary

Measurable effects to the aquatic resource from action alternatives are primarily limited to sediment delivery (measure #3) associated with use of a temporary bridge or culvert removal. These effects would not result in any changes to water quality beneficial use designations or long-term changes to aquatic habitat, channel morphology, or aquatic species. Measurable effects are spatially isolated at the reach scale in Taylor Creek and Trail Creek, are temporally limited as displayed in Table 3-30. Because the No Action alternative would not remove two existing (and undersized) stream aligned culverts from historic roads, an increase potential for culvert failure and associated effects to water quality, aquatic habitat, channel morphology, and aquatic species from increased sediment delivery is possible. However, effects would also be most pronounced at the reach scale (~810 meters below failure sites) and are unlikely to be measurable in Swift Creek. Table 3-32 displays indicator measures for all alternatives at the subwatershed scale. Alternative 3 does not result in any change to indicator measures relative to Alternative 2 and therefore possible effects would be the same as those detailed for Alternative 2.

Table 3-32: Summary Comparison of how the Alternatives Address the Relevant Issues.

Element	Indicator/Measure	*No Action	*Alt 2	Alt 3
Hydrologic Processes	1. ECA (associated WYI or PFI).	10.83(12.9)	11.97(14.95) no WYI or PFI	Same as Alternative 2
	2. Miles of road/trail interaction with riparian habitats.	1.3(0.73)	1.34(0.69)	
Water Quality	3. **Sediment delivery (tons).	0.01(0.23) *(62.6)	0.31(20.25)	
	4. Number of road/trail stream crossings.	8(29)	10(26)	
Aquatic Habitat/Stream Morphology, Aquatic Species	Measures 1-4 are used collectively to quantify possible effects to these resource indicators.			

*Values for Swift Creek-Hemlock Creek subwatershed listed in parenthesis.

**Sediment delivery estimates present total delivery presented in Table 3-30.

†Estimated maximum potential sediment delivery from culvert failure from two stream aligned culverts on historic roads.

Regulatory Framework and Consistency

Management and protection of water resources on National Forest System lands is regulated by the Federal Water Pollution Control Act (Clean Water Act), the Streamside Management Zone Law, Federal Executive Orders, Forest Plan direction, and Forest Service Policy.

Clean Water Act

Section 313 of the Clean Water Act requires that Federal agencies comply with all substantive and procedural requirements related to water quality. Under Section 303 of the Clean Water Act, States have the primary responsibility to develop and implement water quality programs, which include developing water quality standards and Best Management Practices (BMPs). State water quality standards are based on the water quality necessary to protect beneficial uses.

Environmental Protection Agency policy requires each state to implement an anti-degradation policy. Under this policy, water quality must be maintained to fully support existing beneficial uses. Existing water quality that is higher than the established standards must be maintained at the existing level unless a change in water quality is justifiable due to social and/or economic reasons (CFR Vol. 48, No. 217, 131.12, Nov. 8, 1983; Montana Water Quality Act, Section 75-5.)

Water quality standards (Section 303(c)) established in Montana are based on their beneficial uses. Common beneficial uses include drinking (after conventional treatment), bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Federal agency compliance with pollution control is addressed through Section 313 of the Clean Water Act, Executive Order 12580 (Jan. 23, 1987), National Nonpoint Source Policy (Dec. 12, 1984), USDA Nonpoint Source Water Quality Policy (Dec. 5, 1986) and the Environmental Protection Agency in their guidance "Nonpoint Source Controls and Water Quality Standards" (Aug. 19, 1987). In order to comply with State and local nonpoint pollution controls, the Forest Service implements (BMPs) to control non-point source pollution. BMPs are the primary mechanism to achieve water quality standards (EPA 1987).

The state water quality law relates to the Clean Water Act and the maintenance of beneficial uses through the use of BMPs. The BMPs are designed to prevent soil erosion and protect water quality, as well as help prevent soil damage. In a memorandum of Understanding with the State of Montana (1987), the Forest Service has agreed to follow Best Management Practices (BMPs) for all management activities. The Taylor Hellroaring Project would utilize all applicable BMPs during project design and implementation as described in Best Management Practices for Forestry in Montana (MDNRC 2015). Also Forest Service - Soil and Water Conservation Practices (SWCP) (FSH 2509.22) are combined with Montana State BMPs (MDNRC 2015) for incorporation into project design and implementation to ensure that aquatic resources are protected. In 2014, the Forest Service began implementing National BMPs, which are very similar to SWCPs and State BMPs.

BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate introduction of pollutants into receiving waters. Usually, BMPs are applied as a system rather than a single practice. BMPs are selected by site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

Endangered Species Act

Bull trout are listed as a Threatened species under the Endangered Species Act. Likewise, the meltwater lednian stonefly is a candidate species proposed for listing. Therefore, a Biological Assessment (BA) must be prepared for any project that may affect bull trout or meltwater lednian stonefly or their designated Critical Habitat. Separate BAs was prepared for the proposed action, and are located in *Project File Exhibit G-7*. A cross-walk between Primary Constituent Element (PCEs) and potential effects to bull trout is presented in Table 3-33. Therefore, all ESA requirements for management alternatives have been met. Note, habitat for the meltwater lednian stonefly does not exist within the project area.

Table 3-33: Review of PCEs and Potential Impacts from the Taylor Hellroaring Project.

PCE Number and Description	Taylor Hellroaring Project impact, Selected Alternative
1. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.	No contaminants would be generated by this project.
2. Water temperatures ranging from 2 to 15C with adequate thermal refugia available for temperatures at the upper end of this range.	The project has no potential to impact water temperature in critical habitat. It does not change width/depth ratios, does not change pool habitats, does not alter stream banks, does not change peak flows outside of natural variation, does not remove refugias, does not alter riparian conservation areas and does not restrict floodplain connectivity.
3. Complex stream channels with features such as wood debris, side channels, pools, and undercut banks to provide a variety of depths, velocities and instream structures.	The project has no potential to impact large woody debris, pool frequency and quality, large pool frequency, refugia, width/depth ratios, stream bank condition, riparian conservation areas or floodplain connectivity in critical habitat.
4. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-year and juvenile survival. A minimal amount of fine substrate less than 0.63mm in diameter and minimal substrate embeddedness are characteristics of these conditions.	Fine sediment is anticipated to reach Swift Creek and Whitefish Lake although the amount is not expected to be measurable. Neither of these are spawning habitat and thus do not have embryos, fry or young-of-year.
5. A natural hydrograph, including peak, high, low and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.	Modeling of the project impacts found the natural hydrograph, including peak and base flows, will be within natural variation and thus able to support bull trout populations.
6. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.	The project has no potential to impact floodplain connectivity, change peak or base flows, increase drainage network, or impact riparian conservation areas in critical habitat.
7. Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.	The project has no potential to alter life history diversity or isolation, genetic integrity, water temperature, chemical/nutrient contamination, physical barriers, width/depth ratios, peak flows or refugia in critical habitats.
8. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish	The project has no potential to impact floodplain connectivity, riparian conservation areas, growth and survival, or life history diversity and isolation in critical habitats.
9. Few or no predatory, interbreeding, or competitive nonnative species present.	The project has no potential impact to persistence and genetic integrity and does not create any physical barriers in critical habitats.

Forest Service Sensitive Species

The Regional Forester has identified two aquatic species that are sensitive species and require a Biological Evaluation (BE). The two species are westslope cutthroat trout and western pearlshell mussel. The pearlshell mussel is not found in the analysis area. The BE is located in *Project File Exhibit G-11*, and all management alternatives meet the Sensitive Species guidance.

Montana Streamside Management Zone (SMZ) Law

The purpose of the Montana Streamside Zone Law is to protect the quality and quantity of forest waters and to conserve the integrity of Montana streamside zones. The law prohibits clear cutting, burning, equipment operation, road construction, slash disposal, or use of toxic material within at least 50 feet of any stream, lake, or other body of water. The Department of Natural Resources and Conservation (DNRC) must approve any exceptions to these prohibited practices (MDNRC 2006). SMZs are typically nested within Riparian Management Zones (RMZs) that are defined in the forest plan. All management alternatives comply with State SMZ law.

Wetlands and Floodplains

Wetlands and floodplains are protected under Executive Orders 11990 and 11988, respectively. All wetlands and riparian zones would have RMZs and SMZs around them to meet Forest Plan direction and Montana State Streamside Management Zone Law. Therefore all alternatives would meet the requirements of these Executive Orders.

Forest Plan Direction

The Land and Resource Management Plan (forest plan) provides a variety of management direction related to aquatic resources. Much of this direction is based on the Clean Water Act, Endangered Species Act, and the National Forest Management Act. Detailed forest plan direction is designed to protect aquatic resources through desired conditions, goals, objectives, standards, and guidelines. Additional projection is provided by Best Management Practices, stream and riparian zone designation, management area designation, and sensitive soils designation. In 1990, the Forest adopted Amendment #3, which added direction specifically for trout stream standards. The amendment required various protections for certain bull trout streams and several requirements for cutthroat streams.

In 1995 the Forest Service adopted Inland Native Fish Strategy (INFISH) with the goal of recovering native fish populations. Riparian Habitat Conservation Areas (RHCAs) were established beside streams, lakes and wetlands. Various riparian goals are identified and activities within RHCAs must not retard either goals or Riparian Management Objectives. No activity is proposed in RHCA except for stream crossing for roads E1, E3 and E6. These activities fully maintain all INFISH goals and standards. Various desired conditions are identified while standards and guidelines for management in these zones clearly articulate acceptable practices (*USDA FNF, 1986 and amendments*). No vegetation management is proposed in RHCAs (RMZs) although stream crossings associated with roads E1, E3, and E6 would occur in these areas. All activities fully maintain desired conditions, objectives, standards and guidelines detailed in the forest plan.

All action alternatives comply with management direction in the forest plan, including the INFISH amendment. The Forest Plan prohibits “unacceptable fish losses” from land management actions, and this is not anticipated with either Alternative 2 or 3. The Forest Plan also seeks to maintain long term water quality to meet or exceed state water quality standards and this project complies with that direction.

In 1990, the Forest adopted Amendment #3, which added more trout stream standards. The amendment required various protections for certain listed bull trout streams, none of which are in the project area. The amendment has several requirements for cutthroat trout streams, which are applicable to this project. The amendment prescribes (1) Recruitment of at least 40 trees per 1,000 linear feet of stream, which is achieved because no harvest is proposed in riparian area. (2) The amendment requires stream canopy shading to prevent water temperatures from exceeding 17°C [62.6°F]. Although stream temperatures may exceed 17 C due to natural post-fire conditions, this requirement is achieved because no riparian trees that provide shade would be removed. (3) The amendment requires that before any significant ground disturbance in areas that are critical to cutthroat trout will have sediment sources identified and rehabilitated.

The proposed revised forest plan establishes RMZs with the objective of improving riparian habitats and preserving or recovering native fish populations. Riparian management zones (RMZs) are areas adjacent to perennial and intermittent streams, wetlands, ponds, lakes, and reservoirs, as defined by standard FW-STD-RMZ-01. The functions of riparian management zones within aquatic ecosystems include (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading streams, and (4) protecting water quality. (Naimen et al. 1992). A critical function of riparian management zones is to contribute to wildlife habitat use and connectivity. As the interface between aquatic and terrestrial ecosystems, riparian areas provide unique habitat characteristics.

Permitting

All required permits would be acquired prior to project implementation. Where work is needed within a stream and floodplain, the Forest Service would acquire a 124 permit from Montana Fish, Wildlife, and Parks. Properly following the joint permitting process ensures compliance with applicable local, State and Federal laws that relate to protection of streams, wetlands, floodplains, and other water-related features. Additional information pertaining to stream permitting in Montana is available at <http://dnrc.mt.gov/licenses-and-permits/stream-permitting>.

This page intentionally left blank.

Recreation

Introduction

The Tally Lake Ranger District receives a high number of visitor use due to its proximity to the urban areas of Flathead Valley and Whitefish Mountain Resort (WMR). How the public accesses the area is the single most important factor in how they use the area and sets the framework for their recreational experience. The demands placed on the District are intense and diverse, with approximately half of all use occurring as dispersed activities. Many of these activities are day-use and less than twelve hours in duration. These activities include sightseeing, driving for pleasure, camping, picnicking, hunting and fishing, physical training, hiking and backpacking, horseback riding, mountain and road biking and gathering forest products, and others. Recreational use occurs throughout the year with spring and summer and being the most heavily used times. Winter recreation is mostly concentrated in the WMR permit boundary area, although snowmobiling on established routes also occurs. Local residents of Flathead Valley comprise the majority of recreational demands in the area, but summer and winter tourist influxes add to this number.

A stated purpose and need for this project is to provide a range of trail experiences for hikers, mountain bikers and horse riders to connect the local community with the Flathead National Forest. Providing an interconnected trail system that includes loops and connector trails for different skill levels would help achieve this. This includes adding a connector trail to Hungry Horse/Glacier View Ranger Districts and providing significant new loop trail opportunities in the area adjacent to WMR. This would also provide for day opportunities close to the urban core of Whitefish with vista opportunities of Whitefish Lake, as well as providing users the option of accessing trailheads close to town.

Information Sources and Methodology used for Analysis

Resource Indicators and Measures

The proposed action consists of approximately 40 miles of new trail construction. During scoping, most concerns regarded the number of new trail miles, trail location and trail density. The existing trail network within the project area is within the WMR permit area and also includes 1.86 miles of the southern end of NFST 26, the Ralph Thayer Memorial Trail, in the northwestern part of the project area. The best resource measure is number of miles of trails proposed for construction and the location of the proposed trails. The alternatives will compare and contrast the miles of trails and the location and rationale for proposed trails in each alternative and how this addressed concerns identified during scoping. We also will describe how each alternative meets the Recreation Opportunity Spectrum (ROS) outlined in the FNF plan.

Methodology

The impact analysis for recreational resources evaluates effects of the alternatives with regard to:

- Recreation opportunities and experiences
- Public access, visitation, and potential for user-group conflicts

- Consistency with Recreation Opportunity Spectrum (ROS) classifications and Forest Plan management direction.
- Comparing miles and location of proposed trails. See Table 3-39.

The Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a planning system utilized by land managers to classify areas according to the types of recreation opportunities available therein. ROS classifications may range from Primitive inside a designated wilderness to Urban in forests adjacent to metropolitan areas, thereby enabling managers to provide a variety of settings in which to recreate, each with their own characteristics and opportunities.

The ROS classifications found within the project area include: Urban, Rural, Roaded Natural, Semi-primitive Motorized, and Semi-primitive Non-motorized. Most roads and trails in the project area are located in Rural, Roaded Natural, and Semi-primitive Motorized ROS areas that accommodate these types of recreation. (*Project File Exhibit L-1*)

Information Sources

Some sources to help understand the visitor use in this area are the National Visitor Use Monitoring (NVUM) reports for 2005, 2010 and 2015, (USDA 2005, 2010 and 2015) the Whitefish Legacy Trail 2014 Report (Norma, 2014) 2017 Outdoor Recreation Outlook (ARC, 2016) and Institution for Tourism and Recreation Research Publications. These reports indicate number of visitors, where they are from and what activity they were doing. Please see the Chapter 3 Socioeconomic section to better understand what these reports provide and how these information sources were used.

Affected Environment / Existing Condition

Trails

The Flathead Valley, including Whitefish, in northwest Montana is a major destination for outdoor recreationists. Whitefish Mountain Resort (WMR) is a major draw for the area. Over the last decades, running, hiking and mountain bike use of the area has grown dramatically. Conflicts between user groups are increasing in part due to the increase in use and the limited availability of trails adjacent to the city of Whitefish.

In 2006, in response to increased demand and public interest, the city of Whitefish began a process to plan and build a trail system including a loop trail around Whitefish Lake. The primary purpose of the Whitefish Trail system was to increase recreational trail and access opportunities adjacent to the community of Whitefish. As a result, Whitefish Legacy Partners have an established a trail system in the valley bottom with several in-town and near town trailheads that connect private, city, and state lands and will eventually connect to NFS lands. These trails were built for summer activities including hiking, equestrian and cross country mountain bike and winter activities like cross country skiing and snowshoe use.

The proposed trails provide a connection from the popular trails in and around the community of Whitefish to the more remote trails on NFS lands. This would create opportunities for trail users to disperse from the current system onto more remote and challenging trails with greater opportunities for solitude. Extended portions of the proposed trail system along with National Forest System (NFS) Roads will provide access for trail users to Ralph Thayer Memorial

Recreation Trail 26, Smokey Range National Recreation Trail 270, and Danny On Memorial National Recreation Trail 370.

Developed Recreation Sites

There are no developed recreation sites operated by the FNF in the project area. Developed recreational opportunities are provided by WMR both winter and summer. Lift served skiing and snowboarding accounts for approximately 350,000 paid skier visits each winter. Summer scenic chair rides, mountain biking, berry picking and hiking account for almost 50,000 paid visits each season.

Dispersed Recreation

Dispersed recreation occurs within the entire project area. These activities include sightseeing, driving for pleasure, camping, picnicking, hunting and fishing, physical training, hiking and backpacking, horseback riding, mountain and road biking, berry picking and firewood gathering and others.

Special Uses

WMR is the busiest ski resort special use permit holder for a ski area in Region 1 of the Forest Service based on skier days and revenue. It consists of both winter and summer use. There were approximately 352,095 skier day visits for the 2016-2017 season. Other special uses in the communication site adjacent to the summit of WMR for Weese Communications, Flathead County and BNSF. Further to the northwest is a site for Big Mountain communications and further up the ridge is the Bee Broadcasing site. See *Project File Exhibit L-2* for more information on current special use permits.

Winter Use

Besides the use that occurs during the WMR permit boundary area, other popular activities in the project area include snowmobiling. There is an established over snow trail on the north side of WMR in the Canyon Creek area. The Werner Peak and Taylor Road receive over snow use and are groomed when conditions allow. These routes are accessed from DNRC lands and groomed routes from the west and groomed routes from the Canyon Creek trail system to the east.

Road Use

Driving for pleasure is one of the most popular recreation activities occurring on the Flathead National Forest and within the project area. Wheeled motorized access on forest roads provides user access for hiking, bicycling, firewood gathering, hunting, fishing, camping, huckleberry picking, ATV/motorcycle riding, wildlife viewing, stock use, and appreciating National Forests from a vehicle. The Taylor Creek Road NFSR 9790 and the Werner Peak Road NFSR 1658 receive heavy local use.

Environmental Consequences

Analysis Area

This analysis of the recreational resource will focus on recreational activities specific to National Forest System lands within the Taylor Hellroaring project area as described in *Chapter 1*.

Spatial and Temporal Context for Effects Analysis

Direct / Indirect Effects Boundaries

The area analyzed for recreation cumulative effects is recreation opportunities within one mile of the Project Area boundary and interconnected trail systems on land owned by state and private landowners. The time period considered is from ten years prior to project implementation, to ten years into the future, and will include all known and past, present, and reasonably foreseeable actions, listed earlier in *Chapter 3 Introduction* of this EA. Past, present, and reasonably foreseeable activities with the greatest potential impact on recreation include the growing population and visitor use to the Flathead Valley and adjacent areas such as Glacier National Park.

Cumulative Effects Boundaries

The cumulative effects boundary includes adjacent private, city and state lands with connecting trails and connecting recreational use.

Direct and Indirect Effects

No Action

Under the No Action Alternative, no designated trails would be built within the Project Area. There is currently inadequate opportunities for trail-based recreation in the planning area. If no new trails are built adjacent to the project area, the public may try to create illegal trails to make their own connections to desired areas. Consequently, many of these trails likely would not meet current trail design standards. Erosion from improperly located, designed, and constructed trails can cause environmental impacts to soil and water, decrease safety, provide for a poor recreation experience. Unauthorized trails can increase costs of patrolling to locate illegal trails and rehabilitating of unauthorized trails. This area would remain general forest area (GFA) that is difficult to access, except by cross country travel off trail, for activities such as hunting and berry picking.

The No Action Alternative maintains trail-based recreational opportunities at current levels. These opportunities only occur in the WMR permit area, and the NFST 26 Ralph Thayer Memorial Trail. Recreational demand is expected to increase over time, proportional to population growth and increased seasonal visitor use, which would result in gradual increase in crowding on existing trails. Crowding on trails can result in resource damage, increased trail maintenance needs, increased user-group conflicts (particularly on shared trails), proliferation of user-created routes, and diminished recreational experiences.

Direct and Indirect Effects Common to Action Alternatives

Direct Effects

Both action alternatives focus on providing trails for different users and experiences. Long distance trails are created, new single track opportunities are provided, trails for technical riders and new loop systems for different skill level riders. New trails will be designed with sustainability in mind to reduce maintenance needs. Trail construction standards will also be implemented in order to provide for greater user satisfaction and resource protection.

The proposed trail system would create non-motorized trails that enhance recreation experiences, are designed for safety, environmental protection, and operational efficiency. The proposed trail network emphasizes a series of loop trails that provide opportunity for progressively longer and more challenging excursions. This layout allows users to choose the length and challenge of their excursion, and reduces congestion and user conflict. We expect that some hikers such as families or people with limited mobility or time will primarily use the lower elevation, shorter loops. Trail runners, beginner and intermediate mountain bikers, and more adventurous hikers will likely head for the middle loops, and advanced mountain bikers will likely use the longer loops. Loop trails such as these often develop a preferred direction of travel, which further reduces user conflict and improves safety. Trails would be located, designed, constructed and maintained to limit the risk of user and wildlife/human conflict. Trail Classes range from 1-5 and determine elements including tread width, obstacles, constructed features, signing and the recreational environment and experience. See more information on Trail Classes in *Appendix B*.

The project would use a combination of site specific design, standard operating procedures and best management practices to reduce potential adverse impacts to recreational facilities and a trail network. *Chapter 2* lists standard operating procedures and project design features.

The action alternatives would have a positive direct impact to recreation opportunities and user satisfaction. The increase in accessibility of trails, trails for key user types, longer trails, loop trails and trails designed to improve the recreational experience will have a positive benefit. Under Alternative 2, there would be an overall increase in non-motorized recreation opportunities. There would be a total of 40 miles more than the No Action Alternative and 11 more miles than Alternative 3. Since there will be an increase in trails over time, there will be a reduction in crowding on existing trails. This will lead to an overall increase in user satisfaction. Under this alternative, visitor density will be further dispersed to longer single loop trails which could help to reduce management issues such as congestion, visitor conflicts and public safety issues, as well as providing for a more sustainable trail system.

Both action alternatives would add non-motorized trails to the project area, improve parking areas, create a trailhead at Holbrook, and enhance use and access adjacent to WMR areas where a trail network can be better managed. Visitor use to WMR may increase due to people either wanting to access the trail system from riding the chairlift up or ending their trip at the summit and riding the chairlift back to their vehicle. These users may be local or surrounding communities' residents who purchase annual lift passes, or tourists who would purchase single or daily lift tickets.

New non-motorized trails would primarily expand opportunities for hiking but would also improve connectivity for mountain biking especially to the Whitefish Trail area and to the north, to the ridge and existing trails, mainly NFST 26 of which 1.85 miles are in the project area. These changes would improve recreational opportunities and experiences for non-motorized trail users. Creating non equestrian emphasis areas, trail segments not allowing equestrian use, would also reduce user-group conflicts in the project area. These locations are in the Holbrook area and the WMR permit area.

Approximately 15 miles of existing roads would continue to be open, with a trail overlay. The trails that were proposed over these already open roads will have no significant effect to recreation. Pull out areas along these roads will be identified to provide safe parking opportunities. Recreation and travel specialists will identify these locations based on traffic,

sight distance and use levels. Flat areas, landings and road intersections will be utilized where available.

Creation of the trailhead at Holbrook in the short term (i.e. during implementation of project activities), activities associated with construction, could temporarily disturb wildlife foraging and breeding habitat. Disturbances to wildlife habitat resulting from trail construction, would be limited to the proposed trail prism, and adjacent areas. The felling of some green trees or snags, or removal of some herbaceous or shrub species along the newly constructed trails, is not expected to significantly contribute to changes in habitat structure or composition in the project area. Habitat disturbances would be minimal and short-term, and disturbed areas would be restored in accordance with Design Features.

Indirect Effects

If timber harvest occurs in areas where trails are proposed, log hauling would likely be on NFS Roads, temporarily disrupting recreational use on these road, and yielding in an adverse, short-term, minor impact. Prescribed burning in the Project Area would restrict recreational use of the proposed trail system in those areas during and after burning operations, leading to adverse, short-term, minor impact to recreationists. Development of the WT and USFS trail systems would likely increase total trail use which could also increase the use of unauthorized trails on adjacent properties, if this use is not managed.

Both action alternatives may create additional opportunity for camping and campfires in areas that have been open to camping, but poor access has discouraged this use. All areas within the project area would be open to dispersed camping within the limits of the system road(s) for vehicle access. Campers may choose to walk in and camp away from their vehicle. Holbrook Trailhead would be a day use site only with no overnight camping or fires allowed.

Direct and Indirect Effects of the Proposed Action

The proposed action includes more trail miles than Alternative 3. Three trails included in the proposed action that are not in Alternative 3 are:

- **Trail #C3** - A connector trail, on the Glacier View district, to provide better access from other system trails to the NFST 270 Smokey Range Trail.
- **Trail #C4** - A connector trail, on the Glacier View district, to provide better access from other system trails to NFST 270, Smokey Range Trail. This trail provides a loop opportunity from the summit.
- **Trail #2** - 2.11 miles of switchback trail, which is the alternative access to the Whitefish Trail if easements cannot be obtained through private land ownership. This is not the preferred access route, and if approved, would only be built if alternate access is not secured.

These three trails address part of the purpose of the project to connect to trails more easily from the city of Whitefish and the Whitefish Trail.

Direct and Indirect Effects of Alternative 3

The direct and indirect effects of Alternative 3 are included above and are similar to effects of the proposed action but include few miles of trails. The miles and locations of trails were reduced to address issues as described in *Chapter 2*. This alternative would not provide access to NFST 270 Smokey Range Trail from WMR or the Whitefish Trail.

It also would not provide an alternative access for the Whitefish Trail to proposed Whitefish trails at Smith Lake.

Table 3-39: Summary Comparison of how the Alternatives Address the Key Issues.

Trail #	Trail Location	Alt 2 Miles and Description	Alt 3 Miles and Description
1	Holbrook Area. Part of the Whitefish Trail.	1.06 This trail segment leaves the already established Haskill Basin / Reservoir Road WT, would cross WSI land and continue on the north side of the Big Mountain Road, cross the road, continue to the newly created Holbrook Trailhead and continue west to Hellroaring Creek.	1.06 Trail segment would remain the same, except the northern portion would reroute around a seasonal wetland instead of building boardwalk through it.
L1A	Holbrook Area.	.51 Would be an accessible, ADA loop.	.51 Location may change but length will remain the same.
L1B	Holbrook Area.	1.97 West side loop.	1.22 Trail segment west of Trail 1 removed due to concerns from adjacent landowners during scoping.
L1C	Holbrook Area.	.59 East side loop.	.59 Segment remains the same as Alternative 2.
C1	Holbrook Area.	.47 Short trail segment to connect Holbrook Area trails to the Ptarmigan Village.	0 Trail segment dropped due to concerns from Ptarmigan Village Homeowners during scoping.
2	Hellroaring – Whitefish Trail.	2.11 Alternate access for WT from WMR. Segment would only be built if access through private land cannot be obtained.	0 Trail segment would not be built in this Alternative due to wildlife concerns and multiple switchbacks. If not built, would not fully meet the purpose and need of the project of connection the Whitefish Trail.
3	Hellroaring – Whitefish Trail.	.25 Southern access for the WT if easements through private land is obtained.	.25 Segment remains the same as in Alternative 2.
4	Hellroaring – Whitefish Trail.	.76 Main WT that will cross Hellroaring Creek with an engineered bridge.	.76 Segment remains the same as in Alternative 2.

5	Hellroaring – Whitefish Trail.	.31 Western access for the WT.	.31 Segment remains the same as in Alternative 2.
L3	Whitefish Face	1.46 Lower West 2 - East Side. Provides a loop opportunity from the WT	1.46 Segment remains the same as in Alternative 2. Additional length added to incorporate a portion of L5 which was removed.
L4	Whitefish Face	1.55 Lower West 1 - West Side. Provides a loop opportunity from the WT	1.55 Segment remains the same as in Alternative 2.
C2	Whitefish Face	.07 Small connector between L3 and L4 to provide a low elevation loop opportunity.	.07 Segment remains the same as in Alternative 2.
L5	Whitefish Face	2.6 West 1 – East side of the loop. Provides a loop opportunity from the lower elevation loop created by L3 and L4.	0 Trail segment would not be built in this Alternative due to trail density and access to Ridge Trail from L6.
L6	Whitefish Face	2.55 West 2 – West side of the loop. Provides a loop opportunity from the lower elevation loop created by L3 and L4. Connects to L7 at Taylor Creek Road. Continues to Ridge Trail R1.	2.55 Segment remains the same as in Alternative 2.
L7	Whitefish Face	2.12 West 3 – East side. Trail provides access in the northwestern part of the project area.	1.76 Segment remains the same as in Alternative 2 except rerouted in Section 27 to avoid wetland area in fork of Smith Creek and to contour with topography to avoid switchbacks.
L8	Whitefish Face	5.54 West 4 – West side. Trail provides access in the northwestern part of the project area.	3.28 Segment remains the same as in Alternative 2 except mileage is reduced by deleting segment below Taylor Road and to reroute around King Creek.
C5	Whitefish Face	2.3 Connection to State & possible WT future proposal providing access from the Taylor Road NFSR 9790.	2.3 Segment remains the same as in Alternative 2

L9	Whitefish Face	4.3 West 5. Trail provides access to the Ralph Thayer Trail #26.	0 Trail segment would not be built in this Alternative due to trail density as there is already access to Ralph Thayer from the Ridge Trail R1.
R1	Ridge Trail	8.24 This trail provides access between the Ralph Thayer Trail #26 and the WMR permit boundary area. Upon completion, would become an extension of Trail #26.	8.24 Segment remains the same as in Alternative 2
C3	Off Ridge Trail	.73 Backside Loop East Connector Trail segment would provide access over the back side from the Ridge Trail onto GV/HH to provide a loop opportunity and access to Smokey Range Trail #270.	0 Trail segment would not be built in this Alternative due to wildlife concerns and trail density.
C4	Off Ridge Trail	.56 Backside Loop West Connector Trail segment would provide access over the back side from the Ridge Trail onto GV/HH to provide a loop opportunity and access to Smokey Range Trail #270.	0 Trail segment would not be built in this Alternative due to wildlife concerns and trail density. If not built, would not fully meet the purpose and need of the project to provide access to the backside of WMR and Smokey Ridge Trail from Whitefish.*

Alternative 1 is not shown since no trails would be proposed.

Cumulative Effects Common to both Alternatives

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

For this analysis, past actions are assumed to have contributed to the current condition described in this chapter. The Whitefish Trails vision of connecting the loop all the way around Whitefish Lake is in different stages. Currently the trailhead off of Reservoir Road is under development. This will connect to a new trailhead on Big Mountain road which will tie into the Nordic Trails on WMR private land. Future plans for trails in the Swift Creek area on DNRC lands is expected in the next 2-5 years.

Summary

Implementation Strategies and Funding

Implementation of this trail network will depend upon availability of funding and support from private groups and individuals as well as NFS resources, While the implementation of this plan may be accomplished over take several years, the NFS is dedicated to implement priority

actions with the aid of outside groups and resources. Successful partnerships would speed up the implementation of the plan. NFS will actively seek grants and other funding to implement the plan. An important source of potential implementation funding would be the Federal Lands Access Program (FLAP), provides funds for projects that are located on or adjacent to, or that provide access to Federal lands. Tally Lake Ranger District acknowledges the important contributions of many private groups to help manage the Forest and improve recreational opportunities. Cooperation and support from these groups would be critical to successfully implement this plan.

An Implementation Plan will be developed outlining priorities for different stages of construction for the project. This Plan will attempt to balance the resources available and accomplishments on an annual basis. Rehabilitation of damaged natural resources, closure and rehabilitation of illegal routes, if created, and enforcement of regulations, would be balanced with the improvements to the recreational opportunities.

Table 3-40. Suggested Implementation Actions and Timelines.

Implementation Priority	Alternative Action
Priority 1 (< 1 year)	Development of the Implementation Plan Identify volunteer support resources and funding opportunities Start planning/construction of the Holbrook Trailhead Start construction on new non-motorized Ridge Trail (Ralph Thayer)
Priority 2 (2 to 5 years)	Complete construction of Holbrook Trailhead Start construction of Whitefish Trail including bridge over Hellroaring Creek. Complete new non-motorized Ridge Trail (Ralph Thayer) Construct pullout opportunities as areas arise on Taylor Road when harvest activities are complete.
Priority 3 (> 5+ years)	Construct connector trail to HH/GV if approved. Complete one full loop trail to be determined by collaboration.

Required Monitoring

There is no required monitoring for recreation trails. Patrols either conducted by FS personnel or other volunteer groups will monitor for safety and resource damage which will be remedied when discovered. Use levels will be monitored by trail counters in some locations and National Visitor Use Monitoring (NVUM) surveys will be conducted every five years.

A Forest Service directed monitoring program will be created for this project. These monitoring objectives are to:

- evaluate sustainability of project work,
- evaluate effectiveness in meeting trail planning and implementation objectives, and
- provide feedback about where additional work may be needed.

This monitoring program meets these objectives through:

- preconstruction guidance and inspection to ensure work design meets current Forest Service guidelines,
- interim checks during construction to ensure BMPs are being followed,
- post-construction inspection of completed work,
- semi-annual inspections and maintenance reporting by designated volunteers, and
- annual assessment and reporting by assigned Trail Segment Coordinators.

Summary of Environmental Effects

Both action alternatives will increase the recreational opportunities in the project area and provide access to existing trail networks on WMR. Alternative 2 would have a larger long term effect on the landscape as it has more miles proposed and a higher trail density than Alternative 3. The possibility of illegal trails being built to connect areas where proposed trail segments are not built in the selected alternative may cause future resource damage. All trail segments that are built will be built to standards and guidelines in *Appendix B* and the Design Features in *Chapter 2* and will cause the least amount of impact to the land and will have long term sustainability. Framework of the Forest Services' Sustainable Recreation include focuses such as Enhancing Communities, Investing in Special Places and Promoting Citizen Stewardship (*Project File Exhibit L-3*).

Regulatory Framework and Consistency

All trails on Forest Service land would be constructed, managed, and maintained according to standards and guidelines outlined in Forest Service Handbook (FSH) 2309.18 (*Project File Exhibit L-4* and *L-5*).

Compliance with the Forest Plan

Direction from the Flathead National Forest Land and Resource Management Plan (page 2-5): "Provide a range of quality outdoor recreation opportunities within a forest environment that can be developed for visitor use and satisfaction including motorized and non-motorized, in an undeveloped forest environment.

Forest Plan Direction

Forest Plan management area prescriptions provide management direction by emphasizing a particular resource and identifying associated guidelines (prescriptions) for management activities. The prescription for each management area consists of a prescription summary and a set of management guidelines. The prescription summary identifies the primary emphasis of the prescription. However, all prescriptions are multiple use prescriptions, and permitted uses and activities extend beyond the primary emphasis.

Map 4 in Appendix A displays management area boundaries in the project area. Applicable management area prescriptions for dispersed recreation and trail system management are summarized below by management area.

MA 2 – Consists of unroaded lands suited for dispersed recreation that meet the ROS classification of semiprimitive nonmotorized.

- Maintain trails for nonmotorized use.

- Develop additional trails where feasible to expand recreation opportunities (e.g., loops and tie-ins to campground complexes).

MA 7 – Designated for timberlands with high scenic values. This MA is in the NW corner of the project area where several harvest units, and few trails are proposed.

- Develop and implement ORV (Off Road Vehicle) and road management direction that provides security for wildlife but continues to provide reasonable access. Provide for current recreation uses such as motorized recreation, berry picking, hunting, hiking, and firewood gathering.

MA 20 – Per the 1986 FLMP, Management Area 20 includes Big Mountain Winter Sports Area (3,574 acres). Currently, 3,036 acres are managed under special-use permit as a winter sports area. The remainder of this Management Area provides opportunities for WMR expansion and recreational opportunities outside the WMR permit area.

Soil

Introduction

The following section documents the soil resource effects of the proposed Taylor Hellroaring Project (THP). Specific management indicators to be analyzed include soil productivity, soil erosion, and mass failure. Effects to the watershed resource as a whole are discussed in the Aquatics section.

Soil productivity is the ability of the soil to supply the water and nutrients needed to sustain plant growth. Variables that influence soil productivity include physical characteristics, organic matter, and soil biological activity.

Physical characteristics include soil depth, porosity, and bulk density. Changes in these characteristics occur most often when ground-based equipment makes repeated passes over the soil (Lull, 1959). These activities compact soils and, if soils are moist enough, cause rutting, and puddling. These changes to physical soil characteristics reduce pore space volume and water holding capacity. These physical changes reduce infiltration rates, slow soil drainage, impede root growth, and reduce plant-available water and nutrients. Physical soil disturbances also decrease gas exchange, affecting both plants and soil biota.

Organic matter in its various forms contributes to soil productivity. Organic matter is particularly important for water retention, cation exchange, nutrient cycling, and erosion control (Page-Dumroese, Harvey, Jurgensen, & Graham, 1991). Humus is decomposed organic matter. Duff and litter are partially decomposed leaves, needles, and twigs less than three inches in diameter on the soil surface. 85 to 90 percent of the total nutrients in most conifers are contained in branches, twigs, and foliage (Garrison & Moore, 1998). Coarse woody debris consists of woody stems greater than three inches in diameter (Harvey et al., 1994). This material has no effect on soil nitrogen or other nutrients regardless of decay stage and it can compete with vegetation for limited nutrients through immobilization (Busse, 1994; Prescott & Laiho, 2002).

Soil organisms, including fungi and bacteria, drive nutrient cycling processes by decomposing organic matter and mineralizing nutrients for use by plants. Soil organisms depend on organic matter for the nutrients to carry out their life processes. Decomposed large woody debris can provide habitat for the survival of mycorrhizae fungi. These fungi form a symbiotic relationship with tree roots, increasing water and nutrient uptake by the trees and the fungi (Perry, Borchers, Borchers, & Amaranthus, 1990).

Soil erosion is the movement of soil particles by water, wind, or ice. In forested sites on steep slopes, water is the most common cause of soil erosion. Erosion is infrequent on undisturbed forest soils because abundant organic matter provides a protective layer on the soil surface that reduces the impacts of raindrops which allows water to infiltrate and the surface soil below the organic layer is by nature porous, allowing water to infiltrate into and through the soil profile (Goldman, Jackson, & Bursztynsky, 1986).

Soil erosion can occur when surface soil is compacted or when loose surface soil and its protective layer of organic material are changed by management activities. Compaction, rutting, and puddling reduce the movement of water into the soil and tend to channel and concentrate water. As a result, runoff (overland flow) is increased and carries soil particles with it. Natural occurrences such as fire remove organic matter from the soil surface. When organic matter is removed, soil pores can be plugged by impact from raindrops resulting in overland flow and increased rates of soil erosion.

Mass failures can be caused by natural or man-made disturbances. Mass failures can result from sequences of natural events, such as wildfire followed by high-intensity precipitation. Some areas are prone to mass failures because of the nature of the bedrock geology or soil.

Management activities can also saturate a soil by channeling water and concentrating it onto a limited area. All mass failures triggered by human causes are classified as detrimental soil disturbance (DSD). These disturbances cause long-term changes in soil productivity that can last centuries.

Summary of Findings

The soil analysis indicates that all alternatives would meet Region 1 soil quality objectives through the implementation of design features outlined in *Chapter 2*. All Forest Plan management direction would be met by the proposed alternatives.

Analysis Area

The analysis area forms the boundary for the assessment of direct, indirect, and cumulative effects to the soil resource. This area consists of the proposed treatment units, trails, and roads for the THP. This area was selected because it is where the effects of implementing the proposed activities would occur. The effects on soils would not extend beyond the units proposed for treatment.

Methodology

Forest Service Manual Section 2550 and the Region 1 Supplement 2500-99-1 provide direction for maintaining soil quality (*Project File Exhibit H-1*). Establishment of existing condition for proposed treatment units followed the approach outlined in the Region 1 Soil NEPA technical guide (*Project File Exhibit H-2*). Where initial field observations showed potential for existing detrimental disturbance to be in excess of two percent of the activity area, the Forest Soil Disturbance Monitoring Protocol (SDMP) (Page-Dumroese, Abbott, & Rice, 2009) was utilized. This protocol provides a method for systematically quantifying soil conditions based on visual indicators.

The Forest Soil Scientist determines which visual classes represent detrimental soil disturbance based on the characteristics of the soils within the project area. For the THP area, where soil depths and water holding capacities are generally favorable, visual soil disturbance class 3 is considered detrimental. Some instances of class 2 were judged detrimental due to compounding factors.

All SDMP surveys were conducted using an 80 percent confidence interval. The margin of error around each estimate is ± 5 percent. Sample size is determined automatically on the electronic SDMP field form. SDMP field data collection spreadsheets and activity area documentation forms are located in *Project File Exhibit H-3*. Information gathered during field investigations is used to determine cumulative effects.

Numerous bulk density samples have been taken from the Flathead National Forest (FNF) in areas managed for timber production. Statistical analyses of bulk density measurements have established their validity in determining the effects of management on the ground (*Project File Exhibits H-4 and H-5*).

A study of soil moisture trends on the FNF (*Project File Exhibit H-6*) demonstrates the average annual period when soils are sufficiently dry (soil moisture less than field capacity) to reduce detrimental soil disturbance. Literature has been cited that documents the effectiveness of design criteria proposed to reduce anticipated disturbance from the THP. In addition, monitoring reports for activities on soils similar to those in the THP area (*Project File Exhibits H-7-16*) were used to estimate the effects of the proposed activities. Information gathered in field investigations was used to determine cumulative effects (*Project File Exhibit H-17*).

The soils in the project area are described in the updated landtype report and soil survey for the FNF (Martinson & Basko, 1983, 1988). Landtypes provide a basis for soil analysis. Soils are classified according to Soil Taxonomy, a national system used to classify and group soils. Classification allows soils to be grouped to permit the largest number and most precise predictions possible about responses to use and management. This system allows for monitoring results from one taxonomic unit to be related to similar taxonomic units.

Predicted detrimental soil disturbance from proposed temporary roads are calculated based on average clearing width. Temporary road prisms are part of the productive land base as defined by NFMA Sections 4-7, and therefore, predictions of potential impacts on soil productivity are required (FSM 2500 Chapter 2550). All temporary roads are estimated to average 22 feet in width of total disturbance resulting in 2.7 acres of detrimental disturbance per mile. All associated impacts from temporary road construction and rehabilitation are assigned to the related harvest units.

Existing Condition (Affected Environment)

Field investigations were conducted to determine if and how existing soil condition was affected by past management activities and/or dispersed activities (e.g. off-highway vehicle travel and firewood cutting). In addition, proposed units that would require design features to address conditions such as soils that are excessively wet, steep, or had evidence of past harvest that caused compaction, displacement, rutting, puddling, or soil erosion were identified.

Most soils on the FNF, including those within the project area, have a surface that formed in or have been influenced by volcanic ash loess and thus are similarly classified. Since most soil quality monitoring on the FNF has occurred on soils that have a volcanic ash-influenced surface there are a large number of both quantitative bulk density measurements and qualitative ratings that relate to the soils in the project area. This information has two valuable implications; first, we can estimate the amount of detrimental soil disturbance that exists from past management activities by doing transects and observing the amount of visible detrimental disturbance present, and second, we can estimate the amount of detrimental soil disturbance to expect from proposed management activities on given soil types and thus estimate effects to the soil resource.

Soil Disturbance Evaluations

Table 3-41 summarizes exiting detrimental soil disturbance for the proposed mechanical treatment units.

Table 3-41. Existing Detrimental Soil Disturbance.

Unit	Acres	Prescription	DSD %
1	18	Seedtree	6
2	12	Seedtree	6
3	14	Seedtree	7
7	16	Clearcut	6
8	14	Clearcut	6
9	50	Commercial Thin	11
10	12	Commercial Thin	2
11	8	Commercial Thin	7
12	13	Commercial Thin	3
14	20	Seedtree	5
15	14	Seedtree	2
23	30	Commercial Thin	6
24	8	Commercial Thin	3

Unit	Acres	Prescription	DSD %
25	37	Commercial Thin	7
27	17	Seedtree	2
28	38	Commercial Thin	7
29	15	Commercial Thin	3
32	8	Shelterwood	3
41	45	Commercial Thin	2
44	86	Commercial Thin	1
46	10	Commercial Thin	3
48	11	Commercial Thin	3
50	32	Commercial Thin	3
104	53	HFR	3

Soil Productivity Trends

Soil quality in the THP area is stable to trending upward. Literature indicates that disturbed soils improve by means of plant growth, bioturbation, freeze-thaw cycles, wet-dry cycles, and organic matter additions, all of which naturally occur in the project area. These natural processes effectively ameliorate compacted soils over time (Lull, 1959). Compaction recovery rates are highly variable with an expected range of 10 to 70 years (Gonsior, 1983). The target downed wood for these forest types is 5 to 20 tons per acre for moderating soil productivity while minimizing fuels hazard (Brown, Reinhardt, & Kramer, 2003; Graham et al., 1994).

Most disturbed soils have abundant organic matter and roots throughout the upper soil layers. In addition, pre-harvest surveys of proposed units show that many old disturbances are no longer detrimental; indicating they are recovering and soil quality is trending upward.

Landtypes and Interpretations

Table 3-42 lists landtype map units for proposed units (Martinson & Basko, 1988). The dominant soils in the project area are typified by rocky subsoil horizons, moderate erosion hazard, high infiltration rates and moderate to high relative productivity.

Table 3-42. Landtypes of Treatment Units – Alternative 2.

Landtype	Relative Productivity	Surface Erosion Hazard	Mass Failure Hazard	Acres
72	Not Rated	Moderate	Moderate	580
73	Moderate	Moderate	Moderate	295
23-9	High	Moderate	Low	267
57-8	Moderate	Moderate	Low	259
26C-9	High	Moderate	Low	205
26C-8	High	Moderate	Low	86
75	Not Rated	Not Rated	Not Rated	56
57-9	Moderate	Moderate	Low	44
27-8	Moderate	Moderate	Low	24
21-9	Low	Moderate	Low	14
23-8	High	Moderate	Low	4

Productivity

Productivity of the landtypes in the THP area is moderate to high. All soils within the proposed units, with the exception of small, shallow, rocky inclusions, support forest vegetation.

Surface Erosion Hazard

The erosion risk for the landtypes in the THP area is moderate. A majority of these landtypes are characterized by soils with high infiltration rates. The high rock fragment content of most subsurface horizons also promotes water movement through the soils. Runoff from these soils is uncommon.

Mass Failure Hazard

The dominant mass failure hazard rating for the THP area is low. The proposed units exhibited no signs of increased mass failure risk during field reconnaissance.

Environmental Consequences

The analysis of effects for soils assumes that all design criteria outlined in *Chapter 2* would be effectively implemented. The analysis will show the predicted amount of detrimental soil disturbance resulting from the implementation of the action alternatives. The proposed harvest systems and design criteria have been implemented in previous projects and monitored for effectiveness.

The soil analysis process is described in the soil analysis guideline document (*Project File Exhibit H-2*). Cumulative effects are discussed in terms of the activity areas. The Forest Service Manual (FSM) R-1 Supplement No. 2500-99-1 defines an activity area as a land area affected by a management activity to which soil quality objectives are applied. An example of an activity area is a harvest unit or burn unit. Soil quality objectives do not apply to intensively developed sites such as mines, developed recreation sites, administrative sites, or rock quarries. Intensively developed sites, where vegetation or water resources are not the principle objectives, are excluded from the activity area.

The soil analysis is based on the current soil condition as determined from field data collection along with predicted changes in soil condition caused by implementation of the proposed management activities. Detrimental disturbances are defined as the condition where established soil quality objectives are not met and the result is a significant change in soil productivity. At least 85 percent of an activity area must have soil that is in satisfactory condition.

It is important to consider that not all soil disturbances are detrimental. Our past monitoring of projects on the FNF suggests that some soil disturbances create bulk density below the levels that inhibit root growth (*Project File Exhibit H- 4*). Research has shown that increased bulk density on coarse textured soils results in increased production capacity because of associated increases soil water holding capacity (Powers et al., 2005). They also noted that increases in bulk density were not reflected in site production if an understory was absent. In other words, reducing competition can leave more abundant resources for the remaining vegetation, even if soil bulk density increases.

Alternative 1 – No-Action – Direct, Indirect, and Cumulative Effects

This alternative provides a baseline to evaluate the effects of the action alternatives. The effects on soils are discussed as changes over time on soil productivity, soil erosion and mass failures.

Soil Productivity

This alternative would not cause short-term effects on the soil resource over and above existing condition. No additional road building, timber harvest, prescribed burning or fuels reduction would disrupt natural soil processes.

Physical Soil Characteristics

This alternative would not cause soil compaction, rutting, puddling, or soil displacement. Undisturbed soils would remain so. Soil productivity in areas where past timber management compacted soils would slowly improve as plant roots, soil organisms and freeze-thaw events loosen the soil. Most soil disturbances would recover after 70 years (Gonsior, 1983). Sites that are slightly compacted would recover in fewer than 70 years. Displaced, rutted and puddled soils would have reduced productivity for a longer time than compacted soils.

Organic Matter

Standing dead trees would eventually fall over and contribute coarse woody debris. Fine woody debris would remain on site. Soil organisms would decompose the organic materials adding humus to the soil. Nutrients associated with this material would slowly become available for plant growth. As the tree canopies close and shade the soil surface, decomposition rates would slow, allowing organic matter and nutrients to accumulate on the soil surface. This process would continue until another major disturbance, such as fire or a windstorm, opens the tree canopy and speeds up the recycling process again.

Soil Organisms

Microorganism populations would fluctuate with the changes in microclimate and supply of organic matter on the soil surface. These changes would be in response to the changing vegetation as a result of natural events such as fire, wind throw and other sources of natural vegetation mortality. Any changes would be Buffered by the capability of soil microbial communities to adapt to changing conditions on very short time scales (Schmidt et al., 2007).

Soil Erosion

This alternative would allow any current soil erosion to decrease as vegetation returns to soils that lack plant cover. Wildfires could cause short-term increases in soil erosion. Soil erosion rates would fluctuate with natural changes in vegetation.

Mass Failures

This alternative would not change the risk of mass failures within the project area. All slopes are considered stable. Mass failures are very unlikely.

Action Alternatives – Direct & Indirect Effects

Soil Productivity

The following sections are based on the intent to maintain soil productivity by designing skid trails and landings so they occupy less than 15 percent of each activity area and use of site preparation methods that minimize detrimental disturbance. In addition, implementation of design criteria has the potential to further reduce soil impacts.

Physical Soil Characteristics

Ground-Based Harvest

These operations would result in direct and indirect effects on soil physical properties within the boundaries of proposed activity areas. Most detrimental effects would be concentrated on the proposed skid trails, landings, and temporary roads within or associated with timber harvest units. Minimizing the area occupied by landings and skid trails to reduce the detrimental effects on soil productivity from changes in physical soil properties is recommended (Garland, 1983; Page-Dumroese, 1993; Williamson & Neilsen, 2000).

Skid trails and landings would be laid out to occupy less than 15 percent of the activity unit. Calculations demonstrate that spacing skid trails 75 and 100 feet apart limit disturbance to less than 15 percent of the activity area (*Project File Exhibit H-18*). Designated skid trails with 100 foot spacing impact 11 percent of the harvest area (Garland, 1983). Post-harvest monitoring on the FNF consistently shows less than 15 percent detrimental soil disturbance from ground based operations that use designated skid trails (*Project File Exhibits H-7-16*).

In addition to using designated skid trails and landings, there is potential to reduce soil impacts further by limiting equipment operation, to the extent possible, when soils are drier than field capacity (McNabb, Startsev, & Nguyen, 2001; Startsev & McNabb, 2001). Rutting and puddling are most often associated with logging on wet soils (Williamson & Neilsen, 2000). Soil moisture monitoring on the FNF showed that soils are drier than field capacity during the summer dry period which begins in July and often lasts well into October (Exhibit 6). Most summer logging would occur when soils are drier than field capacity. By operating on low soil moisture conditions we have the potential to reduce the amount of detrimental disturbance from skidding operations.

Heavy slash (about 40 kg/m²) has proven effective for buffering the effect of equipment operation on mineral soil (S.-K. Han, 2006). Cut-to-length/log forwarder systems paired with heavy slash mats on skid trails can reduce detrimental soil disturbance over traditional ground-based logging systems. Cut-to-length harvesting systems, which stay on designated skid trails, create soil disturbance on about 10 percent of the harvested area (S.-K. Han, 2006). Logging when soils are drier than field moisture capacity reduces the amount of compaction associated with cut-to-length logging (H.-S. Han, Page-Dumroese, Han, & Tirocke, 2006). Monitoring on timber sales showed that 15 units logged using a cut-to-length/log forwarder system all met soil quality objectives (*Project File Exhibits H-10-12*).

Skyline Harvest

Skyline operations would result in direct and indirect effects on soil physical characteristics within the boundaries of the proposed activity areas. Effects will be less than those from ground-based operations. Skyline yarding disturbs 2 to 8 percent of the soil in a unit (McIver & Starr, 2000). Monitoring results on the FNF show skyline yarding had levels of detrimental disturbance far below 15 percent of an activity area.

Excavator Piling

All mechanical piling would be accomplished with excavators. This method reduces the extent of detrimental soil impacts from the site preparation activities. Excavator effects have been monitored at the project level on the FNF since the early 1990s. In a detailed study, approximately 200 bulk density samples were collected where excavators worked. Those samples exhibited minor increases in soil bulk density (*Project File Exhibit H-5*). In addition, when they are used on slopes less than 45 percent, displacement of the topsoil is rare.

Hazardous Fuel Reduction – Mechanical Treatment

Use of ground-based equipment would have direct and indirect effects on soil physical characteristics within the boundaries of proposed activity areas. There is potential to greatly reduce these effects by limiting equipment operation to periods when soils are dry. Soil compaction is reduced when soils are drier than field capacity (McNabb et al., 2001; Startsev & McNabb, 2001). Rutting and puddling are most often associated with ground-based mechanical equipment operation on wet soils (Williamson & Neilsen, 2000). FNF soils are typically drier than field capacity between July and mid- to late-October (*Project File Exhibit H-6*). Mechanical mastication would occur only when soils are drier than field capacity.

Mastication treatments substantially increase woody debris (Harrod, Ohlson, Flatten, Peterson, & Ottmar, 2009). This heavy slash is effective for buffering the effect of ground-based mechanical equipment operation on mineral soil (H.-S. Han et al., 2006; S.-K. Han, 2006). A significant relationship exists between the presence of bare ground and the potential for increased compaction (Hatchett, Hogan, & Grismer, 2006). Further soil protection is expected through retention of forest floor due to absence of displacement normally associated with ground-based skidding of logs.

Monitoring on recent mechanical mastication units on the FNF met the Regional soil quality objective with the cumulative effect of original regeneration harvest and mastication (Exhibit 19). Impacts in these two units were well below the regional objective for detrimental soil disturbance. Other potential mechanical fuel treatments would be similar to those described under ground-based harvest effects in this section.

Hazardous Fuel Reduction – Hand Treatment

Treatment in these units would typically reduce tree densities to within a target range. Reductions would be accomplished by cutting with chainsaws. In lop and scatter treatments, cut saplings would be left on site. No detrimental soil disturbance would result from the hand cutting of trees or the hand piling of cut trees. No significant effects to soil bulk density, infiltration capacity or soil moisture content are expected (Seymour & Tecle, 2004). No detrimental soil disturbance would result from the hand cutting of saplings or the hand piling of cut saplings.

Burning of hand piles may result in some minor changes to soil structure where temperatures between 220-460° C are generated (DeBano, Neary, & Ffolliott, 1998). No significant effects to soil bulk density, infiltration capacity or soil moisture content are expected (Seymour & Tecle, 2004).

Organic Matter

All proposed treatments would leave varying amounts of organic matter on the site. Woody debris will be retained at 5 to 21 tons per acre as per Forest Plan Amendment 21.

The total amount of nutrients on a site would likely be reduced where organic matter would be removed or displaced. However, plant available nutrients mineralized from organic matter would increase due to increased incoming solar radiation and soil moisture. These conditions accelerate the decomposition of the remaining organic matter and the release of plant-available nutrients in the treated stands (Harvey et al., 1994).

After project implementation, competition between trees would be reduced because fewer trees would remain on the sites. This situation could result in more available nutrients and water for the remaining trees, potentially conferring greater growth, vigor, and disease resistance (Powers et al., 2005).

It is important to note that nutrients in soil and organic matter are not the only nutrients available to the forest vegetation. In logging followed by low severity broadcast burning there would be no long-term depletion of nitrogen reserves because lost nitrogen would be more than replenished by inputs from

precipitation and by biological nitrogen fixation over a rotation of 100 to 150 years (Jurgensen, Harvey, & Larsen, 1981).

Regeneration Harvest

These treatments would remove the most overstory vegetation and have the potential to remove more amounts of organic matter than intermediate harvests. Whole tree yarding would remove tops and branches of harvested trees from the stand to the landing for disposal by pile burning, chipping/masticating, and/or removal. Units proposed for excavator pile burning or broadcast burning would leave much of the nutrients associated with the slash on the site to be used by the remaining forest vegetation.

All harvest prescriptions would leave a portion of the existing stand on the site. Remaining living trees and vegetation in stands will serve as potential nutrient sources on the site.

Commercial Thinning

These treatments would leave a large portion of the existing stand on site, which would maintain more organic matter on the site than regeneration harvests. Whole tree yarding would remove tops and branches of harvested trees from the stand to the landing for disposal by pile burning, chipping/masticating, and/or removal.

Excavator Piling and Burning

This post-harvest treatment will be used for mechanical site preparation work. The proposed site preparation activities would reduce organic material on sites while reducing hazardous fuel loads. A variety of organic material would remain on the site after project implementation.

Prescribed Burning

The effect of fire on soil is described as burn severity, which depends on the duration of burning and intensity (Certini, 2005). Long duration burns tend to reach higher temperatures and penetrate deeper into soil, resulting in more soil microbial kill and consumption of soil organic matter (ibid). These burns result from burning of heavy ground fuel, such as with downed logs and large slash piles. Short duration burning can be associated with fast moving wildfire that blackens trees but leaves some of the forest floor intact. This usually results in low to moderate burn severities on the ground with heat only penetrating a few centimeters (Hartford & Frandsen, 1992).

Prescribed fire activities that result in dominantly low to moderate burn severities would best preserve soil productivity. The amount of nutrients available to plants would increase as a result of the burning. Proposed burn conditions would allow many plants to quickly return to the burned sites from unburned roots and seeds in the soil. Post-fire vegetation response would utilize available nutrients, reducing nutrient leaching. Native forest vegetation would remain on the site, including some of the existing trees.

The ultimate goal of this effort is to maximize the intended vegetative response while minimizing resource impacts. Fire intensity represents the magnitude of produced heat. It is distinct from soil burn severity. Fire management personnel should design burn plans and implement burning activities to minimize the occurrence of high soil burn severity while achieving burn intensities adequate to attain objectives.

Hazardous Fuel Reduction – Mechanical Treatment

Mastication treatments substantially increase woody debris (Harrod et al., 2009). These treatments will not result in additional removal of organic matter from the stand and effects to the forest floor will be minimal.

Other potential mechanical fuel treatments would be similar to those described under ground-based harvest effects in this section.

Hazardous Fuel Reduction – Hand Treatment

Lop and scatter treatment units will be treated by hand and have slash dispersed throughout the unit. Organic matter will not be removed and there will be no measureable effects to the forest floor.

Limiting hand pile size to less than 50 square feet will reduce surface organic horizon loss and limit soil heating. Pile burning when duff moisture is 80 to 100 percent may also reduce organic matter loss and soil heating.

The amount of nutrients lost as particulate matter would be minor. Ash from burned hand piles would contain nutrients available to emergent vegetation, but no significant increases in nitrogen and phosphorus are anticipated (Seymour & Tecle, 2005).

Soil Microorganisms

Post-fire recovery of soil microorganisms occurs rapidly, frequently resulting in population levels greater than before the fire (Jurgensen, Harvey, & Larson, 1977). Less disturbed areas of soil play an important role in inoculating soil lacking or having reduced populations of soil microorganisms (Borchers & Perry, 1990). Unburned areas within prescribed burn units, adjacent undisturbed areas, large woody debris and soils that have only minor amounts of disturbance contain propagules for fungi, bacteria, and other soil organisms and these propagules can be freely dispersed by wind, animals and other agents (ibid).

The variety of organic matter left on the proposed harvest areas would benefit soil microorganisms by providing substrate and habitat. Microbial measures in harvest areas are expected to meet, or exceed, levels in unharvested stands within 40 years (Page-Dumroese, Busse, Overby, Gardner, & Tirocke, 2015). All alternatives would leave both dead and live trees. All alternatives and all proposed activity areas would result in less than 15 percent of the area detrimentally disturbed. Many areas would be undisturbed by equipment. These areas would be a source of propagules in disturbed sites. The amounts of live and dead trees to be left in the proposed harvest areas are described in Chapter 2.

Public comment indicated some concern for post-harvest, indirect effects to mycorrhizal fungi though loss of soil moisture associated with canopy removal. Experimental results indicate mycorrhizal growth and colonization are not affected by soil moisture reductions (Cavagnaro, 2016). This project will follow proven measures to limit indirect effects to mycorrhizal fungi include limiting soil disturbance, removal of forest floor, soil burn severity, and burn duration, as well as maintaining soil organic material and decaying wood (Amaranthus, 1991). No detrimental impacts to mycorrhizal fungi will result from vegetation management proposals.

Soil compaction, puddling, rutting, and displacement reduce gas exchange and can potentially affect soil microorganism survival. Favorable habitat for soil organisms would be maintained because all proposed harvest areas would be designed to reduce soil disturbance to meet soil quality objectives.

Soil Erosion

- Soil erosion risk would be minimized by implementing design features listed in Chapter 2.

Sediment from the permanent transportation system has direct effects on water quality, but is not a component of the soil assessment process. These effects are evaluated in the *Aquatics* section of this EA.

Timber Harvest and Mechanical Hazardous Fuel Reduction

Management activities that leave organic matter on the soil surface minimize soil erosion. Watershed Erosion Prediction Project (WEPP)(See *Aquatics* Section of this EA) model results estimate the potential soil erosion rate from mechanical treatment units at 0.1 tons/acre (*Project File Exhibit H-20*). The probability of occurrence in the first year following treatment is 0 to 12 percent. By way of comparison, the average annual erosion on Montana cropland in 2007 was 6.4 tons/acre/year. A ton of soil spread across an acre would be as thick as a dime.

Hazardous Fuel Reduction – Hand Treatment

Maintenance of infiltration rates and effective ground cover of soils is necessary to prevent erosion. The lack of compactive forces in addition to small pile burning would not result in a significant reduction in infiltration rates over undisturbed soil. Although reductions in effective ground cover are expected at the small burn pile locations, the lack of accompanying increase in overland flow and the rapid establishment of live plant cover will reduce short-term soil erosion. No long-term soil erosion is anticipated from this treatment.

Soil erosion would be unlikely to occur as a result of lop and scatter or mastication thinning treatments. Masticated material and hand thinning slash would add cover to the soil surface, reducing the risk of erosion.

Prescribed Burning

With return period analysis based on a 50 year climate average there is a 0 to 12 percent probability there will be erosion in the first year following implementation of prescribed burns. Model results put the amount of erosion in this scenario at an average of 0.02 tons per acre. (*Project File Exhibit H- 20*).

Post-fire vegetative response will be rapid, regardless of burn severity and areas that burn intensely will have sufficient organic material and vegetative response to reduce risks to soil erosion (Lentile et al., 2007). Soil erosion rates would decrease as vegetation and effective ground cover are re-established.

Mass Failure

High rates of slope stability were observed during field investigations of all proposed activity areas. These areas are well-suited for the proposed management activities. The occurrence of any mass failure activity as a result of implementation of any of the proposed actions is unlikely.

Temporary Road Construction

All temporary roads constructed for this project will be reclaimed by any site-appropriate combination of design features listed in *Chapter 2* of this EA.

Re-contouring activities would not ameliorate the long-term impacts to soil productivity immediately, but would improve soil conditions compared to those of an existing or abandoned road. The establishment of vegetation and associated additions of organic matter would encourage recovery over time. Re-contouring would provide a suitable seed bed for native forest vegetation while increasing soil hydraulic conductivity, organic matter, total carbon, and total nitrogen (Lloyd, Lohse, & Ferré, 2013). These conditions would likely accelerate the recovery of the soil productivity.

Erosion is expected from temporary roads when native surfaces are exposed to rainfall impact and overland flow. Some areas might have short-term increases of soil erosion above two tons per acre per year. Erosion rates would decrease as roads are obliterated following use.

WEPP model results estimate the potential amount of soil erosion from these uses at a maximum of 2.1 tons per acre per year over the three year sale contract period. Total potential erosion at this rate would be 5.5 tons. This figure represents total erosion from all segments for the anticipated duration of use (*Project File Exhibit H-20*).

System Road Construction

New system roads are considered dedicated lands removed from the productive land base and thus are not included in soil quality objectives. Permanent road re-construction would consist of 3.2 miles of system road constructed over decommissioned National Forest system roads. New permanent road construction would total 0.8 miles. Road reconstruction would result in a minimal loss of soil productivity from the corresponding area as the original, stable road templates were left in place after decommissioning. New construction would result in a reduction of approximately 2 acres from the forest's productive land base.

System Trail Construction

New system trails are considered dedicated lands removed from the productive land base and thus are not included in soil quality objectives. These designations would consist of a maximum of 40 miles of new system trails within the project area and would result in a maximum reduction of approximately 17 acres from the forest's productive land base.

Other Recreation Proposals

Although impacts on soils in designated recreation areas and permanent roads fall outside of the analysis areas, they are discussed and reviewed for potential issues. Upgrading of the Holbrook parking area to a designated trailhead and the creation of road right-of-way pullouts would result in some short-term erosion and minor displacement during the construction phase. There would be no additional impacts to soil productivity.

Best Management Practices/Aquatics

Culvert removals and temporary bridge installation would cause some short-term soil erosion during the construction and removal phases but would result in improved road drainage and a reduction of road failure risk during high flow events.

Action Alternatives – Cumulative Effects

The risks of cumulative effects were assessed within each proposed activity area. Cumulative effects consist of the impacts from all past, present, future and proposed activities overlapping in time and space with the proposed project area. Units proposed for mechanical treatment were reviewed on the ground to quantify the effects from past activities and determine if existing levels of detrimental disturbance exceed the Region 1 soil quality objectives.

The estimated cumulative effects for each activity area from implementation of the action alternatives are displayed in Table 3-43. These predicted cumulative detrimental soil disturbance values are based on implementation of all design features for soils in *Chapter 2*.

Table 3-43. Cumulative Effects Summary – Alternatives 2 and 3

Unit	Existing Condition DSD	Treatment DSD	Temporary Road DSD	Cumulative DSD
1	6%	2%	0%	8%
2	6%	2%	0%	8%
3	7%	6%	0%	13%
4	0%	6%	0%	6%

Unit	Existing Condition DSD	Treatment DSD	Temporary Road DSD	Cumulative DSD
5	0%	2%	0%	2%
6	0%	8%	1%	9%
7	6%	8%	0%	14%
8	6%	8%	0%	14%
9	11%	3%	0%	14%
10	2%	6%	0%	8%
11	7%	2%	0%	9%
12	3%	6%	1%	9%
13	0%	10%	0%	10%
14	5%	8%	0%	13%
15	2%	10%	0%	12%
17	0%	10%	0%	10%
19	0%	8%	0%	8%
20	0%	6%	0%	6%
21	0%	10%	0%	10%
22	0%	8%	0%	8%
23	6%	2%	0%	8%
24	3%	2%	0%	5%
25	7%	6%	0%	13%
27	2%	10%	0%	12%
28	7%	6%	0%	13%
29	3%	2%	0%	5%
30	0%	8%	0%	8%
31	0%	2%	0%	2%
32	3%	8%	0%	11%
33	0%	8%	0%	8%
34	0%	8%	1%	9%
37	0%	0%	0%	0%
38	0%	0%	0%	0%
41	2%	2%	0%	4%
42	0%	8%	0%	8%
43	0%	10%	0%	10%
44	1%	6%	1%	8%
45	0%	2%	0%	2%
46	3%	6%	0%	9%
47	0%	6%	0%	6%
48	3%	6%	0%	9%
49	0%	8%	0%	8%
50	3%	6%	0%	9%
51	0%	6%	0%	6%
52	0%	10%	0%	10%
53	0%	10%	0%	10%
100	0%	6%	0%	6%

Unit	Existing Condition DSD	Treatment DSD	Temporary Road DSD	Cumulative DSD
101	0%	6%	0%	6%
103	0%	6%	0%	6%
104	3%	6%	0%	9%
105	0%	6%	0%	6%
106	0%	6%	0%	6%
107	0%	6%	0%	6%
108	0%	6%	0%	6%
143	3%	0%	0%	0%
144	0%	0%	0%	0%
145	0%	0%	0%	0%
146	0%	0%	0%	0%
B1	0%	3%	0%	3%
B2	0%	3%	0%	3%
B3	0%	3%	0%	3%

Contrasting Effects of Action Alternatives with Past Actions

The estimated level of detrimental disturbance from this proposed project is less than that associated with harvest activities that occurred earlier than 1990. During the past two decades the level of concern for maintaining soil quality has greatly increased. This increase has been accompanied with implementation of management practices that protect the soil. These changes include:

- The use of excavators instead of bulldozers for mechanical site preparation
- Use of designated skid trails
- Operating when soils are dry or when winter conditions would protect soil
- Use of cut-to length/log forwarder systems
- Use of slash layers to reduce effects on skid trails
- Full rehabilitation of temporary roads

In addition, timber sales are audited for compliance with BMPs and are monitored as specified in the NEPA decision, both of which contribute to better results.

Effects of Ongoing and Reasonably Foreseeable Activities

Most ongoing and foreseeable activities would not overlap with either action alternatives in both time and space. Specifically, their effects do not overlap in space as they occur outside of the proposed activity areas.

Combined Effects from Past, Proposed, Ongoing and Foreseeable Activities

Several proposed units in the action alternatives would have cumulative effects from the combination of past and proposed activities. These effects are displayed in Table 3-43. All proposed activities associated with the action alternatives would meet the soil quality objectives with the implementation of the design criteria for soils described in *Chapter 2*.

Summary of Effects or Statement of Findings

The soil analysis indicates that all alternatives and all activities proposed by the alternatives would meet the Region 1 soil quality objectives through the implementation of management practices outlined in *Chapter 2*. All Forest Plan management direction would be met by the proposed alternatives.

Regulatory Framework and Consistency

Forest plan soil resource standards ensure that all resource management activities will maintain soil productivity and minimize erosion through implementation of:

- Management direction presented in the Landtype Guidelines
- Erosion Prevention Standards (Engineering Handbook Supplement)
- Design or modify all management practices as necessary to protect land productivity

The Soil and Water Conservation Practices Handbook is incorporated by reference in the Forest Plan (Forest Service handbook 2509.22 - Soil and water conservation practices handbook, 1988). The Handbook describes Best Management Practices (BMPs) to be used in the planning and implementation of timber sales and associated activities.

The National Forest Management Act requires that Forest Service regulations implementing NFMA specify guidelines to insure that timber will be harvested from National Forest System lands only where “soil, slope, or other watershed conditions will not be irreversibly damaged.” 16 USC 1604(g)(3)(E)(i). Region 1 soil quality objectives identified in Forest Service Manual (FSM) R-1 Supplement 2500-99-01 (see AR Doc. H-72) were set forth to meet the direction of NFMA to manage Forest Service lands without permanent impairment of land productivity and to maintain or improve soil quality.

Regional guidance is available from the Region 1 Forest Service Manual for Soil Management FSM 2500-99-1. Regional policy states “(d)esign new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent.”

This page intentionally left blank.

Threatened and Sensitive Plant Species

Introduction

This document analyzes the potential effects of the proposed Taylor Hellroaring Project on Federally listed plants and Regional Forester sensitive plants occurring or potentially occurring on the Tally Lake Ranger District, Flathead National Forest. This document complies with the legal requirements set forth under the policies and standards set forth in the Endangered Species Act (ESA) of 1973 and Forest Service Manual (FSM) 2670.

Under provisions of the ESA, federal agencies are directed to conserve endangered and threatened species and to ensure that actions authorized, funded, or carried out by these agencies are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of their critical habitats.

Water howellia (*Howellia aquatilis*), a vascular plant species in the family Campanulaceae, was listed as threatened under the ESA by the U. S. Fish and Wildlife Service (USFWS) on July 14, 1994 (FR 59(134): 35860-35864). No critical habitat has been identified for the species. A draft recovery plan was issued, but no recovery plan has been finalized. Recently, the U.S. Fish and Wildlife Service has released a 5-year review of the status of water howellia and has found that the threats to water howellia identified at the time of ESA-listing have been removed or largely minimized and has recommended it for delisting (USDI 2013).

Spalding's catchfly (*Silene spaldingii*), a vascular plant species in the family Caryophyllaceae, was listed as threatened under the ESA by the USFWS on November 9, 2001 (FR 66(196): 51598-51606). Although the USFWS intends to identify critical habitat for this species, critical habitat designation was precluded at the time of listing due to a lack of funding. A recovery plan was finalized in 2007 (USDI 2007).

Whitebark pine (*Pinus albicaulis*), a tree species in the family Pinaceae, was listed as a candidate species under the ESA by the USFWS on July 19, 2011 (FR 76(138): 42631-42654). USFWS determined that whitebark pine federal listing is warranted but precluded, which makes the species a candidate for federal listing as threatened or endangered. As a result, Region 1 added whitebark pine to the Regional Forester's Sensitive Species list, to take effect December 24, 2011 (USDAFS 2011).

Forest Service Sensitive Species Policy (FSM 2670) directs national forests to assist states in achieving conservation goals for endemic species; complete biological evaluations of programs and activities; avoid and minimize impacts to species with viability concerns; analyze the significance of adverse effects on populations or habitat; and coordinate with states and USFWS. The Forest Service Manual (2670.15) further defines sensitive species as those plant species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trend in numbers, density or habitat capability that would reduce a species distribution.

In addition to federally listed threatened and sensitive plant species, the forest also has an obligation to protect Montana state listed plant species of concern.

Information Sources and Methodology used for Analysis

Resource Indicators and Measures

Methodology

Sensitive and rare plant species are grouped in habitat guilds (*Project File Exhibit S-1*). Known vegetation types and elevation ranges of the project area were considered in evaluating suitable habitat for rare plants. All proposed treatment areas were evaluated for potential habitat and those identified areas were surveyed for Threatened, Endangered, and Sensitive (TES) plants and invasive plant species. Surveys for TES plants within the project area were conducted during the 2017 field season in the proposed harvest units. (*Project File Exhibit S-2*)

Information Sources

Data sources used in this analysis include the Montana Natural Heritage Program's (MNHP) Element Occurrence Database, the Flathead National Forest's Survey Atlas, and the Forest Service Natural Resource Management (NRM) database.

Incomplete and Unavailable Information

Little is known about the historical condition for threatened and sensitive plants in the FNF and in the project area. Botanical surveys were not initiated in the area before the onset of the Forest's Botany program in 1991.

Affected Environment / Existing Condition

The USFWS Montana Field Office currently lists two species as threatened for the FNF: water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) (USFWS 2017). There are no documented occurrences for these two species in the Montana Natural Heritage Program (MNHP) rare plants database or the NRM database on the Tally Lake Ranger District. See *Project File Exhibit S-1* for more information.

There are 52 recognized Regional Forester's sensitive plant species (RFSS) for the FNF (USDAFS 2011; *Project File Exhibit S-1*). The MNHP and NRM databases were queried to determine known sensitive plant occurrences within the analysis area. There are individuals of whitebark pine in the project area. No other rare plant species were detected during surveys.

Environmental Consequences

Analysis Area

The analysis area is the proposed units as shown in Map 1 in *Appendix A*.

Spatial Bounds

The analysis area for this project is based on the area of the project's influence/impacts on known occurrences or suitable habitat for TES plant species. The analysis area is confined to the project area and includes all treatment units and road systems with activities related to this proposed project.

Temporal Bounds

The temporal bounds may be up to 100 years after project implementation (Kuopat 2009). The recovery of individual plants and populations after a disturbance event is species-specific and may depend on the disturbance type and its effects to the microsite, the tolerance of the species to disturbance, and the species methods of reproduction (i.e. rhizomes, taproots, bulbs, and corms). Following project implementation, vegetation conditions may be suitable for some TES plant species to become established immediately while other species may take between 50 and 100 years to return to the tree and shrub canopy cover conditions that provide suitable habitat.

Direct and Indirect Effects

No Action Alternative 1

Water howellia

No known occurrences of water howellia exist within the project area, based on FNF occurrence records and Montana Natural Heritage database. The nearest known occurrences are located in the Swan Valley.

No direct, or indirect, effects to water howellia from this project are expected, due to the lack of habitat and no known occurrences of water howellia within the project area.

Spalding's catchfly

There are no known occurrences of Spalding's catchfly within the project area or within the Flathead National Forest, based on FNF occurrence records and Montana Natural Heritage database.

No direct, or indirect, effects to Spalding's catchfly from this project are expected, due to the lack of known occurrences or suitable habitat within the project area.

Regional Forester's Sensitive Species

There would be no direct, or indirect, effects to RFSS or SOC plants as a result of this project. Whitebark pine would be expected to decrease across the high elevation stands due to competition from subalpine fir and mortality caused by white pine blister rust. White pine blister rust would continue to infect and kill susceptible whitebark pine in the analysis area. Ladder fuels would increase resulting in an increase in conditions conducive to stand replacement wildland fire. This alternative would not provide conditions necessary to regenerate the long-lived, seral species whitebark pine until a stand replacement fire event occurred.

Proposed Action Alternative 2

Project Design Features

The project would use a combination of site specific design features, standard operating procedures and best management practices to reduce potential adverse impacts to threatened and sensitive plant species. Project design features are located in *Chapter 2*.

Known occurrences

There are individuals of whitebark pine in the project area. Cone-bearing individuals would be avoided in the project area from harvest activities; however, whitebark pine habitat would be affected by prescribed burning. Protection of whitebark pine trees that are cone bearing that exhibit potential rust resistant would be protected from prescribed burning to the best of the Forest Service's ability. Firing will attempt to not ignite under whitebark pine trees. Aerial ignitions will avoid groups of whitebark pine.

Suitable Habitat

The project area contains habitat types for sensitive plants associated with subalpine forests, mid-elevation moist coniferous forest and margins, riparian, alpine, and disturbed habitat groups listed in Appendix B. Undocumented occurrences of RFSS plants may be affected by soil disturbance, competition from invasive species, roadside dusting, and increased light availability due to project activities.

Timber Harvesting – Harvesting in upland forested areas can alter suitable habitat. The removal of canopy cover allows more light to the ground, as well as more air movement, which can decrease humidity and increase temperatures. These changes to microclimate can indirectly affect any existing RFSS individuals. Impacts include wilting from increased temperature and decreased humidity and sunburn from increased light levels. These changes to the habitat can also make these areas more suitable for invasion by invasive species.

Commercial thinning would retain an average of 40 percent canopy cover, while a shelterwood treatment remove most trees from the harvested area, leaving up to 30 or 40 trees per acre (*Table 2-2*). Regeneration harvests such as seedtree, shelterwood and clear cut harvests would have the most impact on suitable habitat, since it would change the site conditions considerably, and it could take up to 50 years for the canopy to recover. This treatment mimics stand-replacing fires by removing up to 95 percent of the canopy. The habitat guilds which would be affected by these treatments are mid-elevation moist coniferous and subalpine forests.

The method of tree removal would be mechanized (tractor or skyline). Both prescriptions would be implemented with both of these methods. Excavator piling followed by burning or whole tree yarding is the proposed method for slash treatment in both the commercial thin and seed tree units. Mechanized harvesting and slash removal creates soil disturbance, which removes native vegetation from the landscape and alters suitable habitat, as well as provides suitable conditions for invasive plant species.

Tree planting in regeneration treatments would occur post-harvest if units do not naturally regenerate. These are units where inadequate natural regeneration of tree species is predicted. Shade-intolerant tree species are expected to regenerate in these units, including western larch and western white pine.

Fuel Treatment Activities – Suitable habitat in the proposed prescribed burn units would be directly affected for a brief period due to burn over of the site. Burning activities that occur after germination and prior to seed set for annual plants could possibly reduce population viability for plant populations. Perennial plants would also be burned over; however, depending on fire severity, rootstock would remain intact and experience temporary temperature increases in the soil. These effects would be a short duration and may benefit these plants by stimulating growth and removing debris from their stem bases. Understory prescribed fire and

thinning of the canopy may stimulate the expansion of undetected populations by reducing competition and increasing light penetration for those species that thrive in open conditions. However, fire activities can also increase exposed mineral soil and increase the risk of these areas to invasive species establishment, which would affect the integrity of suitable habitat. The risk of weed establishment would be low due to the low number of documented infestations in the project area.

Other activities include the burning of hand piles. Past observations have seen these piles as high risk for invasive species infestations. The high intensity burning of the confined area essentially sterilizes the soil and greatly inhibits native revegetation (Hebel, et al. 2009). Although invasive species are also inhibited by the lack of nutrients, they are better adapted to these sterile conditions, and once they are introduced, there are no natural barriers to prevent establishment and persistence of invasive species. These areas are priority for post-treatment monitoring, seeding with a grass mix, and possible herbicide treatment.

Understory Removal – This fuels treatment proposed to minimize hazardous fuel accumulation and ladder fuels. Small trees (up to 7 inches diameter at breast height) and down wood (up to 9 inch diameter) would be cut, and slash would be hand or excavator piled and burned or masticated. This type of treatment is intended to reduce the potential for crown fire and allow firefighters to more safely engage initial attack or extended attack fires. The over story trees and large snags in these stands would remain. Hand treatment would be utilized on slopes >40 percent, where access is limited and/or in grizzly bear security core, otherwise mechanical treatments may be utilized. An additional benefit of this treatment is the preparation of conditions suitable for whitebark pine restoration at elevations greater than 6000 feet. White pine blister rust-resistant white bark pine could be planted in the openings created by this. Increased light and moisture would be available to those trees left after treatment and to the understory vegetation, improving growth and vigor of these components. Hand treatments do not create as much soil disturbance and virtually no removal of native vegetation as mechanical slash removal used in commercial treatments.

Roads – There are approximately 0.4 miles of temporary roads proposed on FS land for the project area. Once the project is completed, the temporary roads would be rehabilitated post-implementation using a variety of design criteria. Temporary roads can become corridors for invasive species to enter areas that would not normally be at risk of invasion. By allowing invasive species into natural areas, suitable habitat decreases. Rehabilitating these roads, and seeding them with an approved seed mix, has inhibited weed spread in the past and would be implemented in this project.

Nearly four miles of roads are proposed to be added to the system. The majority of these roads are on existing templates. Reconstruction activities include widening the roadbed, brushing, blading, installing culverts, cleaning ditches, etc. These templates have already altered suitable habitat. Reopening them increases the risk of weed spread and introduction into the adjacent forest; adjacent harvest units to infested roads would have a higher risk.

Alternative 3

This alternative proposes fewer trails. The effects for rare plant species are the same as stated in the analysis for the Proposed Action above. The amount of effects would be less in Alternative 3 than in the Proposed Action, as in less soil disturbance, fewer edge effects, etc.

Cumulative Effects

No Action

Water howellia

No cumulative effects to water howellia from this project are expected, due to the lack of habitat and no known occurrences of water howellia within the project area.

Spalding's catchfly

No cumulative effects to Spalding's catchfly from this project are expected, due to the lack of known occurrences or suitable habitat within the project area.

Regional Forester's Sensitive Species

There would be no cumulative effects to RFSS or SOC plants as a result of this project.

Alternative 2

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Past, present, and reasonably foreseeable actions within the project area include timber harvest, fuels treatment, road construction and maintenance, dispersed and developed recreation, land development, wildland fire and fire suppression, weed control, and forest product use. These actions may have historically affected RFSS plants and may continue to have effects.

Timber Harvesting – Timber harvesting decreases canopy cover and increases light level to the forest floor. This may be beneficial for some sensitive species, but may have adverse effects for other species requiring greater canopy cover (e.g. clustered lady's-slipper). Over time, changes in forest structure alter native vegetation types and sensitive species habitat. In many cases, timber harvesting creates stand changes similar to wildland fire; however, the pattern and distribution of forest size classes has drastically shifted from historical patterns that were created under natural disturbance regimes. Today forested stands are more fragmented in forest structure and size class across the landscape than in the past.

Timber harvest activities disturb soil which increases the amount of exposed mineral soil. This includes mechanized equipment moving over the ground, as well as skid trails necessary for tree removal. Soil disturbance carries a higher risk of invasive species establishment, and if equipment is contaminated, also has a higher risk of introduction of invasive species. Soil disturbance also exposes the dormant seed bank in the soil. The introduction and establishment of invasive species would affect the integrity of native and sensitive species habitats.

There is evidence of past harvesting prior to Forest Service ownership in this area (1960s) over approximately 400 acres. The native vegetation has been left alone for many years and does not have much in the way of non-native competition. The Stoltz lands in the project area have been harvested for timber in the past and will continue to be harvested into the future. State land in and adjacent to the project area has had some timber harvest in the past, which will likely occur in the future as well.

Roads – Past, present, and future maintenance/construction of roads can have both adverse and beneficial cumulative effects on TES plant populations. Disturbance of roadsides may benefit those species that have a competitive edge in disturbed environments (i.e. Howell's gumweed, pale corydalis, Austin's knotweed, and western moonwort); yet disturbance would temporarily adversely affect these populations until new seedlings establish. Since there are so few roads in the project area, there would be not as much disturbance or weed spread to affect RFSS habitat. When roads were built, they may have affected rare plants, but there are no historical accounts of flora from this area.

Wildland Fire and Fuels Reduction – In general, NFS lands contain high fuel loads in the understory due to fire suppression over the last century. Wildland fire suppression has created a denser understory condition in many un-treated stands where historically, low intensity understory wildland fires occurred regularly. The fires that have been eliminated from the understory played a role in reducing fuels and encroaching vegetation. Wildland fire suppression, resulting in closed-canopy forests, has reduced light levels and affected understory vegetation. Additionally, wildland fire suppression activities increase exposed mineral soil which can be vulnerable to invasive species establishment, which would affect the integrity of RFSS habitat. When wildland fires occur, they can often burn hotter, affecting the soil and reducing its nutrient content. Native plants eventually grow back over time, but often compete with invasive species for the remaining nutrients.

Fuels reduction, whether by the Forest or by other landowners, reduces the risk of catastrophic wildland fires and the need for fire suppression activities. Since vegetation removal is part of fuels reduction activities, there is a risk of disturbing undocumented RFSS plant populations; however, an intense burn would also disturb existing RFSS populations. The most recent large wildland fire in this area was in 2001 (Werner Fire). Fires in this area are actively suppressed.

Recreation – This project area does not have much developed recreation save for the Whitefish Mountain Resort on Big Mountain, which part of the permit area overlaps the project area. The disturbed areas in the permitted area include lift corridors, roads, ski runs and the Danny On Trail. Additional trails from this project would increase the amount of effects in the project area, in addition to existing features. Alternative 2 would have more cumulative effects to the landscape than Alternative 3 due to more trails proposed. These linear, non-vegetated features create edge effects into the adjacent understory and affect suitable habitat by increasing light and temperature, and decreasing humidity. These features also provide corridors for invasive species, allowing them to move into the understory.

This area is also very popular for forest product collection, specifically huckleberry picking. There are many vehicles parked alongside the roads in the project area during July and August, many of which are from out of area. This kind of activity creates user-made trails into the understory, creating disturbance, changing light and humidity conditions, and increasing the risk of introducing weeds.

Other recreation activities such as off-trail hiking, hunting, trapping, dispersed camping, and horse riding can also impact sensitive plant habitat. Native vegetation and RFSS plants may experience cumulative effects of trampling and collecting from dispersed recreation.

Land Development – Effects to sensitive plant resources as a result of past development and land clearing on private lands could have been detrimental to population viability; however, since there is no historical data on sensitive species, it is difficult to analyze those actions. Much of the suitable habitat for plants associated with wetlands has been lost or degraded on private

lands. These areas have been used for development and were often cleared of trees or drained. Continued development of lands could reduce potential habitat, alter hydrologic regimes, and increase the likelihood for new invasive species establishment. There are many other land owners adjacent to the project boundary, some of which have buildings, driveways and roads over the years. These activities have altered the landscape permanently and are expected to continue.

Alternative 3

Alternative 3 has the same cumulative effects as Alternative 2 but with fewer proposed trails. There would be fewer long term edge effects and less soil disturbance.

Summary

The proposed Taylor Hellroaring Project may affect whitebark pine since individual trees and suitable habitat occur in the project area. No other RFSS or SOC plants were documented during surveys or from databases in that area. There would be effects to suitable habitat. Suitable habitat would presumably recover in 10 to 50 years after implementation in areas of harvest. Temporary road corridors that have been recontoured would take longer due to the lack of existing native vegetation and soil biota in those corridors.

Regulatory Framework and Consistency

The Taylor Hellroaring Fuel Reduction Project would meet the direction outlined by the Flathead National Forest in the Forest Plan and Amendments, as well as direction found in FSM 2670. It is also in compliance with the Endangered Species Act and the National Forest Management Act. The biological evaluation and assessment (*Project File Exhibit S-1*) provides additional information on the potential effects of the alternatives.

Invasive Plant Species

Introduction

The introduction of non-native invasive plant species continues to reduce the ecological integrity and economic productivity of natural systems and agriculture on a worldwide basis. These are plant species that are not native to a particular place and are disrupting the natural processes of that place (i.e., displacing native plants or animal species, degrading natural communities, changing hydrology, changing microclimatic features, increasing soil erosion, etc.). Non-native invasive species generally have no natural control in the place to which they are introduced, allowing them to spread aggressively, out-compete native plants, and reduce overall native community biodiversity.

Forest Service Policy (EO 13112; FSM 2900) identifies prevention of the introduction and establishment of non-native plant species as an agency objective. This policy directs the Forest Service to:

- Determine the factors that favor establishment and spread of invasive plants,
- Analyze invasive species risks in resource management projects, and
- Design management practices that reduce these risks (USDA 1995, 2001a; USDA Forest Service 2011).

The desired condition inferred from EO 13112, FSM 2900, and the 2001 Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment (NIWC EA) (*Project File Exhibit W-2*) and Decision Notice (NIWC DN) (*Project File Exhibit W-3*) is the prevention of new infestations (within the area where activities would occur or from the use of travel routes associated with those activities) and to manage the infestations currently established on the forest through control measures.

Invasive Species Management

The Flathead National Forest implemented the NIWC DN (*Project File Exhibit W-3*), which evaluated the effects of treating invasive plants. The objective of the NIWC DN was to implement an adaptive and integrated pest management strategy to control and reduce the presence of invasive species on the Flathead National Forest. Currently, inventory and treatment is prioritized by the Forest Weed Coordinator. The NIWC DN outlines factors for prioritization (*Project File Exhibit W-3*, pp. 6 - 7).

Methods used to prevent invasive species from being introduced and spreading into new areas include washing vehicles and equipment upon entering or leaving an area, using weed-free seed and straw mulch for re-vegetation, and possibly closing infested areas to travel. Methods to control the spread of invasive species include prevention, treatment, and containment. Treatments, such as manual, mechanical, biological, and chemical methods, are generally limited to localized areas and Montana State listed invasive species (MNWP 2015). Containment combines prevention and treatment with the objective of limiting spread of an existing infestation and reducing the acres of existing infestations by treating around the perimeter of the infestation.

Information Sources and Methodology used for Analysis

Resource Indicators and Measures

Methodology

As project areas are surveyed during each field season, undocumented infestations are inventoried. Data for the Taylor Hellroaring project invasive species analysis were primarily collected by surveys in 2017 in the proposed units. The data are entered into the Natural Resource Manager (NRM) database, an agency-wide corporate database for storing, managing, and retrieving data on soils, geology, geomorphology, vegetation, wildlife, and climate. From this database, the Forest Botanist can retrieve invasive plant infestation data to create a GIS layer for environmental analyses. There are still many infestations that have not been entered into NRM; however, NRM has been updated with documented infestations located between 2005 and 2017, which includes the project area.

Invasive species can be introduced via machinery, passenger vehicles, animals, and recreationists. Disturbed areas, such as roadsides, trails, previous logging units, and old roads are more susceptible to infestation than undisturbed areas. Native vegetation takes longer to establish in these areas, which allows invasive species that are faster growing and have higher seed production and germination rates to invade an area and prevent native plants from re-establishing. Certain habitats, such as dry, warm, south-facing slopes, have a higher risk of infestation of certain weeds than wetter, cooler, shadier habitats. More common species, like spotted knapweed, thrive in dry, warm environments, while hawkweed can survive in most habitats on this forest. Other species such as reed canarygrass and Canada thistle thrive in cooler, wetter habitats, although there are fewer species adapted to these conditions. See *Project File Exhibit T-1* for contributing factors to weed movement and definitions of weed risk criteria.

Direct effects are the risk of spread/introduction of invasive species within the project area. These effects are the expansion or dispersal of current infestations as a result of project activities. They are measured by:

- The proximity of known infestations (within 0.25 mile) to proposed activities. Sites closer to known infestations and seed sources are more likely to become infested.
- The amount of travel through infestations spreading seed directly adjacent to infestation. This measure pertains to project-related activities and cannot be related to non-project traffic such as recreational vehicles or passenger cars, etc.

Indirect effects are the risk of establishment/persistence of invasive species within the project area. These effects are the likelihood that habitat becomes more suitable for the establishment and/or persistence based on project actions. They are measured by:

- The acres of harvest types affecting light availability by changing canopy cover. Sun-loving invasive species are able to establish and persist longer in units with increased light, and shade-tolerant invasive species would either be maintained or adapt to closing canopies.
- The acres of soil disturbance (both detrimental and non-detrimental), based on harvest activity and miles of road projects. Disturbed areas are more likely to be colonized by invasive species.

Information Sources

The FNF uses the Montana Noxious Weed List (2015) to identify which invasive species to manage across the Forest, as well as a weed risk assessment (WRA) project in the Northern Region coordinated between The Nature Conservancy and the Forest Service (USDAFS 2003). The WRA identified species that pose a threat to native vegetation in addition to Montana's state weed list.

Affected Environment / Existing Condition

Historic Condition

During the mid- to late-1800s, non-native invasive species rapidly established in the northwest of the United States due to settlement related to agriculture, importing of goods at main sea ports, farming, timber production, and livestock grazing (Parks, et al. 2005). Exotic seeds and plant material were transported with grain and feed and dumped with ballast water along the shore at major port entries. However, mountainous regions have relatively fewer invasive species than lowland regions, owing to the large amount of public land and minimal access in these areas. As a result, there are not as many people settling in these areas and the rate of introduction and spread are not as high as in more populated areas. However, invasive species have become established in these relatively isolated areas and often dominate landscapes. Locally, the rate of establishment and spread has been influenced by timber harvest, road building, grazing, and recreation. Most of these activities began on a large scale in the 1960s on the FNF. Some roadless areas remain relatively invasive-free because of healthy undisturbed native plant communities where few vectors exist to spread invasives.

The FNF has been less affected than many other public lands since most invasives are best adapted to grasslands, shrublands, and warmer/drier forest types than exist here. However, the Forest has many roads, landings, clearings, gravel pits, trails, campgrounds, and other areas that are disturbed and highly susceptible to invasion.

Existing Condition

There are few infestations in the project area that have been inventoried during project surveys and previous surveys (*Project File Exhibit T-2*). Much of the surrounding area is private land, state forest and the permitted area for Whitefish Mountain Resort, but the proposed units are in contiguous NFS lands.

The invasive species currently infesting the Taylor Hellroaring project area include primarily St. Johnswort, Canada thistle and hawkweed, with a few smaller infestations of other weed species. See *Project File Exhibit T-3* for species descriptions. There are about forty infested acres in the project area, primarily within the Whitefish Mountain Resort permitted area and along Taylor Creek Road.

Environmental Consequences

Analysis Area

Spatial and Temporal Context for Effects Analysis

The spatial bounds of the analysis area for invasive species are based on the project's influence and impacts on the risk of introduction, spread, and establishment of invasive species within

the project area. Because ground disturbance increases these risks, the analysis area includes all treatment units and road systems with activity related to this proposed project. A 0.25 mile buffer on treatment areas (road systems, proposed units, etc.) is based on the maximum skid distance logging equipment can potentially move vegetation and soil.

Project activities leading to soil disturbance and increased light would increase the risk of invasive plant introduction, spread, establishment, and persistence. Some shade-tolerant species, such as hawkweed, may persist indefinitely even after the canopy closes. The risk of invasive plant introduction and spread can occur immediately after activities begin, or until 5 to 10 years (average seed viability) after activities cease. The risk of invasive plant establishment and persistence may occur up to 50 years after implementation is complete, depending on native vegetation recovery. After 50 years, in the longest example, the overstory and understory tree and shrub canopy cover conditions would shade the ground and greatly reduce the risk of establishment and persistence by most invasive species (Kuopat 2009).

It is assumed that after the project is completed, the risk of introduction and spread due to project activities would be low. It is also assumed that after the canopy closes the risk of establishment and persistence would be low.

Direct and Indirect Effects

No Action

There would be no activities and, therefore, no direct or indirect effects that would change the existing condition with selection of No Action. Non-native invasive species would continue to persist at their current rates and may increase through natural means of spread (animals, wind, water) or by humans (foot travel, vehicles, OHVs), but not as a direct or indirect result of the No Action Alternative.

No Action carries the least amount of risk for invasive species introduction, spread, establishment and persistence, since there would be no entry into forested stands and no additional areas of ground disturbance. However, invasive species currently present within the project area could potentially spread into disturbed and undisturbed sites. Invasive species are well adapted to disturbed soils and open bare ground. Trails and old roads serve as corridors for spread. Once seeds are dispersed to a new site, the type of habitat and local disturbance patterns can influence the establishment and persistence of invasive species. Because No Action proposes no entry into recently disturbed areas and no additional ground disturbance related to this project, the risk of introduction, spread, establishment and persistence for invasive species in the project area would be low.

Proposed Action

Proximity

Close proximity of infestations can increase the risk of introduction and spread. The risk of introduction is greater when project activities are located near an existing seed source. For example, invasive species like Canada thistle have wind-dispersed seeds which can easily establish in freshly disturbed soil. The closer the infestation is to the disturbance, the greater the quantity of seed and the higher the rate of establishment. There are currently about forty acres inventoried within the project area, most of which are on roads and trail in the permitted area for Whitefish Mountain Resort, as well as Taylor Creek Road. Weed infestations were

inventoried in thirty-eight units during surveys, either within the unit or along an adjacent road to the unit.

Travel

Vehicle travel through infestations can spread invasive plant seed along road corridors from short to long distances. Invasive plant seed could be introduced from a nearby infestation or a distant source, in soil clinging to off-road vehicles, passenger vehicles and logging equipment, or transported by other sources (i.e. birds, animals, wind) (Von der Lippe & Kowarik 2007). Wind-dispersed seeds can be moved by fast moving vehicles without having to be physically attached. It is difficult to quantify the amount of traffic on highways, town roads, and NFS roads, although improved roads generally have more traffic than the unimproved roads. The Taylor Creek Road is a popular road with the public for recreational access and receives a lot of traffic in the summer months.

Travel on trails is similar in that hikers, bikers, and stock can be vectors for weed seed and move it down the trail, and into any areas off trail as well. Forty miles of trail are proposed for construction as well as overlaid on top of existing road prisms. Existing road prisms likely contain infestations that carry the risk of spreading weeds due to human and wildlife interaction.

Light Availability

Light availability is a crucial factor in plant growth. An increase in the amount and duration of light availability can increase the risk of establishment and persistence of certain 'sun-loving' species. Invasive species like spotted knapweed thrive in open conditions. Some species such as hawkweed thrive in both sun and shade. Other species like Canada thistle can survive on the forest edge without penetrating into deep shade. Depending on the species and the harvest activity, an area can either be susceptible to an infestation or can resist an infestation.

Light conditions can be measured by the acres of canopy removal such as timber harvesting and thinning. Both action alternatives proposed the same amount of timber removal (see Chapter 2 for specific acres). Only when the canopy closes would sun-loving invasive species be unable to thrive. If the increased light conditions are near an infestation of sun-loving species, the risk of spread is higher than in a clean area, and light conditions may encourage establishment into a suitable habitat. Once an infestation is established, it may persist for a long time, provided that vegetation conditions remain favorable, such as a clearcut harvest. However, as vegetation conditions change, the infestation may die back. Light availability would increase from this project.

Edge effects include increased light availability, as well as increased temperatures and decreased humidity. Depending on the edge, dusting can also be a factor. These effects alter the local climate for vegetation and impact individuals. Species diversity increase but often with non-native species (Buckley et al 2002; Nelson and Halpern 2005).

Soil Disturbance

Activities associated with timber harvesting, road maintenance and decommissioning, temporary road construction, trail construction, and fire suppression all disturb the soil. Soil disturbance prepares the ground for colonizing plant species by removing the native vegetation and duff layer, and exposing mineral soil. If seeds are introduced, they can germinate more readily in disturbed soil than if the soil surface was intact (Silveri, et al. 2001). If an area is already infested, disturbing the soil can expose dormant seeds, allowing them to germinate. Soil

disturbance does not automatically lead to increased rates of spread of invasive species, but can create favorable conditions for establishment of invasive plants (Christen & Matlack 2006). The removal of native vegetation and the compaction of the soil, which restricts native plant growth, allow invasive species to invade unchallenged (Trombulak & Frissell 2000).

Soil disturbance estimates are based on detrimental soil disturbance surveys collected by the Forest Soil Scientist; however, all soil disturbance that exposes fresh soil or the dormant seed bank is considered at risk for infestation. In addition to harvest activities, soil would also be disturbed by temporary road construction. See *Chapter 2* for miles of road, and see the Soils Section for amount of detrimental soil disturbance. All of these activities causing soil disturbance (detrimental and non-detrimental) provide suitable habitat for invasive species colonization.

Project Design Features

The project would use a combination of site specific design, standard operating procedures and best management practices to reduce potential adverse impacts to the landscape from invasive plant species. Project design features are located in *Chapter 2*.

Alternative 3

This alternative proposes 26 miles of new trail construction. The effects for invasive plant species are similar to those stated in the analysis for the Proposed Action above. The amount of effects would be slightly less in Alternative 3 than in the Proposed Action due to the lower trail mileage proposal

Cumulative Effects

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

No Action Alternative

Since there would be no direct or indirect effects from Forest Service actions that could contribute to invasive species introduction or spread, there would be no cumulative effects from this project. All infestations within the project area are eligible for treatment under a previous invasive species control decision (USDAFS 2001).

For all alternatives including the No-Action Alternative, there is the potential for wildland fire. A wildland fire within the project area could increase the risk of spread, establishment, and persistence of invasive species weeds in the project area. Wildland fire would expose bare ground that may be susceptible to invasive species establishment. The areas that would have a higher risk of weed spread following a wildland fire are adjacent to roads, recreation trails, and suppression activities. Without the fuel reduction treatments in the Proposed Action, the risk of wildland fire is greatest in the No Action alternative.

Proposed Action Alternative

Past, present, and reasonably foreseeable actions within the project area that have affected or would affect invasive species include timber harvest, wildland fires and fire suppression, road construction and maintenance, recreation, weed control, and land development. Until recently, past activities incorporated few or no actions to prevent the introduction and spread of invasive species. In general, past, present, and reasonably foreseeable activities with the greatest

amount of ground disturbance, accompanied by a vector source of invasive plant seeds, have the greatest risk of invasive plant introduction, spread, establishment, and persistence.

It is unknown when non-native invasive species became established within the analysis area. The earliest inventory date in the NRM Database is 2003, and the earliest treatment record is from 1991, but there have been invasive species on the FNF for longer. Previous ground disturbing activities most likely contributed to the establishment and spread of invasive species. Since the establishment of invasive species is unknown and cannot be inferred from existing records, all infestations have been integrated into the existing condition.

Proximity

The project area contains very few infestations on the Forest and on the Tally Lake District; about forty acres inventoried in the project area. There are approximately 4,700 acres inventoried on the Tally Lake Ranger District and approximately 32,000 acres inventoried on the Forest. Building temporary roads, as well as using mechanized equipment, would likely spread the few infestations into adjacent natural areas from the access roads originating on Stoltz lands. Seed would most likely drop closer to the harvest units than farther away since equipment would travel over rough roads, shaking off debris in the process.

Travel

This project area is easy to access from State and NFS lands. There is recreational travel along the Taylor Creek Road as well as from adjacent private lands. The high amount of use on Taylor Creek Road in the summer/fall provide a higher risk of weed introduction and spread. Travel from this project area through state land and the town of Whitefish would not affect other NFS lands. The amount of traffic that is on Whitefish Lake Road that also uses Taylor Creek Road has increased the risk of weed introduction and spread. This project would contribute marginally to that weed spread and introduction. Whitefish Mountain Resort also has a lot of traffic year-round that contributes to the risk of introduction and spread of weeds to the area. The project would not increase or decrease that amount of traffic into the resort's permitted area.

Light Availability

Past harvesting in the project area increased the amount of acres with more light availability from past project activities; however, there have been only been about 600 acres of harvesting on NFS lands in this area from the 1960s and early 2000s. The adjacent state and industrial forest lands have experienced more harvesting in the recent past, increasing light availability and edge effects to the project area. Generally, acres which are opened up by activities are more susceptible to the persistence of sun-loving invasive species than if no activities occurred. Eventually, if the canopy is allowed to close, most infestations would be shaded out.

Wildland fire has been part of the landscape for centuries, up until recently. The most recent large fires in the project area occurred in the early twentieth century. At that time, there were not the amount and species of weeds on the landscape as there are now. Since then, the forest has been suppressing wildland fire in the area since the 1930s and will continue to do so. The last large wildland fire in the project area was Werner Fire in 2001. The forest vegetation continues to grow although canopy cover has not grown in within sixteen years.

Whitefish Mountain Resort on Big Mountain has several ski runs and lift lines that require little to no vegetation for operations. The activities to remove vegetation will continue for the duration of the ski resort permit. The resort area contains several infestations of weeds, which

are part of the resort's weed treatment program as well as the forest's weed treatment program.

Soil Disturbance

Soil disturbance estimates for past actions are based on the same type of activities proposed in this project. They are a minimum estimate of past soil disturbance and not meant to be an exact quantification of past projects. See the Soils section of the EA for information on past and potential detrimental disturbance in the project area. The disturbance of NFS lands in the project area was created by previous timber management, associated road construction, trail construction, and ski resort activities, which means that these disturbed areas contain suitable conditions for infestations. It is assumed that vegetation management and other soil disturbing activities would likely continue in the project area. The risk of establishment and persistence would be moderate due to infestations in the primary access corridors and due to the proposed trail construction in the project area.

Wildland fire suppression activities, such as dozer lines, hand-dug fire lines, vehicle traffic, helicopter landing sites, etc., contribute greatly to soil disturbance in those localized areas (Zouhar, et al. 2008). These activities carry a high risk of introduction and spread for invasive species based on the urgency of the activities and low priority of invasive species management compared to protecting life and property. Once fire operations cease, there is a high risk of establishment and persistence in these freshly-disturbed areas that are now open to more light. Werner Fires (2001) likely had suppression activities. Fire suppression will likely occur again.

Invasive Species Control

The FNF has an integrated weed management program that identifies and controls infestations across the Forest. Prevention of new infestations and controlling spread of existing infestations are the goals of invasive species management in the project area. Herbicide is the most commonly used treatment to kill invasive plant species, which can affect native plant species. The forest also uses biological control on tansy ragwort, spotted knapweed, Canada thistle, and toadflax. Weeds were treated along the roads and trails in the Whitefish Mountain Resort permitted area from 2012 to 2016 under the Flathead National Forest Noxious and Invasive Weed Control Decision. Taylor Creek Road has not been treated for weeds recently but would be treated as part of this project's design criteria, along with the other NFS roads in the project area.

Without prevention measures, inventories, and treatment, the risk of spread would increase in this project area and would further affect suitable habitat. The project design features in this proposed project would contribute to preventing further invasive species establishment as a result of project activities.

Recreation

Recreation across NFS lands has increased over the past few years and will continue to influence the spread of invasive species on the forest and in the project area; however, the amount of ground disturbance and travel through infestations from hiking and camping, compared to large-scale vegetation management, is much less and is generally limited to established roads, trails, campgrounds, and a few dispersed locations.

People and associated activities contribute to the introduction and spread of invasive species within the project area. The trails and roads in the ski permit area have infestations and are treated often; however, those roads and trails are used often by recreationists and resort

personnel. Weed seed is likely introduced on a regular basis. The risk increases with each person or vehicle. Taylor Creek Road is a popular location for forest visitors, especially for huckleberry picking, hiking and biking. There are also access roads from private lands entering FS lands in the project area which are known to be used for non-motorized and motorized use. These linear, non-vegetated features create edge effects into the adjacent understory, providing suitable conditions for invasive species, as well as corridors for invasive species, allowing them to move into the understory. Other recreation activities such as off-trail hiking, hunting, and trapping can also provide vectors for invasive species.

Additional trails in the action alternatives would contribute to the effects mentioned above, providing more vectors for weeds. However, trails can be traversed with backpack sprayers and accessed more easily than timber units.

Whitefish Mountain Resort on Big Mountain is a draw for recreationists during summer and winter with mountain biking, hiking, berry picking, and downhill and cross country skiing. The majority of visitors drive and carry the risk of transporting new weed species to the area, as well as redistributing current weed species around the area. Recreation areas such as this are a high priority for the forest to treat due to the amount of recreationists visiting the area.

Land Development

Past development and clearing on private lands most likely have introduced and spread invasive species; however, since there is no historical data regarding invasive species on private or public lands, it is difficult to analyze those actions. Much of the other landownership surrounding the Taylor Hellroaring project area is forest cropland, either State land or Stoltz industrial timber lands. Unlike private lands for development, these lands are primarily managed forests. Very little development occurs other than road building. However, private timber industrial lands do not need to abide by the same regulations as the Forest Service, which means weeds may not be a high priority for control.

There are other privately owned lands near the project area, such as Whitefish Mountain Resort. Development will continue at that site. This project area is close to urban communities; continued development of lands reduce native vegetation, alter hydrologic regimes, and increase the likelihood for new invasive species establishment.

Alternative 3

Cumulative effects for Alternative 3 are similar to the effects of the proposed action. Effects would be slightly less since there would be fewer trails available as vectors or to provide edge effects over the long term.

Summary

Based on Forest Service policy, regulations, and management requirements, the risk of invasive species spread, introduction, establishment, and persistence as a result of project actions, would be Moderate in the Proposed Action and Alternative 3 of the Taylor Hellroaring project. The risk is moderate due to the few documented infestations in the project area, the level of increase of light and soil disturbance from proposed treatments, as well as the required preventative measures of equipment washing, pre-treatment of haul routes, temporary road rehabilitation, and seeding disturbed areas with an approved seed mix.

Required Monitoring

Efficacy monitoring is required of fifty percent of acres treated over the fiscal year. Often the forest monitors more than fifty percent. This monitoring is not project-related and would continue regardless of the project's activities.

Regulatory Framework and Consistency

Management direction for noxious and invasive weed control on the Flathead National Forest is set at the National and Forest levels. Forest Service policies were developed in response to Federal laws guiding implementation of noxious weed control actions. These policies were set forth in Amendment 2000-95-5 of FSM 2080 Noxious Weeds Management and had been tiered to in the Forest Plan. Forest Service Manual 2900 Invasive Species Management was issued in 2011 and supersedes FSM 2080; however it has not yet been incorporated into the Forest Plan. The Flathead National Forest will comply with both the Forest Plan and FSM 2900. Treatment and monitoring of known infestations in the project area would be implemented under the authority and guidance of the NIWC DN (USDA FS 2001a). These documents were designed to meet Forest Service policies for invasive species control and associated legal requirements. The proposed project incorporates and is consistent with the NIWC DN (*Project File Exhibit W-3*). Design features and management requirements for actions proposed under this project follow the FSM for invasive species management and are listed in Chapter 2 of this EA.

Socioeconomics

Introduction

While social and economic effects of the proposed alternatives are assessed qualitatively and quantitatively, respectively, they reach a similar conclusion. No significant effects to the surrounding economy, or to social conditions are anticipated to occur as a result of the Taylor Hellroaring project implementation. The economic analysis results specifically show that quantifiable economic effects of the action alternatives from operations, timber resources and potential changes in visitation and recreational use. For specific financial efficiency or economic impact analysis results, refer to Table 3-46 and Table 3-47 in the effects analysis of this report.

Information Sources and Methodology used for Analysis

Resource Indicators and Measures

A financial efficiency analysis presents valuation of cash flows in terms of Present Net Value (PNV), and an economic impact analysis presents jobs and labor income measures to assess the economic effects of the project elements proposed in the alternatives. A qualitative analysis of social effects of the project elements across alternatives is also provided, but provides no direct resource measurement.

Information Sources

Information for this analysis comes from multiple Federal sources and was gathered from the Headwaters Economics Economic Profile System and Populations at Risk data repositories, both of which can be accessed at www.headwaterseconomics.org. Additional analysis data comes from the Forest Service National Visitor Use Monitoring (NVUM) program (*Project File Exhibits N-1, N-2 and N-3*), as well as from project resource reports and project data, and additional Forest, Regional and national program direction. These include USDA Forest Service Strategic Plan FY2015-FY2020 (*Project File Exhibit N-4*), The USDA Recreation Agenda (2010) (*Project File Exhibit N-5*), Federal Outdoor Recreation Trends (2016) (*Project File Exhibit N-6*), and various economic outlook and trends (*Project File Exhibit N-8, N-9, N-10 and N-12*) Also see the *Recreation* section for other sources of information.

With available data, a partial financial efficiency analysis and an economic impact analysis is provided for vegetation and infrastructure and operation activities proposed across the various alternatives. The results of these analyses are assessed across alternatives and in relation to the existing economic conditions within the analysis area, as defined below.

Incomplete and Unavailable Information

Satellite accounts for outdoor recreation industries are not yet available from the U.S. Department of Commerce. Outdoor recreation spending cannot be accounted separate of other travel and tourism related industries due to the current organization of North American Industry Classification system (NAICS) codes. Subcounty-level data includes records from the U.S. Census Bureau, but does not include economic activity data from County Business Patterns.

Analysis Area

The analysis area for determining the direct and indirect, social and economic effects from the Taylor Hellroaring Project Area is Flathead County, Montana (Figure 3-6). With a very large percentage of

Flathead National Forest (FNF) visitation coming from local visitors, and with most timber processing facilities that process FNF timber located within Flathead County (Sorenson et al. 2012), the analysis area for a project centered in the county, at this scale, can be reasonably limited to one county.

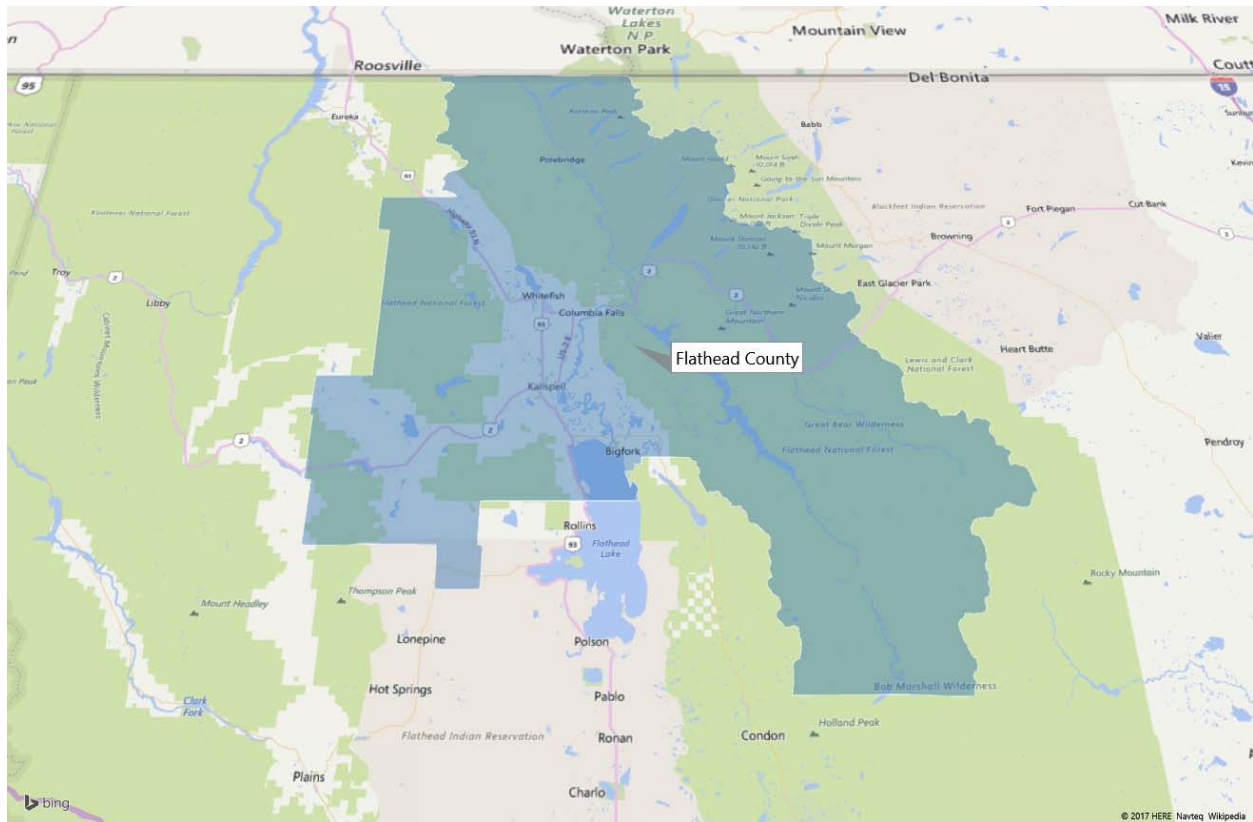


Figure 3-6. Social and Economic Analysis Area, Flathead County, Montana.

The Taylor Hellroaring project area includes 7,712 acres on the Tally Lake Ranger District of the FNF. The project area is located just northwest of Whitefish, centered in the northern area of Flathead County.

Regulations

National Environmental Policy Act (NEPA)

The National Environmental Policy Act of 1969 (NEPA) requires that natural and social sciences be integrated in all planning and decision-making that affect the human environment. The human environment includes the biological and physical environment and the relationship of people to that environment. Forest Service land management planning regulations further instructs the consideration of social science knowledge in forest and grassland planning.

Specific to potential economic consequences in travel management, NEPA does not require a complete monetary benefit-cost analysis (40 CFR 1502.23). Given most values (i.e. costs and benefits) associated with travel management stem from passive uses that do not involve direct market transactions, a complete benefit-cost analysis including all market and non-market values was not performed.

Forest Service Manual and Handbook (FSM, FSH)

The Forest Service has developed manual and handbook direction providing basic principles, techniques, and general guidance for assessing social and economic effects (FSM 1970 and FSH 1909.17).

Existing Conditions

Flathead County Population and Employment

Flathead is home to many communities including Kalispell, Whitefish, Bigfork and Columbia Falls. Flathead County population (Figure 3-7) and employment base (Figure 3-8) has grown faster than Montana, or the U.S. since 1970. In 2015, Flathead County had a population of 96,165, and approximately 62,669 jobs, as compared to 39,716 and 15,627 jobs in 1970. Employment in this county has grown at a faster rate than population, particularly in service related industries. Taylor Hellroaring project activities have the potential to influence non-service and service industries in Flathead County.

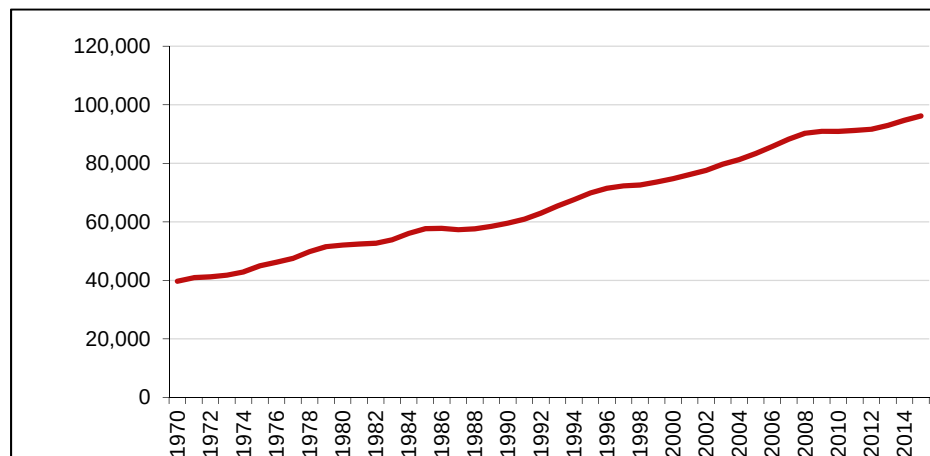


Figure 3-7. Flathead County Population, 1970 to 2015

Since 1970, Flathead County services base has grown much faster than more traditional sectors in the economy, including timber related industries (Figure 3-8). Flathead County has substantially diversified its economy over these recent decades, expanding service employment to more than quadruple that of non-service employment. Post-recession Flathead County non-service employment has leveled off at around 10,000 jobs, down from a base sector high of nearly 15,000 in 2007. Some of these lost jobs existed in timber related industries.

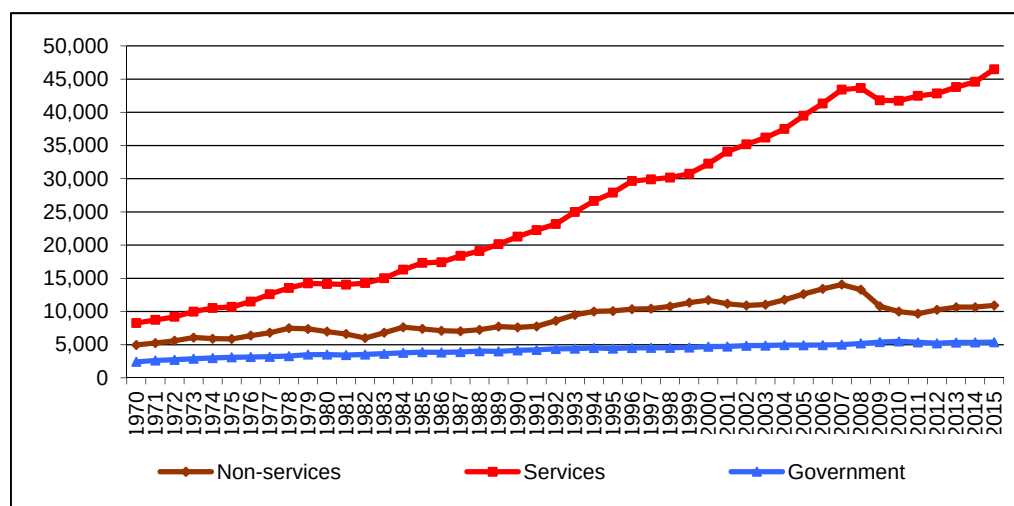


Figure 3-8. Employment by base sector in Flathead County, 1970-2015.

Industries related to the Taylor Hellroaring project include travel and tourism and timber industries. In 2015, travel and tourism industries provided approximately 20 percent, or 7,175 jobs, and timber industries provided 3.3 percent, or 1,206 jobs, of the total 36,507 private jobs in the County (Table 3-44 and 3-45). Government and government enterprises employ approximately 5,000 additional jobs in the County.

Table 3-44. Travel and Tourism Private Employment in Flathead County

Total Private Employment	36,507
Travel & Tourism Related	7,175
Retail Trade	988
Gasoline Stations	307
Clothing & Accessory Stores	302
Misc. Store Retailers	379
Passenger Transportation	105
Air Transportation	91
Scenic & Sightseeing Transport	14
Arts, Entertainment, & Recreation	1,172
Performing Arts & Spectator Sports	76
Museums, Parks, & Historic Sites	15
Amusement, Gambling, & Rec.	1,081
Accommodation & Food	4,910
Accommodation	965
Food Services & Drinking Places	3,945
Non-Travel & Tourism	29,332

Table 3-45. Timber Private Employment in Flathead County

Total Private Employment	36,507
Timber	1,206
Growing & Harvesting	158
Forestry & Logging	150
Support Activities for Forestry	8
Sawmills & Paper Mills	947
Sawmills & Wood Preservation	252
Pulp, Paper, & Paperboard Mills	0
Veneer, Plywood, & Engineered Wood	695
Wood Products Manufacturing	101
Other Wood Product Mfg.	101
Converted Paper Product Mfg.	0
Non-Timber	35,301

Recreation

Outdoor recreation enthusiasts are drawn to the project area because of the easy urban and year-around access. Public use of the area is influenced by the urban proximity, and is considered to be one of the truly urbanized management areas within the NFS. The area can be accessed by over 90,000 residences within a 20-30 minute drive or by non-motorized activities directly from the adjacent public or private lands. With U.S. Highway 93 and Glacier Park International Airport near the project area, it is a year round destination for non-local visitors as well.

The area serves as a backdrop and backyard recreation opportunity for local residents, and it is estimated that over 79 percent of all the visitors on the Flathead National Forest originate from the

surrounding communities. A complex system of public roads, highways, motorized and non-motorized trails provides access to many recreational opportunities and this access influences participation rates in a variety of recreational activities. Forest visitors then contribute to the local economy through the purchase of goods and services during their trip, including specialized equipment matching their specific recreational venture.

Outdoor enthusiasts contribute to the State and local economies by purchasing equipment, making expenditures while on recreational activity trips (day and overnight at hotels), spending money to visit locations (entrance and campground fee), purchasing accessories needed while recreating (clothes, safety equipment, bicycles), and making other expenditures for items that support their activities (food and fuel, etc.). The Institute for Tourism and Recreation Research out of the University of Montana completed a survey of the economic contribution of touring bicycle users in Montana (ITRR 2015). The survey shows that on average, cyclists spend \$75.75/day and the ITRR nonresident survey in 2012 3rd quarter vacationer spent \$58.24/day. They also estimated nonresident visitor's road/tour biking visits were 565,372 while in Montana in 2012. (*Project File Exhibit N-6*)

The FNF area has a high number of user groups on the national forest lands. Outfitting and guiding for activities like rafting, fishing, bicycle tours, horseback riding, hunting and others require a permit and contribute to the local economies.

Other non-motorized recreation activities also contribute to State and local economies. Activities such as hiking, bicycling, horseback riding, camping, picnicking, watching wildlife, historical sites, fishing, target shooting, hunting, sightseeing, gathering forest products, skiing, and nature study/interpretation all involve the consumption of various goods and services.

Based on results from NVUM (*Project File Exhibit N-3*), both motorized and non-motorized forest users contribute to the local economy as they access the Forest for day and overnight trips. NVUM survey results for the FNF indicates that the average spending, per party, per trip is approximately \$238.

Lifestyles, Attitudes, Beliefs, and Values

Recreational activities and travel routes are important to many people, and management of these resources can greatly influence personal lifestyles (*Project File Exhibit N-7*). Drawn from Kusel and Fortmann (1991), the concept of community well-being can be defined as the cumulative individual benefits drawn from the economic, recreational, social, and natural environments available in a community. The study area consists of three communities that are distinct in terms of social and economic characteristics. Kalispell has a larger population and increased metropolitan environment. The city has a substantially larger employment base with advanced manufacturing and service industries not found in the other communities of the valley. To the north of Kalispell, Whitefish is one of the most affluent and educated populations in the state, and has a higher percentage of retirees. Columbia Falls, to the east, is more rural in nature, with changed demographics including increased percentages of lower income households and a higher percentage of employment in non-services and natural resource manufacturing. All three cities consider the FNF as a valuable resource in providing a high quality of life. The travel time to the Forest from Kalispell is longer than from Columbia Falls or Whitefish. Trailhead access proposed is much closer to Whitefish, than to the other two communities.

Subsistence use of resources provides products to some local families. Firewood can be an important source of heat, and harvested wild game and fish along with other forest products can be food staples. However, residents also rely on this area for its recreational and aesthetic qualities as well as its productive capacity. Recreational activities are an important source of entertainment for lower income

families that can't afford to travel long distances to seek leisure time. The close and even bordering proximity to the larger populations create a unique opportunity for all classes and activity interests to take advantage of the natural setting. Some Forest visits can be over a lunch break or after work, while others can be several days or longer. All of these factors influence lifestyles, attitudes, beliefs, and values.

Perceptions of access to the Forest, non-motorized recreation, and travel on and off system roads vary according to user groups; some are in favor of expanding travel and non-motorized recreational opportunities, and some are in favor of more limitations and closures to additional access. The heavy demand and competition for activities on existing routes, on and off NFS lands has led to user conflicts and continued degradation of the route and even surrounding resources. Clashes between residents with differing value systems are likely to occur, because the population (user groups) served by the Forest is diverse, as it includes residents of urban and rural areas, as well as residents employed in some capacity by the outdoor industry whether private, state or federal.

Environmental Consequences

Effects Common to All Alternatives

Activities supported by the FNF affect economic and social conditions in a variety of ways. For example, many local residents identify forest recreation and natural amenities with their quality of life. People are drawn to this region for the high quality of life provided by the natural beauty and setting of the private land surrounded by public land owned by both state and federal including NFS and NPS lands. Therefore management of the lands surrounding the project area may affect some lifestyles, attitudes, beliefs, and values. Some social displacement of specific recreational activities could occur. See Chapter 3 *Recreation* section for additional discussion of recreational opportunities provided under each of the alternatives.

In addition to the social implications of forest management, visitors to the Taylor Hellroaring project area have some consequences for local economic conditions. Ultimately, expenditures related to use of the Forests may impact the type and number of jobs and level of income in the local economy. Expenditures by non-locals are considered new money to the economy and support additional jobs and income for the resident work force (*Project File Exhibit N-9*).

Overall, impacts of implementing the proposed project to social and economic resources are expected to be minimal, but may serve to increase stability in the local economy by contributing jobs and income. No user fees are proposed under any of the alternatives. Expenditures made for the proposed project under any action alternative, as well as the net economic impact to the local economies from changes in visitation would be negligible, because the effects would be very small relative to the large and diverse economy of the affected economies; particularly Whitefish. Implementation of this plan would be dependent on partnerships and volunteer efforts as well as the acquisition of grants through external funding sources and other sources of funding and labor that are not directly tied to standard appropriations.

Direct Effects

Direct economic effects of the proposal include the cost of implementing the project. Costs are estimated for implementing proposed construction of trails under each of the alternatives. However, implementation would only occur once partnerships are created, and direct costs would be paid for by partners. Therefore, the costs are taken into account for economic impacts (jobs and labor income

contributed), but they do not affect the financial position of the Forest, so they have no effect on financial efficiency (PNV). Actual costs would include costs for design of new trails; contractor labor for operation of heavy equipment during new trail construction; and other direct costs for signs, and other materials. Volunteers would make minor improvements to existing trails, would be involved in constructing new non-motorized trails, and supplement contractor labor during construction. The addition of system trails under both action alternatives would also increase the miles of trails requiring annual maintenance if performed by FS personnel. Annual maintenance costs for non-motorized trails are estimated at \$165/mile. Agreements for maintenance would likely be implemented and maintenance performed by partners.

Indirect Effects

Indirect effects include changes in the study area economy or effects to local lifestyles and values from changes in motorized and non-motorized recreation opportunities.

Based on an increasing trends of annual use of NFS lands and use on the Whitefish Trail (*Project File Exhibit N-11*) as well as an increasing local population with an interest in recreational opportunities, demands for all types of non-motorized recreation opportunities in the project area will likely continue. Though project implementation cannot always be connected to causing an increase in demand, it can be viewed as increasing recreation opportunity supply, to meet an increasing social, or public, demand.

Each alternative provides options for a variety non-motorized opportunities by designating routes to appeal to different user groups and providing new loop opportunities. It is unlikely that creating non-motorized trails, under any action alternative would cause noticeable changes in the larger economy of the project area, and the benefits of enhancing recreational opportunities are hard to measure and are very small relative to the large and complex economy of the surrounding communities. The overall impact on the region surrounding the analysis area is expected to remain stable or to increase under the action alternatives, as there would be an increase in non-motorized recreation opportunities.

Local businesses immediately adjacent to the project area (Whitefish) could benefit directly from people seeking to access NFS lands to non-motorized recreation opportunities. Businesses that may be affected by the proposed project also provide services and supplies to a variety of user groups for a large area of public lands in the surrounding region. Noticeable effects to the tourism and recreation economic sectors of the economy would not be anticipated under any of the proposed alternatives.

The dominant use of the project area would consists of non-motorized trail-related opportunities. The action alternatives would improve recreational opportunities and experiences and for some forest visitors, improvements proposed under the action alternatives are of great importance and would influence their choice of recreation destinations.

There would be no adverse effects of the proposed alternatives on other authorized non-recreation improvements and uses under special use permits because the proposed project is primarily an improvement of existing uses in the project area, and would not displace non-recreation uses. There would be no lost revenue for other special use permit holders.

Alternative 1 – No Action

Direct Effects

There would be no direct effects to the local economy if the construction of a trail system and related forest management is not implemented in the project area under the no action alternative.

Indirect Effects

Alternative 1 would maintain recreational opportunities at current levels. There would be no changes to the current trail system. Social behaviors and the need for a larger trail system surrounding the community would continue to conflict with various activities and regulations and policies. There would be no change to trails and no indirect effects to the economy or the lifestyles and values of residents in the project area. Recreational use of the project area would be expected to remain stable or increase proportionally to population growth over time. Implementation of Alternative 1 would likely not affect expenditures made in the local or regional economy.

Alternative 2

Direct Effects

Costs for design and construction of trails under Alternative 2 would be expected to be higher than that of Alternative 3 as there is more trail mileage. However, most of these costs will be paid by partners, so they have no effect on the financial efficiency from the agency or taxpayer perspective.

Alternative 2 would increase the miles and non-motorized trail requiring maintenance by approximately 40 miles when completely built. This increase in trail miles is not expected to have measurable effects on the Tally Lake Ranger District's trail maintenance due to the availability and commitment of external resources to address many maintenance needs. An Implementation Strategy would be created to prioritize the segments of the trails being built.

Indirect Effects

Alternative 2 would provide the greatest net increase in the miles of non-motorized system trails of the action alternatives. Trail-based recreational opportunities would increase for hikers, mountain bikers, equestrians and other non-motorized users.

Alternative 2 promotes and enhances recreational opportunities in the Holbrook area of the planning area. The development of the trailhead in Holbrook and the future connectivity to the north and possibly to the west would help to address the increased demand for non-motorized activities adjacent to Whitefish. This would promote more long distance travel for equestrian, bicycles and foot travel. Restrictions on motorized travel could stimulate recreational visits for non-motorized and other activities. Non-motorized and other recreational activities account for a large portion of forest visits. Less motorized recreation in some areas may increase the quality of the experience for these visitors.

The town of Whitefish and other local businesses may experience increased business activity. The addition of 40 miles of non- motorized single-track trail (and improved connectivity to adjacent areas) may draw additional local and non-local users. Non-local users tend to make greater expenditures on lodging, gasoline, food, and other trip related expenditures than local users. This alternative provides the best scenario for economic gain for businesses that provide supplies and services to non-motorized user groups. However, there are considerable outdoor recreational opportunities available outside of

the project area that contribute to the local economy, and economic effects of Alternative 2 to local businesses are anticipated to be very small relative to the existing recreation resource in the planning area as well as the large, diverse economy of Flathead county.

Impacts to users who access the area for other activities would be minimal. The areas allowed for dispersed camping as shown on the NVUM could limit some capacity in this immediate area. Once the area that are suitable for camping are fully occupied, campers would have to travel to other areas for that activity.

Alternative 3

Direct Effects

Costs for design and construction of trails under Alternative 3 would be expected to be lower than that of Alternative 2 as there is less mileage. These trails segments would not be built alone by FS funds, but partnership would be created assuming that all work would be conducted by an independent contractor.

Alternative 3 would increase the miles and non-motorized trail requiring maintenance by approximately 26 miles when completely built. This increase in trail miles is not expected to have measurable effects on the District's trail maintenance due to the availability and commitment of external resources to address many maintenance needs. An Implementation Strategy would be created to prioritize the segments of the trails being built.

Indirect Effects

Alternative 3 would provide a net increase of 26 miles of non-motorized trails. Recreational opportunities would increase for mountain bikers and other non-motorized users; however, the increases in non-motorized opportunities would be less than proposed under Alternative 2.

This alternative would enhance non-motorized recreation activities and by the creation of a contiguous non-motorized emphasis area directly adjacent to WMR in the project area. The addition of 26 miles of non-motorized trail could draw additional non-local motorized users, who make greater expenditures on lodging, gasoline, food, and other trip related expenditures than local users; however, this beneficial effect would be smaller than would occur under Alternative 2.

There are considerable outdoor recreational opportunities available outside of the project area that contribute to the local economy, and economic effects of Alternative 3 to local businesses are anticipated to be very similar relative to the existing recreation resource on the project area as well as the large, diverse economy of the Flathead County.

The social effects of Alternative 3 would be similar to Alternative 2. However, the extent of designated loop opportunities would be less under Alternative 3 than is proposed under Alternative 2.

Financial Efficiency of Alternatives 2 and 3

The financial efficiency analysis is specific to the timber harvest and ecosystem management activities associated with the project (as directed in Forest Service Manual 2400–Timber Management, and guidance found in the Forest Service Handbook 2409.18). Costs for sale preparation, sale administration, regeneration, and ecosystem restoration are included. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. The expected revenue for each alternative is the corresponding base rate from the sale feasibility analysis, multiplied by the quantity of timber to be

harvested. The PNV was calculated using a 4 percent real discount rate over the seven-year project lifespan (2018-2024). For more information on the values or costs of the project used to calculate PNV, see *Project File Exhibits N-13 and N-14*.

Table 3-46 summarizes the project financial efficiency with PNV calculations for each alternative. Because all costs of the project are not related to the timber sale, two PNVs were calculated. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design features. A second PNV includes all costs for the alternatives, including other activities not associated with the commercial harvest. As shown in the table, Alternatives 2 and 3 have the same PNV, as they only differ in the number of trail miles constructed (40 miles for Alternative 2 and 26 miles for Alternative 3). As trail construction is expected to be paid for by partners, the mileage difference does not impact financial efficiency. Both action alternatives are financially efficient for timber harvest and required design features, with a PNV of about \$326,000. The PNV for all project activities is positive and therefore still financially efficient, with a PNV of about \$62,000.

Table 3-46. Estimated Present Net Value of Timber and Non-Timber Activity by Alternative

Timber Sale and Required Design Features	Alt 2 - Proposed Action	Alt 3	No Action
PV Costs	\$210,098	\$210,098	\$0
PV Revenue	\$535,862	\$535,862	\$0
PNV	\$325,764	\$325,764	\$0
<u>All Project Activities</u>			
PV Costs	\$473,789	\$473,789	\$0
PV Revenue	\$535,862	\$535,862	\$0
PNV	\$62,073	\$62,073	\$0

Economic Impacts for Alternatives 2 and 3

The analysis calculated the jobs and labor income associated with the processing the timber products harvested and additional activities that are anticipated to be contracted out. Timber products harvested from the proposed project and the non-timber activities would have direct, indirect, and induced effects on local jobs and labor income.

In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type, estimating 50 percent to be processed as sawlogs, 20 percent as pulp, 15 percent as veneer logs, and 15 percent to be processed post and pole products. The direct employment and labor income response coefficients (jobs and labor income per million cubic feet) for timber harvesting and processing activities were derived by the University of Montana's BBER (Sorenson et al. 2016). In order to estimate jobs and labor income associated with other activities, expenditures for these activities were developed by the resource specialists on the interdisciplinary team. The indirect and induced multiplier effects were estimated using the IMPLAN model for the economic impact area (IMPLAN 2014). Only the expenditures associated with the contracted activities are included in the impact analysis, rather than work to be completed by Forest Service personnel.

Table 3-47 displays the direct, indirect and induced, and total estimates for employment (part- and full-time) and labor income that could be attributed to each alternative. Since the expenditures occur over

time, the estimated employment and labor income impacts would be spread out over the expected 7-year life of the project (2017-2023). It is important to note that these may not be new jobs or income, but rather jobs and income that are supported by this project. These impacts are shown both in total (over the life of the project) and on an annual basis. It is anticipated that the timber harvest would occur over a 4-year period, with other activities spread out over the full 7 years. However, project implementation could take longer or be accomplished earlier.

Table 3-47. Estimated Economic Impacts by Non-Timber and Timber Activity by Alternative.

	Alternatives					
	Alt 2 - Proposed Action		Alt 3		No Action	
<u>Non-timber Activities</u>						
Part and Full Time Jobs Contributed	Total	Annual	Total	Annual	Total	Annual
Direct	29	4	22	3	0	0
Indirect and Induced	5	1	4	1	0	0
Total	34	5	26	4	0	0
Labor Income Contributed (Thousands of 2016 \$s)						
Direct	\$610	\$87	\$472	\$67	\$0	\$0
Indirect and Induced	\$171	\$24	\$134	\$19	\$0	\$0
Total	\$782	\$112	\$606	\$87	\$0	\$0
<u>Timber Harvest</u>						
Part and Full Time Jobs Contributed	Total	Annual	Total	Annual	Total	Annual
Direct	28	7	28	7	0	0
Indirect and Induced	32	8	32	8	0	0
Total	61	15	61	15	0	0
Labor Income Contributed (Thousands of 2016 \$s)						
Direct	\$1,401	\$350	\$1,401	\$350	\$0	\$0
Indirect and Induced	\$1,009	\$252	\$1,009	\$252	\$0	\$0
Total	\$2,410	\$603	\$2,410	\$603	\$0	\$0
<u>All Activities</u>						
Part and Full Time Jobs Contributed	Total	Annual	Total	Annual	Total	Annual
Direct	57	11	50	10	0	0
Indirect and Induced	37	9	36	9	0	0
Total	94	20	87	19	0	0
Labor Income Contributed (Thousands of 2016 \$s)						
Direct	\$2,012	\$437	\$1,873	\$418	\$0	\$0
Indirect and Induced	\$1,181	\$277	\$1,143	\$271	\$0	\$0
Total	\$3,192	\$714	\$3,017	\$689	\$0	\$0

Cumulative Effects

The financial efficiency of the project would not be affected by the past, present, or reasonable foreseeable future actions in the project area. Other projects occurring in the economic impact area will have cumulative economic impacts and have the potential to contribute cumulatively to jobs and labor income provided by the proposed action.

Summary

Either action alternative would have a positive socioeconomic effect on Whitefish, the surrounding communities and visitors who travel to this area for recreation. More trail opportunities should reduce potential overcrowding on existing trail systems. Local business that sell outdoor products could see an increase in sales and other business could also feel indirect effects of more recreational opportunities surrounding the community on national forest lands. The timber produced from the timber sale would sustain local jobs in harvesting and milling, while contributing indirect and induced jobs through business to business purchases and local spending of wages and salaries generated as a result of the project activities.

Regulatory Framework and Consistency

Forest Land Management Plan

The Flathead National Forest 1986 Land Management Plan advocates for the provision of a broad spectrum of recreation opportunities made available through functional and updated transportation systems.

All Alternatives comply with the FNF Forest Plan, as well as other relevant laws, regulations, policies and plans. One goal of the Flathead National Forest Plan is to provide a sustained yield of timber products that is cost effective and responsive to the needs of the local economy. The action alternatives offer varying levels of commercial harvest and are consistent with being both cost effective and responsive to the needs of the local economy and the recreation goals are consistent with the FLMP.

Civil Rights and Environmental Justice

This project is in compliance with EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." Environmental justice issues were considered in all steps of the NEPA process including public participation, alternative development, determining the affected environment, project design, and analysis of environmental consequences. At no step were minority, low-income, or Tribal populations negatively affected by any of the proposed actions in any of the alternatives.

Heritage Resources

Introduction

Heritage Resources involve the conservation of archeological, cultural, architectural, and historic sites and artifacts. This section describes the existing Heritage Resource conditions of the Taylor Hellroaring Project and how the no action and action alternatives would affect the various components of this resource. The effects analysis focuses on those areas where potentially ground-disturbing activities, such as prescribed burning and logging, are proposed. Activities that only involve the use of hand crews and no heavy equipment would typically receive less consideration.

Analysis Area

Spatial Bounds

The analysis area used to discuss the effects on Heritage Resources is the Taylor Hellroaring Project area. The effects on Heritage Resources would not extend beyond the project boundary.

Data Sources, Methods, and Assumptions used

The Flathead National Forest is taking a multi-phase approach to Heritage Resource compliance [36 CFR 800] for the Taylor Hellroaring Project. This is possible because of the site-specific nature of Heritage Resources and Heritage Resource compliance. The first phase is a reconnaissance-level inventory of known Heritage Resources and a sampling of areas with a high probability for the occurrence of additional Heritage Resources. A pre-survey files search for information on previously recorded heritage sites in the proposed project area is also conducted. This phase includes initial consultation with the Confederated Salish and Kootenai Tribes to identify any concerns they may have regarding traditional cultural properties, traditional use plants, and areas of spiritual importance in the project area (*Project File Exhibit K-1*). The second phase occurs prior to actual project implementation and requires a thorough inventory of all proposed undertakings to locate, record, and evaluate the historical significance of any identified Heritage Resources.

Affected Environment

Historic Condition

Human occupation of the Flathead Valley in general, and within the boundaries of the proposed Taylor Hellroaring Project, specifically, has likely spanned the past 10,000 years (Flint 1982). Evidence of those prehistoric hunters and gatherers, however, forest wide, is rare. The prehistory of western Montana is characterized by approximately 10,000 years of hunter-gatherer land use resulting in numerous occupational sites, lithic scatters, rock cairns, burials, game drives/traps, and culturally scarred trees (Kornfeld et al. 2010; MacDonald 2012). Major occupational sites are usually limited to the major river drainages of the Flathead River. Hunter-gatherers frequented higher elevation mountainous areas during the summer months, similar to those of the Taylor Hellroaring proposed area. Prehistoric travel routes developed, and usually were restricted to major creek drainages as well as saddle and ridge systems.

These higher elevation areas provided hunter-gatherers with a wide range of resources, from roots and berries to small and medium game animals. Typical Heritage Resource sites or artifacts that one might encounter during pedestrian inventories would include stone rings, scarred trees, pictographs or petroglyphs, lithic (stone) scatters of flint/chert debris from the production of stone tools, isolated projectile points, travois trails, hearths or roasting pits, bone tools, stone scrapers, awls, bifaces, knives, and cores (Kornfeld et al. 2010; MacDonald 2012).

Historic era European-American settlement of the Flathead Valley, in general, came at approximately 1900. Prior to this time, trappers and hunters frequented the Flathead Valley, as early as 1811 for the Northwest Company and the Hudson's Bay Company. Specific to the Taylor Hellroaring project area, one cabin, built right before World War I, was occupied by Ichinojo Sakurai, a Japanese fur trapper (Underwood 1981). It is likely that trappers like Sakurai were common in this area before major settlement, but little evidence has been left behind.

The first homesteader of the Whitefish area, John Morton, built his cabin on the shore of the Whitefish River in 1883. He and several other early homesteaders worked for the Boston & Montana Commercial Company, a logging company that floated logs to Kalispell. It wasn't until 1905 that the town of Whitefish was established, which was the result of the re-routing of the Great Northern Railway to the proximity of Whitefish, and the placement of the railroad's regional headquarters at the south end of Whitefish Lake. For the next 50 years, logging, farming, and ranching dominated the local economy. In the 1940's, recreation became a larger part of the economy, with the still popular Big Mountain Ski Area (Whitefish Chamber of Commerce 2017).

Evidence of early settlers that might be discovered during Heritage Resource Surveys include historic trash dumps, trappers' lean-tos, metal traps, log cabins and homesteads, rifles or other firearms, and various metal tools from plows to saws.

Existing Condition

Pre-Survey Files Search

As the first part of a two-phase inventory, which was accomplished before project implementation, both Swan Valley Connections Partner Archeologist and the Forest's Heritage Resources Staff conducted a file search in-house and with the Montana SHPO (State Historic Preservation Office) for information on known, previously recorded heritage sites in the Taylor Hellroaring Project Area. General Land Office Plat Maps, HES plats, BLM Land Status Records, historic forest maps, local history texts, the Forest's Historic Overview, studies on Native American use of western Montana, and the Forest's cumulative site atlas and survey atlas were all referenced.

The results of a pre-survey files search for information on known heritage resources in the proposed Taylor Hellroaring Project Area identified three recorded heritage properties within a ½-mile of the project boundary and 24 previous inventories going back to 1978. Previous heritage surveys covered less than 20 percent of the acreage in the Taylor Hellroaring Project Area. Some of the recorded heritage properties are in or near proposed treatment units and all will be evaluated for possible effects by the proposed activities.

Pedestrian Survey

The second phase of the two-part strategy requires a pedestrian-based, stratified-sample survey (inventory) of the proposed Taylor Hellroaring Project Area. The survey strategy was taken from the

Forest's Site Identification Strategy, which is part of the Region 1 Programmatic Agreement (R1PA) with the Montana State Historic Preservation Office and the Advisory Council on Historic Preservation regarding compliance to Section 106 of the National Historic Preservation Act. The survey methodology is tied to topography and basic professional judgments about prehistoric and historic land use and cultural adaptation throughout history.

Simply stated, the methodology requires an 80 percent reconnaissance in topographic areas of less than 20 percent slope (such a level stream terraces) or in areas considered to exhibit a "high probability" for evidence of past cultural manifestations (i.e., ridge tops, rock outcrops, stream confluences). Survey transects would be spaced every 20 meters (65 feet) apart. Topographic areas in excess of 20 percent slope, but less than 50 percent, and which feature a "moderate" level of probability for containing cultural sites, were surveyed at 40 percent coverage, or with survey transects spaced every 40 meters. "Low"-level probability areas (slopes in excess of 50 percent) received 10 percent coverage with survey transects spaced every 230-feet apart.

The results of the stratified sample survey methodology were completed on October 15, 2017. One previously recorded heritage site was revisited and updated to state standards. Nine new heritage sites were identified during the course of this inventory. Therefore, ten heritage resources are located within the project's proposed action areas.

Two of these historic heritage resources are recommended as eligible for the NRHP. Also, three sites are culturally scarred tree sites that have the potential to yield important information about the nutrition, lifeways, and ceremonial practices of Native Americans, as well as the potential of European-Americans conducting a Native American practice; these sites are also considered sacred to the Salish and Kootenai tribes.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects

Implementation of the No Action Alternative would neither directly nor indirectly affect Heritage Resources, because there would be no change to the integrity of Heritage Resources, since no activities would be implemented. An exception is the threat of wildland fire. Failure to reduce fuels as proposed in Alternative 2 – Proposed Action could increase the potential for severe wildland fire, increasing the potential for adverse effects by fire to Heritage Resources through and beyond the project area. Wildland fire also increases the risk of site looting and vandalism due to the exposure through lack of vegetative cover.

Alternatives 2 and 3– Action Alternatives

Direct and Indirect Effects

The Flathead National Forest participates in the Region One Programmatic Agreement (R1PA) with the Montana State Historic Preservation Office and the Advisory Council that provides for a more efficient process for conducting cultural resource inventories and meeting Section 106 compliance. Under the R1PA, if there are no eligible properties affected by the undertaking either through project redesign or because there are no properties located within the undertaking, then the undertaking is included in an annual report to the Montana State Historic Preservation Office and compliance is completed without project consultation. On the other hand, if an eligible property is affected by the proposed undertaking,

then compliance is completed in the standard way with consultation with the Montana Historic Preservation Office.

Alternatives 2 and 3– Proposed Action

Cumulative Effects

There is the potential for cumulative effects to identified Heritage Resources in the Taylor Hellroaring Project Area from the proposed undertaking of the Taylor Hellroaring Project. However if the following design features are implemented then no effects would occur:

To provide potentially significant sites with adequate protection from effects associated with the proposed actions, it is required that a 30 m (100 ft) buffer around the sites that are potentially eligible for the NRHP be avoided during the proposed actions. Those sites include a significant historic statue, 24FH82, one potentially significant cairn, TH002, and two culturally scarred tree sites, TH010 and TH011.

These features are included in Chapter 2 of this EA under Design Features.

Regulatory Framework

The Forest Service has obligations under the American Indian Religious Freedom Act of 1978 to "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian" [Public Law 95-442]. The Confederated Salish and Kootenai Tribe also has rights under the Hellgate Treaty of 1855, including hunting, gathering, and grazing rights.

The Confederated Salish and Kootenai Tribes of Montana have been identified as a tribal group concerned about the management of Heritage Resources on the Flathead National Forest. The tribe were contacted in the initial planning stages of the Taylor Hellroaring Project to establish lines of communication, to advise them on the scope of the undertaking including potential effects, and to make their resource concerns (if any) an official part of the project file (*Project File K-1*). Consultation with recognized tribal governments is further defined and required by the Native American Graves Protection and Repatriation Act of 1990 [Public Law 101-106], the 1992 amendments to the National Historic Preservation Act, and the 1999 revisions to the implementing regulations in 36 CFR Part 800; Protection of Historic Properties.

Besides the American Indian Religious Freedom Act, the USDA Forest Service is also mandated to comply with the National Historic Preservation Act of 1966 (Public Law 89-665). Section 106 of the National Historic Preservation Act requires that Federal agencies with direct or indirect jurisdiction over Federal, Federally-assisted, or Federally-licensed undertakings, afford the Advisory Council on Historic Preservation a reasonable opportunity for comment on such undertakings that affect properties included in or eligible for inclusion in the National Register of Historic Places prior to the agency's approval of any such undertaking" (36 CFR 800.1). Historic properties are identified by a cultural resource inventory and are determined as either eligible or not eligible for the National Register. Eligibility is reviewed and concurrence given by the Montana State Historic Preservation Office. Sites determined as eligible are then either protected in place or adverse impacts must be mitigated. This process takes place prior to any decisions relative to the project.

The American Indian Religious Freedom Act (1978) and the National Historic Preservation Act (1966) requirements are carried forward in the Forest Plan standards for Heritage Resources (Forest Plan, pages II-18 to II-21).

The Following Items meet the Regulatory Guidelines:

Inventory Procedures

Cultural resource inventories have been conducted on all ground disturbing projects that are generated, licensed, permitted, or allowed to occur by the Forest Service.

Evaluation Procedures

Identified cultural resources were evaluated in relation to published criteria for eligibility to the NRHP.

Protection/Preservation Measures

Known, significant cultural resource sites on the Forest will be protected from inadvertent or intentional damage or destruction by requiring the avoidance of a 30 m (100 ft) buffer during implementation of the proposed actions.

Coordination/Consultation Procedures

The Forest will make an effort to coordinate cultural resource issues and concerns with the Confederated Salish and Kootenai tribes, other Federal and State agencies, the historical and archaeological communities, and the general public.

Protection of historic and prehistoric Heritage Resources is prescribed under a number of laws including the National Historic Preservation Act. Implementing regulations for the National Historic Preservation Act are codified in 36 CFR 800. Forest Plan standards and guidelines are designed to meet the requirements of these regulations. All Taylor Hellroaring Project alternatives are consistent with the laws and regulations listed above and incorporated into the requirements of the Flathead Forest Plan. Section 106 compliance and consultation with the Montana State Historic Preservation Office for this project will be completed prior to project implementation.

This page intentionally left blank.

Wildlife -Introduction

The wildlife section of this chapter is divided into sections for various habitats and groups of species. Riparian habitats provide key habitat components for many wildlife species, and will be analyzed in a section that includes Neotropical migratory birds. Many wildlife species are associated with old growth habitats and snags and downed wood. Canada lynx and grizzly bears are threatened species occurring in the project area along with several wildlife species identified as sensitive species for the Flathead National Forest. Effects on habitat linkages for wildlife are covered in sections on old growth, snag and downed wood habitats and fisher. Habitat and population information for all of these species can be found in *Project File Exhibit Rg-1*. Tables 3-48 and 3-49 document rationale for determining which species to carry forward into the analysis for this project. See *Project File Exhibit sections Q, Rb, Rd, Rg, Rn, Rr, Rs, and Rt* for more information.

Table 3-48. Presence and Status of Wildlife Management Indicator Species and Habitats In and Near the Taylor Hellroaring Project Area.

Wildlife Species	Status *	Presence in Analysis Area
Bald Eagle	Sensitive; MIS	Yes
Bighorn Sheep	Sensitive; MIS	No
Black-backed Woodpecker	Sensitive; MIS	Possible
Boreal Toad	Sensitive; MIS	Yes
Canada Lynx	Threatened; MIS	Yes
Common Loon	Sensitive; MIS	No
Elk, Mule Deer, White-tailed Deer	MIS	Yes
Fisher	Sensitive; MIS	Possible
Flammulated Owl	Sensitive; MIS	Possible
Gray Wolf	Sensitive; MIS	Yes
Grizzly Bear	Threatened; MIS	Yes
Harlequin Duck	Sensitive; MIS	Yes
Northern Bog Lemming	Sensitive; MIS	Possible
Northern Leopard Frog	Sensitive; MIS	Possible
Peregrine Falcon	Sensitive; MIS	Possible
Townsend's Big-eared Bat	Sensitive; MIS	Possible
Wolverine	Proposed; MIS	Yes
Neotropical Migratory Birds	These include numerous threatened, sensitive, and MIS wildlife species	Yes
Old Growth Associated Species		Yes
Riparian Habitat Species		Yes
Snag/Down Wood Habitat Species		Yes

* MIS = Management Indicator Species.

The analysis area for Canada lynx encompasses two Lynx Analysis Units, and the analysis area for grizzly bear is three Grizzly Bear Management Subunits. The analysis area for all other wildlife species and habitats is the Taylor Hellroaring Wildlife Analysis Area, stretching from Whitefish Lake to China Basin. See Figure 3-9.

Table 3-49. Species-Specific Habitat Occurrence

Wildlife Species	Comments Related to the Taylor Hellroaring Wildlife Analysis Area (or the larger areas used for Canada Lynx and Grizzly bear)
Bald Eagle	Active bald eagle nesting near Whitefish Lake within the Taylor Hellroaring Wildlife Analysis Area. Fish, waterfowl, and carrion provide food in the area.
Bighorn Sheep	There are no herds that are resident on the Flathead National Forest (FNF), but bighorns that are believed to be resident in surrounding areas are sometimes seen on the FNF. Closest known bighorn population is in Glacier National Park; occasionally observed from Mount Thompson Seton to Tuchuck Mountain on the FNF.
Black-backed Woodpecker	The last wildfires in the Taylor Hellroaring Wildlife Analysis Area were in 2001 and 2006, so high numbers of this species are no longer expected. A large wildfire could make the bulk of the analysis area ideal habitat for this species.
Boreal Owl	Potential habitat in many mature and old growth forests in the Taylor Hellroaring Wildlife Analysis Area. Detected in similar habitat within 3 miles of the area by call-back and nest-box surveys.
Canada Lynx	Potential habitat throughout the Lakalaho and Upper Big Lynx Analysis Units. All of the Lakalaho LAU and nearly all of the Upper Big LAU are designated as Critical Habitat for lynx. Records of lynx occurrence in and near the area included verified observations via monitoring. Snowshoe hares are abundant.
Common Loon	No nesting attempts known within the Taylor Hellroaring Wildlife Analysis Area. Successful nesting on numerous lakes within 5 miles of the analysis area, including Boyle Lake, but none of those lakes are downstream of proposed activities. Gathers and feeds on Whitefish Lake, mostly before and after nesting season.
Elk, Mule Deer, and White-tailed Deer	The Taylor Hellroaring Wildlife Analysis Area is used year-round by moose and an area of elk, mule deer, and white-tailed deer winter range occurs in the lower areas of Anchor Creek south past Roaring Creek and the Holbrook Overlook area. Hunting-season security areas for elk appear to be limited.
Fisher	Potential habitat is spread across the Taylor Hellroaring Wildlife Analysis Area. Monitoring efforts are ongoing.
Flammulated Owl	A limited amount of older drier Douglas-fir forest with open understory occurs in some of the lower elevations of the Taylor Hellroaring Wildlife Analysis Area. Possible breeding recorded in Douglas-fir stands 25 miles to the west and southwest of the analysis area on the Kootenai National Forest.
Gray Wolf	Wolves from the Mullan and Smoky packs appear to make use of the Taylor Hellroaring Wildlife Analysis Area.
Grizzly Bear	Frequent reports of grizzlies across the grizzly bear subunits, including reproductive females and winter dens. High-quality feeding habitat is abundant.
Harlequin Duck	Unpaired adults are occasionally reported on Swift Creek within the Taylor Hellroaring Wildlife Analysis Area. Indirect evidence of breeding has been reported in Big Creek 5 stream-miles downstream of the eastern part of the analysis area.
Northern Bog Lemming	Found in the Bowen Creek drainage 19 miles to the west of the Taylor Hellroaring Wildlife Analysis Area and also in scattered wetlands in the Sunday Creek drainage on Kootenai National Forest lands. One area of possible habitat on FS land in the analysis area.
Northern Leopard Frog	Very rare in Western Montana. Not known on the Flathead National Forest although it is likely they occurred historically. Closest reports are near Eureka, MT, and west of Kalispell, MT. One area of possible habitat on FS land in the analysis area.
Peregrine Falcon	Closest suspected reproduction is about 8 miles to the southwest. The Taylor Hellroaring Wildlife Analysis Area lacks steep cliffy areas and does not appear able to support potential nesting habitat. Lakes in the lower elevations may provide foraging habitat.
Townsend's Big-eared Bat	Snags, bridges, and abandoned buildings in the Taylor Hellroaring Wildlife Analysis Area may provide roosting habitat; wetlands and forests may provide feeding habitat. Found during monitoring surveys on scattered locations across the Flathead National Forest.

Western (Boreal) Toad	Scattered observations of adults in the Taylor Hellroaring Wildlife Analysis Area. Known and potential breeding in several ponds, wetlands, and ditches. Upland habitat for adults throughout the analysis area.
Wolverine	Occasionally reported feeding or moving within the analysis area. Records of wolverine occurrence in and near the Taylor Hellroaring Wildlife Analysis Area included verified observations via monitoring.
Neotropical Migratory Birds	Well-distributed and diverse habitat exists throughout the Taylor Hellroaring Wildlife Analysis Area for a suite of Neotropical migratory birds.
Old Growth Associated Species	Old growth and other mature forests are well distributed across Forest Service land in the Taylor Hellroaring Wildlife Analysis Area.
Riparian Habitat Species	Diverse habitat for a suite of riparian wildlife species is well distributed across the Taylor Hellroaring Wildlife Analysis Area.
Snag and Downed Wood Habitat Species	Large snags and current and future down wood are well distributed across Forest Service land in the Taylor Hellroaring Wildlife Analysis Area.

See *Project File Exhibits sections Q, Rb, Rd, Rg, Rn, Rr, Rs, and Rt* for more information.

The criteria used to determine which species to not carry forward for further analysis included lack of habitat in the Taylor Hellroaring Wildlife Analysis Area and lack of effects to the habitat of a species from any of the alternatives (Table 3-50). Prior to the preparation of this document, a review was conducted of District and Forest wildlife records, the U.S. Fish and Wildlife Service (USFWS) list of Federally Threatened and Endangered species on the Flathead National Forest (*Project File Exhibit Rt-1*), the Forest Service Region 1 Sensitive Species List (*Project File Exhibit Rs-1*), and the Montana Fish, Wildlife, and Parks websites (*Exhibit Rg-4*).

Table 3-50. Species and Rationale for Not Including Detailed Effects Analysis for the Taylor Hellroaring Project

Species	Rationale
Bald Eagle	The only known or suspected nesting habitat in the Taylor Hellroaring Wildlife Analysis Area is a small acreage close to Whitefish Lake, all of which is over one mile from proposed activities. There would be no effect or nesting, nest habitat, or the availability of aquatic or terrestrial food sources. Therefore, all of the alternatives would have no impact on bald eagles (<i>Project File Exhibit Rs-22</i>).
Bighorn Sheep	Closest known habitat use is over 25 miles east of the Taylor Hellroaring Wildlife Analysis Area. This project would have no impact upon this species because it is not located in the vicinity of any resident herds of bighorn sheep nor is it in a linkage area between populations. Therefore, all of the alternatives would have no impact on bighorn sheep (<i>Project File Exhibit Rs-7</i>).
Common Loon	No potential for effects on any nesting lake and no potential for effects on Whitefish Lake that could disturb loons nor affect the availability of fish and other prey species (<i>Project File Exhibit section G</i>). Therefore, all of the alternatives would have no impact on common loons (<i>Project File Exhibit Rs-21</i>).
Harlequin Duck	Harlequin ducks have been observed to use Swift Creek in the lower elevations of the Taylor Hellroaring Wildlife Analysis Area, all of which is over one mile from proposed activities. There would be no effect or nesting, nest habitat, or the availability of any food sources. Therefore, all of the alternatives would have no impact on harlequin ducks (<i>Project File Exhibit Rs-15</i>).
Northern Bog Lemming	Proposed activities would all be 1/10 mile or further from potential habitat. Therefore, all of the alternatives would have no impact on northern bog lemmings (<i>Project File Exhibit Rs-4</i>).
Northern Leopard Frog	Proposed activities would all be 1/10 mile or further from potential habitat. Therefore, all of the alternatives would have no impact on northern leopard frogs (<i>Project File Exhibit Rs-12</i>).

Peregrine Falcon	Closest known habitat use is over 8 miles east of the Taylor Hellroaring Wildlife Analysis Area. There would be no effect or nesting, nest habitat, or the availability of food sources. Therefore, all of the alternatives would have no impact on peregrine falcons (<i>Project File Exhibit Rs-23</i>).

See *Project File Exhibit Rg-1* for additional information.

As described in the individual sections, the evaluation of direct, indirect, and cumulative effects on wildlife species and habitats used the best available science and records of wildlife use of habitats within and close to the Taylor Hellroaring Wildlife Analysis Area or the larger areas used for Canada lynx and grizzly bear (Figure 3-9). Applicable past, present, and reasonably foreseeable events described in the Introduction section of *Chapter 3* were considered during the evaluation of the affected environment and for the analysis of effects. The condition of the affected environment, together with applicable reasonably foreseeable events as described in the above-mentioned section, were considered during the analysis of the environmental effects of the alternatives. The listed events that are not specifically analyzed or mentioned in the following discussion were considered to have no potential effect or negligible effects on wildlife or their habitats.

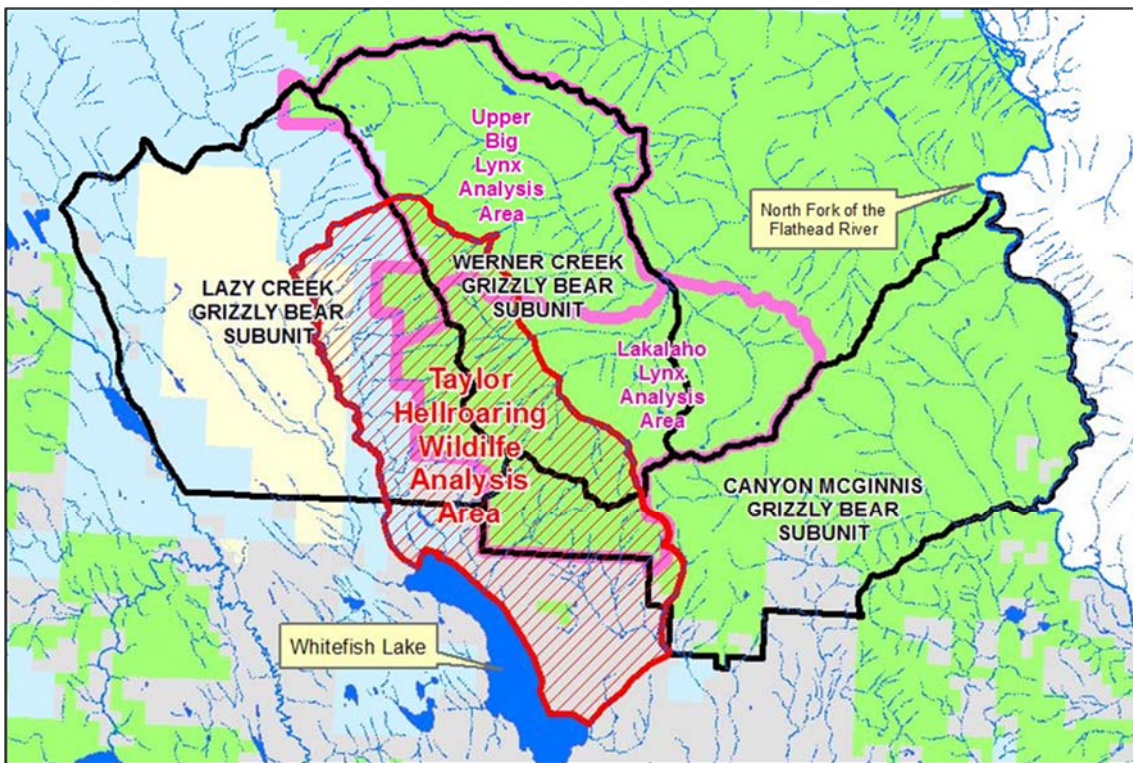


Figure 3-9. Wildlife Analysis Areas for the Taylor Hellroaring Project.

The Forest Plan's Amendment 21 Record of Decision (USDA Forest Service 1999a) stated that it was appropriate to focus limited resources on programmatic efforts to evaluate and monitor the effects of management actions on the habitat of those species for which population viability is a particular concern. The Flathead National Forest has monitored sensitive species and reported on their status in a document which is updated annually (2017 Flathead National Forest evaluation and compliance with NFMA requirements to provide for diversity of animal communities; *Project File Exhibit Rg-1*). The Flathead Forest has also published a Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010 (*Project File Exhibit Rg-8*). This monitoring report also addresses forest birds and old-growth forests; live trees, snags, and coarse woody debris retention; and vegetation composition, structure, and landscape pattern. In some cases, monitoring has been conducted by the Forest

Service and in other cases monitoring has been conducted by research scientists or personnel from other agencies and private organizations. The sources of monitoring data are identified in the sections that follow.

This page intentionally left blank.

Threatened and Proposed Wildlife

Threatened status of a species affords them and their habitat special protection from adverse effects resulting from federally authorized or funded projects. It is the responsibility of the FNF to design activities that contribute to the recovery of listed species in accordance with recovery plans that were developed as directed by the Endangered Species Act (ESA) (50 CFR part 402). The Flathead National Forest's Amendment 21 to the Forest Plan has a goal to "provide sufficient habitat to promote the recovery of threatened and endangered species and conserve the ecosystems upon which they depend." Section 9 of the Endangered Species Act of 1973, as amended, requires threatened and endangered species be protected from "harm" and "harassment" wherever they occur, regardless of recovery boundaries. A biological assessment for these species (*Project File Exhibit Rt-4*) will be prepared and consultation with the USFWS will be completed prior to a Decision Notice being completed for this project. See *Project File Exhibits Rt-2 and Rt-3* for documentation of USFWS consultation. All alternatives are consistent with NFMA diversity requirements for wildlife, as described in the *Old Growth, Snags, and Downed Wood Wildlife Habitat* section of this chapter. See *Project File Exhibit Rg-1* for more information.

Tables 3-48 and 3-49 in the *Wildlife Introduction* section summarized the presence, status and occurrence for the proposed and threatened wildlife species in the project area (Canada lynx, grizzly bear and wolverine). The United States Fish and Wildlife Service (USFWS) concurs with the list of these species that "may occur" in the Taylor Hellroaring Wildlife Analysis Area (*Project File Exhibit Rt-1*).

Canada Lynx

Introduction

In Western Montana, Canada lynx (*Felis lynx*) typically forage in sapling forests or multi-storied older stands that have a dense layer of saplings and lower branches that support their primary prey, the snowshoe hare (Squires and Ruggiero 2007). During winter, lynx prefer dense mature, multi-layer forests with spruce and subalpine fir; during summer, lynx also select younger forests with high horizontal cover (Squires, et al. 2010). Lynx most often den under downed logs in mesic older forests (Squires, et al. 2008). They use forested cover for traveling between patches of boreal forest (USDI FWS 2008a), frequently moving along forested saddles, ridges, and riparian areas. Another important aspect of lynx habitat is winter snow that is deep and fluffy for extended periods. In the Northern Rockies, the Canada lynx is adapted to fire regimes that created new foraging opportunities in young stands and along edges, while leaving behind a mosaic of travel connections and dense older stands.

The alteration of cover for this species and its primary prey through timber harvest, precommercial thinning, and wildland fire can have negative short-term effects (Koehler and Aubrey 1994). This is especially true in feeding habitat and where large openings are created without travel connections between areas of dense young forest and older forests used for denning. Stands up to about 15-20 years old that are not above snow level, while unsuitable to lynx in the short term, are needed to provide sapling foraging habitat for the future. Timber harvest and fuel reduction generally reduce existing or future downed woody material, while sometimes accelerating regeneration of the green canopy cover used by lynx and its prey. An insect epidemic or wildland fire can provide a great influx of downed logs, providing denning sites and cover for lynx kittens. Non-target trapping mortality correlates with ease of human access into an area during prime trapping seasons. Human activity in spring and summer, especially motorized use, may force lynx to move kittens, although this does not

appear to affect kitten survival (Olson et al. 2011). Maternal dens are “little more than temporary sheltered locations” and the relocation of kittens to a succession of maternal dens appears to be the norm in all lynx and bobcat species (Olson et al. 2011).

Information found in the Northern Rockies Lynx Management Direction (NRLMD) (*Project File Exhibit Rt-10*), the Canada Lynx Conservation Assessment and Strategy (USDA FS, Interagency Lynx Biology Team 2013), and numerous additional published research efforts indicate that primary lynx habitat in the Rocky Mountains and on the FNF includes lodgepole pine, subalpine fir, and Engelmann spruce. Moist Douglas-fir types are considered secondary habitat that can support squirrels, an alternate prey species for lynx during periods when snowshoe hare densities are low. In Montana west of the Continental Divide, lynx habitat is primarily subalpine fir habitat types, generally between 4,000 and 7,000 feet (*Project File Exhibit Rt-8*).

Methodologies and Information Sources

Data used for analysis included over 1700 acres of lynx and snowshoe hare habitat surveyed in the Upper Big and Lakalaho Lynx Analysis Units (LAU) (See Figure 3-10); field surveys of snags and downed logs; old growth surveys; other project area field visits and walk-through surveys; aerial imagery; the FACTS activity tracking database; the R1 Vegetation Map; research literature; and GIS data for features such as general forest attributes, slope, aspect, habitat types, and elevation. Observation, monitoring, habitat, and habitat use information are in *Project File Exhibits Rt-7, Rt-8, and Rt-12*. See the *Forest Vegetation* section of this chapter and *Project File Exhibit Rg-9* for more information. Effects of vegetation management, road construction, and trail construction were determined by overlaying coverages of potential lynx habitat, as described in the NRLMD, with proposed unit, road, and trail locations (*Project File Exhibit Rt-15*). All vegetation management activities were modeled as occurring simultaneously. Open road information is in *Project File Exhibit Rg-5*. See also the section on *Old Growth, Snags, and Downed Wood Wildlife Habitat* in this chapter.

Analysis Area and Spatial and Temporal Context for Effects Analysis

The analysis area for effects on Canada lynx is the Upper Big and Lakalaho Lynx Analysis Units (LAUs), *Project File Exhibit Rt-8*). The Taylor Hellroaring Project Area (Figure 3-10, below) lies primarily in the Lakalaho LAU. Units 1, 2 and 3 and portions of units 4 and 5 fall within the Upper Big LAU. Lynx Analysis Units (LAUs) are large enough to include the home ranges of one female lynx and numerous snowshoe hares, and to represent the effects of timber harvest, fuel reduction, and road/trail construction, and firewood cutting across the landscape. *Project File Exhibit Rt-6* includes information about LAUs across the landscape. An assessment at multiple scales was also conducted to address population viability concerns (*Project File Exhibit Rg-1*). See also *Project File Exhibit Rt-11* for a Region-wide assessment done in 2001. The temporal scale of the effects analysis extends 20 years into the future, enough time for new feeding habitats to develop.

The majority of actions proposed in the alternatives that could directly or indirectly affect Canada lynx are contained within these two LAUs. The Holbrook area of the project is not located within an LAU.

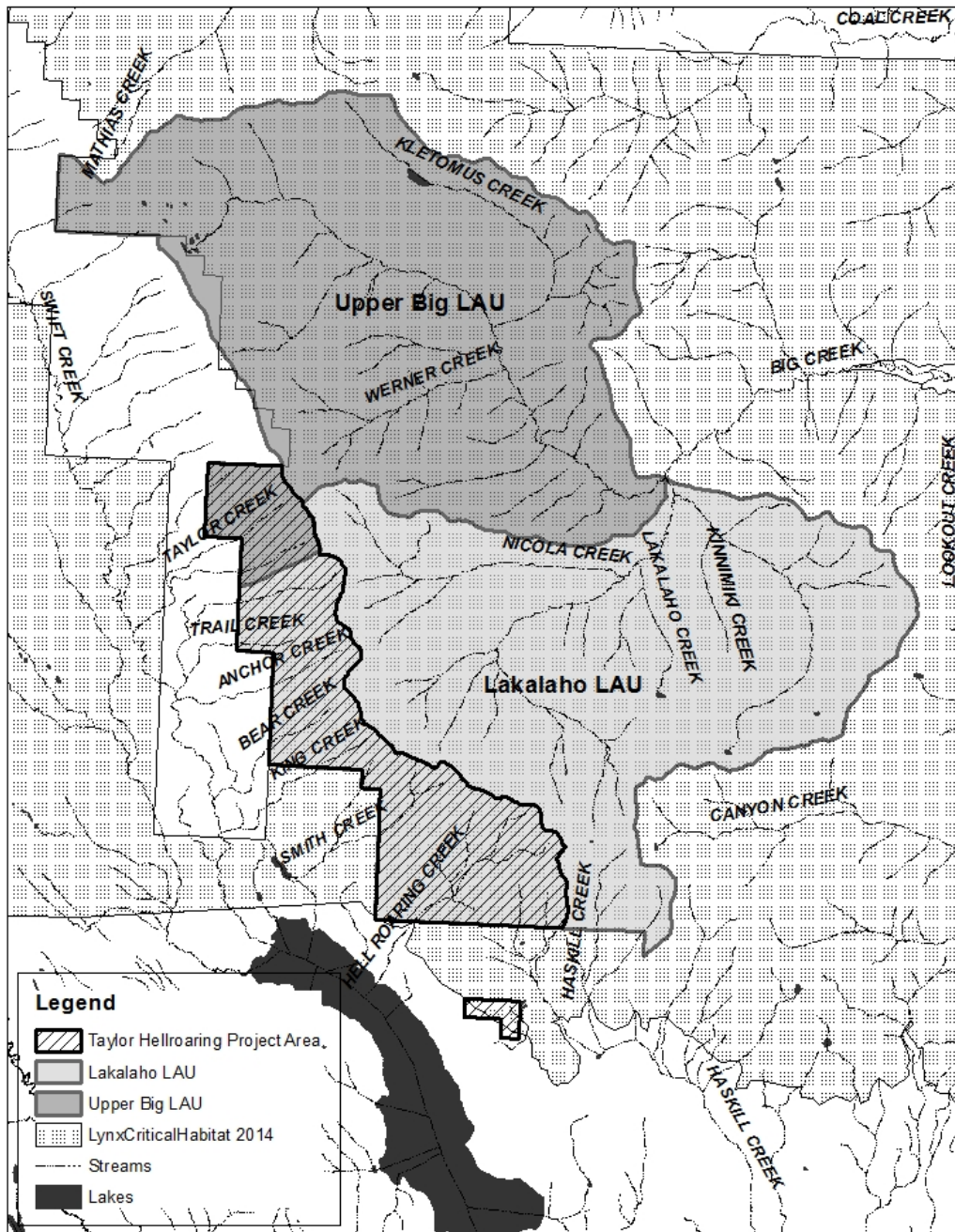


Figure 3-10. Taylor Hellroaring Project Area, affected LAUs, and Critical Habitat.

Affected Environment

Population Status

Lynx range over much of Canada, Alaska, and the northern edges of the lower 48 states, although the only population strongholds in the western United States are in Washington State, western Montana, and possibly northern Idaho (USFS FS, Interagency Lynx Biology Team 2013). Several national forests in USFS Region One support lynx. Snowshoe hare populations cycle widely in the more northern parts of Canada lynx range, leading to fluctuations in lynx populations. However, hare populations in the southern areas such as Montana generally have much less pronounced fluctuations (Hodges 2000).

These southern populations of lynx apparently exist close to a threshold of population equilibrium (McKelvey, et al. 2000).

Canada lynx and their sign have been recorded in and near the Upper Big and Lakalaho Lynx Analysis Units (*Project File Exhibit Rt-7*). Snowshoe hares, the primary prey of lynx, appear to be very common throughout the Tally Lake and Glacier View Ranger Districts, particularly along roads, in moderately dense sapling-to-pole sized stands, and in some older multi-storied stands. Numerous snowshoe hares and their sign have been recorded across both LAUs. Species that may compete with lynx for prey have also been observed across the area. Numerous historic and current lynx records exist across western Montana and the Flathead National Forest, including those of lynx adults with kittens. Efforts such as lynx telemetry studies, carnivore snow-track surveys, lynx hair-snare sampling, and compilation of incidental reports are ongoing on FNF lands (*Project File Exhibit Rt-7*).

See *Project File Exhibit Rg-1* for more detailed population, monitoring, management, and legislation information for the Canada lynx.

Habitat

Potential lynx habitat is abundant across the Flathead National Forest (*Project File Exhibit Rg-1*). In 2001, a regional, multi-scale lynx habitat assessment (Hillis, et al. 2003, *Project File Exhibit Rt-11*) found that lynx habitat is widespread across USFS Region One (R1) and the FNF. This assessment derived estimates of the proportions of foraging and unsuitable habitat at the forest-scale and compared them to forage and unsuitable habitat estimates at larger scales. This analysis showed that unsuitable habitat totaled ten percent of lynx habitat on the FNF and 9.2 percent at the R1 scale. Foraging habitat equaled nine percent of lynx habitat on the FNF and five percent of lynx habitat in R1. This is below the historic average, but would likely continue to increase as a result of recent wildland fires. Denning habitat equaled 15 percent at the R1 level, exceeding the historic and standard levels of ten percent. At the FNF scale, 67 percent of the land base is designated as roadless and wilderness habitat. This reduces the risk of mortality attributed to humans and reduces the potential negative effects of fragmenting small populations (USDI FWS 2009a).

Eighty-one percent of the Upper Big LAU and 93 percent of the Lakalaho LAU consist of habitat delineated as “mapped lynx habitat”. There are no barriers to lynx movement in either LAU. Both LAUs are located in the Whitefish Range which is one of the “putative” (generally accepted or thought to exist) corridors that connect lynx habitat in Canada with that in the United States’ Northern Rockies (Squires, et al. 2013). The Holbrook area of the project is not located within a Lynx Analysis Unit, however 28 percent of this isolated 140-acre NFS parcel contains mapped lynx habitat. This area is separated from the Lakalaho LAU by a 1-mile wide strip of private land that includes the lower elevations of Whitefish Mountain Resort. The Holbrook area is also at the low-elevation extreme of modelled lynx habitat.

Tables 3-51 and 3-52 display the current situation of potential habitat for lynx (*Project File Exhibit Rt-8*), using descriptions from the NRLMD (*Project File Exhibit Rt-10*). Currently, approximately 19 percent of lynx habitat in the Upper Big LAU and 4 percent of lynx habitat in the Lakalaho LAU is in early seral/structural stage condition and too young to be of use for lynx. Denning habitat is well distributed throughout both LAUs (*Project File Exhibit Rt-8*) and most areas of denning habitat have feeding habitat nearby and most are moist types that are likely to support alternate prey, such as red squirrels. Figure 3-11 shows the current distribution of lynx habitats. *Project File Exhibit Rt-12* has additional photographs of lynx habitat in the Upper Big and Lakalaho LAUs. Potential lynx habitat in the Holbrook area of the project consists of 40 acres of “other” habitat, with the remaining 100 acres in dry forest types considered permanent non-lynx habitat.

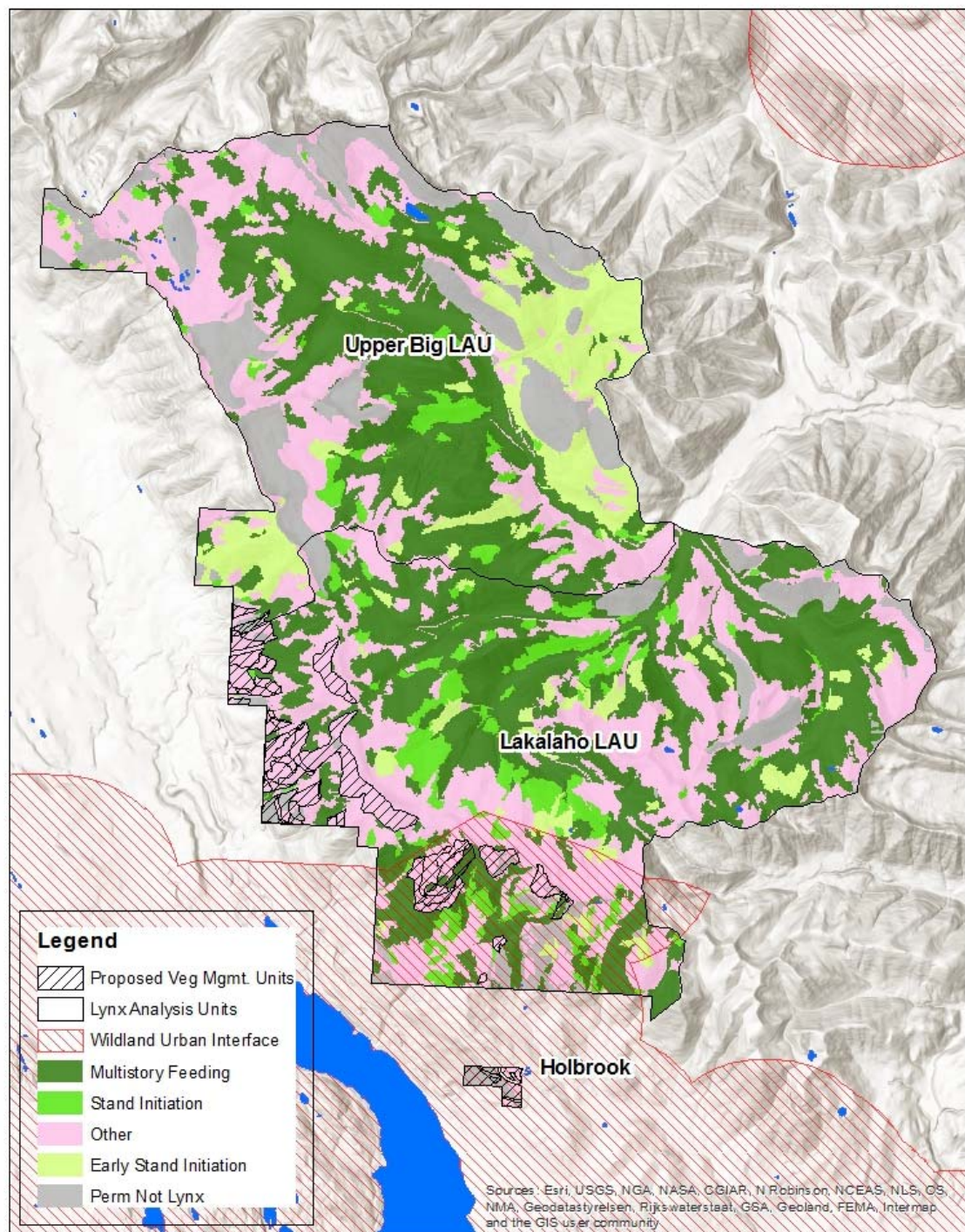


Figure 3-11. Current Lynx Habitat Conditions, Upper Big and Lakalaho Lynx Analysis Units and Holbrook area, including Proposed Vegetation Management Units and Mapped Wildland Urban Interface. (Definitions in Table 3-52)

Table 3-51. Potential Lynx Habitat across the Upper Big and Lakalaho LAU (Project File Exhibit Rt-8).

Lynx Analysis Unit (LAU)	Total Acres LAU	Permanent Non-lynx ¹	Lynx Habitat Acres	% of LAU in Lynx Habitat
Upper Big	19,611	3,739	15,872	81%
Lakalaho	22,456	1,558	20,898	93%

¹ Permanent Non-lynx habitat includes dry forest habitat types, rock outcrops, sites dominated by dry grass/forbs/shrubs, low elevations, and large water bodies if present within the LAU.

Table 3-52. Acres of Lynx Habitat Components and Percentages of Mapped Lynx Habitat across the Upper Big and Lakalaho LAUs (Project File Exhibit Rt-8).

Lynx Analysis Unit (LAU)	Total Acres LAU	Total Acres Lynx Habitat	Stand Initiation (winter forage) ¹ Acres (% of lynx habitat)	Early Stand Initiation (not providing winter forage) ² Acres (% of lynx habitat)	Multistory (forage) ³ Acres (% of lynx habitat)	Other ⁴ (non-feeding) Acres (% of lynx habitat)
Upper Big	19,611	15,872	733 (4.6%)	2,994 (18.9%)	6,778 (42.7%)	5,366 (33.8%)
Lakalaho	22,456	20,898	1,924 (9.2%)	895 (4.3%)	9,296 (44.5%)	8,783 (42.0%)

¹ Stand initiation structural stage *that currently provides* snowshoe hare habitat.

² Stand initiation structural stage *that currently does not provide* winter snowshoe hare habitat because trees have not yet grown tall enough to protrude above the snow in winter.

³ Forested multi-storied structural stage with many age classes and vegetation layers *that appears to currently provide* winter snowshoe hare habitat (VEGS6).

⁴ Forested conditions that do not fit Categories 1 through 4. Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat.

Refer to *Project File Exhibit Rg-7* and the section on *Old Growth, Snags, and Downed Wood Wildlife Habitat* in this chapter for more information about the existing condition in terms of connectivity.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No additional actions, such as timber harvest, fuel reduction, prescribed fire, road construction, or trail construction are proposed with this alternative. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by the lynx (Table 3-57, in the Cumulative Effects section). In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance of large stand replacing wildland fires in adjacent areas, which could have mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat. Ecological disturbances are often favorable to lynx, but the net effects could be negative in a managed landscape.

Direct and Indirect Effects of Alternatives 2 and 3

The assumptions involved in the analysis of vegetation management effects on lynx are detailed in *Project File Exhibit Rt-15*. These include a) alteration of lynx habitats would occur as shown in Table 3-53; b) trees would continue to grow, particularly affecting young sapling stands; and c) there would be a lack of other stand-level changes, such as wildland fire and insect epidemics. All vegetation management was modeled as occurring simultaneously.

Table 3-53. Vegetation Management Changes in Lynx Habitat Used for Effects Analysis. (Project File Exhibit Rt-15).

Prescription*	Multistory³ (forage)	Stand Initiation¹ (winter forage)	Other⁴ (Denning; non-feeding)	Early Stand Initiation² (not providing winter forage)
Regeneration Harvest (CC, ST, SW)	Early Stand Initiation ² (not providing winter forage) = "Early Stand Initiation"	[NONE]	Early Stand Initiation ² (not providing winter forage) = "Early Stand Initiation"	[NONE]
Intermediate Harvest (CT, HFR)	Other ⁴ (Stem exclusion; non-feeding) = "Other"	[NONE]	(No change)	[NONE]
Prescribed Burn/Slashing	[NONE]	[NONE]	Early Stand Initiation ² (not providing winter forage) = "Early Stand Initiation"	[NONE]

* = Clear Cut (CC), Seed Tree (ST), Shelterwood (SW), Commercial Thin (CT), Hazardous Fuel Reduction (HFR)

¹Stand initiation structural stage that currently provides winter snowshoe hare habitat.

²Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter.

³Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.

⁴Other – Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat.

Table 3-54. Changes to Potential Lynx Habitats through Vegetation Management, Upper Big and Lakalaho LAUs, in acres and percent of lynx habitat. (Project File Exhibit Rt-15).

Lynx Analysis Unit	Total Acres LAU	Total Acres Lynx Habitat	Stand Initiation (winter forage)¹ Acres (% of lynx habitat)	Early Stand Initiation (not providing winter forage)² Acres (% of lynx habitat)	Multistory (forage)³ Acres (% of lynx habitat)	Other⁴ (non-feeding) Acres (% of lynx habitat)
Upper Big Existing Condition	19,611	15,872	733 (4.6%)	2,994 (18.9%)	6,778 (42.7%)	5,366 (33.8%)
Upper Big Post-project			733 (4.6%)	3,015 (19.0%)	6,778 (42.7%)	5,345 (33.7%)
Lakalaho Existing Condition	22,456	20,898	1924 (9.2%)	895 (4.3%)	9,296 (44.5%)	8,783 (42.0%)
Lakalaho Post-project			1924 (9.2%)	1,728 (8.3%)	9,222 (44.1%)	8,024 (38.4%)

¹Stand initiation structural stage that currently provides winter snowshoe hare habitat.

²Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter.

³Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.

⁴Other – Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat.

Table 3-55. Summary of Changes to Potential Lynx Habitats through Vegetation Management, Upper Big and Lakalaho LAUs, in acres. (Project File Exhibit Rt-15).

LAU	Stand Initiation	Early Stand Initiation	Multistory Feeding	Other
Upper Big		+21		-21
Lakalaho		+833	-74	-759

Eighty-five percent of the vegetation management in the action alternatives would occur in stands identified as some type of lynx habitat (*Project File Exhibit Rt-15*). Table 3-54 shows changes in lynx habitats due to vegetation management and resulting percentages of lynx habitats across the Lynx Analysis Units.

Effects on lynx feeding habitats vary by alternative and whether they are inside or outside the Wildland Urban Interface (WUI). No reductions to multistory lynx feeding habitats would occur outside the WUI. Both action alternatives would have 74 acres of vegetation management in multistory feeding habitat that is inside the mapped Wildland Urban Interface (WUI). These acres are within portions of units 52, 103, 106 and 143.

In both action alternatives, the loss of denning habitat (which is plentiful in the area) would be partially balanced in that the removal of fuels would reduce the probability of fire spreading to remaining denning habitat of higher quality. In addition, tree planting and the removal of smaller-diameter downed wood in harvest units would accelerate regeneration into sapling stands preferred by snowshoe hares and hunting lynx.

Road construction and use would have effects on lynx and lynx habitat. In both action alternatives, most of the road construction would pass through areas of potential lynx habitat (*Project File Exhibit Rt-15*). All newly constructed permanent roads would be placed in Intermittent Stored Service (ISS) upon project completion, with entrances obliterated to discourage motorized travel. All temporary roads would be reclaimed upon project completion. All roads would be closed to motorized public access during and after implementation of the project, although the permanent roads could facilitate non-motorized access for trapping for other furbearer species.

Table 3-56. Summary of Changes to Potential Lynx Habitats through Road Construction, Upper Big and Lakalaho LAUs, in acres, (Project File Exhibit Rt-15).

	Temporary Roads		Permanent Roads	
	Existing	New	Existing	New
Upper Big				
Multistory Feeding			-0.5	
Stand Initiation				
Other			-1.0	
Early Stand Initiation				
Lakalaho				
Multistory Feeding			-0.3	
Stand Initiation			-0.2	
Other	-0.2	-0.4	-6.7	-2.5
Early Stand Initiation				
Total Acres	-0.2	-0.4	-8.7	-2.5

(See Table 3-52, above, for definitions of these habitats.)

Some proposed timber harvest units may be logged in winter (although this is not required), requiring snow plowing on roads. Indirectly, snow plowing may facilitate movement of competitors that prey on snowshoe hares (such as bobcat, wolf, and coyote), but the science on this is inconclusive at this time (*Project File Exhibit Rt-16*). Temporary roads, permanent roads placed in ISS, and skid trails are not expected to receive use by over-snow recreationists.

Trail construction and use would also have effects on lynx and lynx habitats. Most newly constructed trails would pass through areas of potential lynx habitat. Trail class was used to estimate acres of habitat effected by trail construction. Typical width of trail clearing ranges from 6-8 feet wide. Effects may be different where vegetation is removed adjacent to trails to maintain sight distances for safety purposes. This might occur in sections of trail where stacked switchbacks would be constructed and where there are curving sections of trail.

Table 3-57. Summary of Changes to Potential Lynx Habitat through Trail Construction by Alternative and LAU, in acres, not including vegetation management.

Lynx Habitat	Change in Acres	
	Alt. 2	Alt. 3
Upper Big		
Multistory Feeding	-0.1	
Stand Initiation		
Other	-0.0	
Early Stand Initiation		
Lakalaho		
Multistory Feeding	-2.3	-1.3
Stand Initiation	-0.8	-0.3
Other	-5.7	-4.4
Early Stand Initiation	-0.0	-0.0
Total Acres	-9.0	-5.9

Project activities would also occur in the Holbrook area, an isolated parcel of NFS land that is not in a Lynx Analysis Unit. Under both action alternatives, there would be approximately 40 acres of commercial thinning in “other” habitat. The remaining 96 acres of commercial thinning along with the 4 acres of seed tree harvest would occur in “permanent non-lynx” habitat. All road construction in the Holbrook area would occur in “permanent non-lynx” habitat, with 0.2 miles of temporary road and 0.2 miles of system road proposed. Proposed trail construction differs by alternative. Under alternative 2, 4.60 miles of trail are proposed, with 1.01 miles in “other” habitat and 3.59 miles in “permanent non-lynx” habitat. Under alternative 3, 3.38 miles of trail are proposed, with 0.81 miles in “other” habitat and 2.57 miles in “permanent non-lynx”. As noted above for proposed activities within the Lakalaho LAU, denning habitat is plentiful in the area and its loss of would be partially balanced by the reduced probability of fire spreading to denning habitat of higher quality.

The ability of lynx to travel across the Upper Big and Lakalaho LAUs would be affected by timber harvest, road construction, trail construction, and human access, but the area would maintain the potential to provide connectivity or linkage between larger areas of lynx habitat (Squires, et al. 2013). Proposed regeneration harvest creates open areas that lynx sometimes avoid (Squires, 2010). Road traffic on existing roads would fall far below traffic volumes expected to impede movements by lynx (USDA Forest Service, 2013).

Vegetation management, road construction, trail construction, prescribed burning (including helicopter ignition), and other actions could cause temporary disturbance to lynx, with possible temporary displacement from the immediate area. These actions would not have measurable effects on this species beyond their potential to displace lynx to a minor degree.

If active lynx denning is discovered in any proposed harvest, fuel reduction, or prescribed burning unit, activities would be modified if needed to protect denning stand conditions and maintain reproduction efforts as stated in *Chapter 2* of this EA under Design Features.

Cumulative Effects

Most of the cumulative effects relevant to Canada lynx (*Project File Exhibit Rt-6*) are described in the sections of this chapter on *Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat; and Commonly Hunted Big Game*. These include loss and alteration of habitat due to timber harvest, past wildland fires, and access for recreation, firewood cutting, hunting, and trapping. See also *Project File Exhibits Q-8, Rb-6, Rd-12, Rn-3, Rr-2, and Rt-6*. For an assessment of this species' viability at the Forest level, see the Final Environmental Impact Statement for the Flathead's Forest Plan Amendment 21 (USDA Forest Service 1999a) and *Project File Exhibit Rg-1*.

Tables 3-58 and 3-59 take into account all ongoing, proposed, and reasonably foreseeable changes to vegetation across the Upper Big and Lakalaho LAUs. This includes all activities proposed in this project including vegetation management, road construction, and trail construction. Changes to vegetation in the Lakalaho LAU included in the Whitefish Municipal Watershed Fuel Reduction Project were incorporated into the baseline vegetation data used for this analysis. Timber harvest, precommercial thinning, and fuel reduction across national forest, state, and private lands has removed or altered lynx habitat, typically leaving few smaller trees, low limbs, snags, or large downed wood (*Project File Exhibits Rg-1 and Rt-6*). Such areas can still function as lynx habitat but at reduced quality for a period of time. In the project area, much of the potential lynx habitat is in mature forest with very little understory vegetation and a relative scarcity of lynx multistory forage. Past fire suppression may have contributed to this as well as low levels of sapling feeding habitat. This has also led to an increased risk of a stand-replacement wildland fire.

Table 3-58. Changes to Potential Lynx Habitat through all Project Activities by Alternative and LAU, in acres and percent of lynx habitat. (*Project File Exhibit Rt-15*).

Lynx Analysis Unit	Total Acres LAU	Total Acres Lynx Habitat	Stand Initiation Acres (% of lynx habitat)	Early Stand Initiation Acres (% of lynx habitat)	Multistory (forage) Acres (% of lynx habitat)	Other Acres (% of lynx habitat)
Upper Big Existing Condition	19,611	15,872	733 (4.6%)	2,994 (18.9%)	6,778 (42.7%)	5,366 (33.8%)
Upper Big Alt. 2			733 (4.6%)	3,015 (19.0%)	6,777 (42.7%)	5,344 (33.7%)
Upper Big Alt. 3			733 (4.6%)	3,015 (19.0%)	6,778 (42.7%)	5,344 (33.7%)
Lakalaho Existing Condition	22,456	20,898	1,924 (9.2%)	895 (4.3%)	9,296 (44.5%)	8,783 (42.0%)
Lakalaho Alt. 2			1,923 (9.2%)	1,728 (8.3%)	9,219 (44.1%)	8,009 (38.3%)

Lakalaho Alt. 3			1,924 (9.2%)	1,728 (8.3%)	9,220 (44.1%)	8,010 (38.3%)

See Table 3-52 for definitions.

Table 3-59. Summary of Changes to Potential Lynx Habitat through all Project Activities by Alternative, in acres. (Project File Exhibit Rt-15).

Lynx Habitat	Change in Acres	
	Alt. 2	Alt. 3
Multistory Feeding	-77.2	-76.1
Stand Initiation	-1.0	-0.5
Other	-796.5	-795.2
Early Stand Initiation	+854.0	+854.0

Roads constructed across the Upper Big and Lakalaho LAUs facilitate access for trapping, hunting, firewood cutting, and other activities, as discussed in the *Snags and Downed Wood Habitat* section of this chapter. Firewood cutting along open roads has decreased downed logs particularly important for lynx and their prey. Brushing of saplings along most USFS roads in lynx habitat has reduced their value to snowshoe hares. Across the area, open and closed roads facilitate human access, contributing to the risk of mortality or displacement of lynx (Project File Exhibit Rg-5). Roads can cause some collision-related injuries or mortalities to lynx. The action alternatives for the Taylor Hellroaring Project would construct one mile of new temporary and permanent roads, some of which are likely to impact lynx habitats as detailed above. Construction and maintenance of trails will require clearing of downfall. Snowmobile access can provide easy winter access for trappers and possibly competitors. Total miles of over snow routes on Forest Service lands in the LAUs are displayed in Table 3-60. The analysis area is also close to several population centers and is easily accessed. No new winter use is proposed for this project, so there would be no cumulative effect of over the snow routes.

Table 3-60. Miles of Over Snow Routes by LAU.

LAU Name	Over Snow Routes (miles)	
	Seasonal	Yearlong
Lakalaho	45.4	8.7
Upper Big	26.4	9.3
Total	71.7	18.0

Hunting, trapping, and predator control may have had the greatest cumulative impact in the past. Human access, available cover, and public attitudes largely determine mortality risk to lynx. Probably due to trapping, lynx were extremely scarce in the first half of the last century in Montana. The lynx trapping season is currently closed in Montana. This project is not expected to have a cumulative impact due to the trapping season closure.

Other cumulative effects on lynx are varied, but they do not differ by alternative. All project activities have the potential to displace Canada lynx. In addition to the human endeavors discussed above, all human activities could disturb or displace lynx. These include numerous recreational activities such as hunting, hiking, mountain biking, fishing, camping, snowmobiling, dog sledding, downhill skiing, cross-country skiing, horseback riding, driving, motorcycle and ATV riding, and firewood and other miscellaneous forest product gathering. Wildland fire suppression, timber harvest, prescribed

burning, fuels reduction, road construction/maintenance/BMPs, trail construction/maintenance, private land development, and noxious weed control could similarly disturb lynx.

In consideration of habitat conditions, human use, human dwellings, roaded access, and the number of reported observations, the mortality risk to Canada lynx remains low-to-moderate. No geographic or man-made barriers exist within the Upper Big and Lakalaho LAUs that would preclude lynx movements to adjacent populations.

Summary

The two action alternatives would have similar impacts to lynx, lynx foraging habitat, and lynx denning habitat, with only slightly more acres affected in Alternative 2 due to the additional miles of trail construction. Both action alternatives would comply with the Northern Rockies Lynx Management Direction (NRLMD) and retain a mosaic of forest habitats for lynx to travel and forage throughout the project Lynx Analysis Units.

Regulatory Framework and Consistency

The contiguous United States population segment of the lynx, including Montana, became a threatened species on March 24, 2000. The Final EIS and Record of Decision for the Northern Rockies Lynx Management Direction (NRLMD) were completed in March 2007 (*Project File Exhibit Rt-10*). This decision amended the Forest Plan by providing lynx habitat management goals, objectives, standards, and guidelines (Table 3-61). Both action alternatives would be consistent with the Northern Rockies Canada Lynx Direction. See *Project File Exhibit Rt-10* and *Chapter 2* of this EA for more information.

Table 3-61. Northern Rockies Lynx Management Direction Applicable to the Taylor Hellroaring Project. (See *Project File Exhibit Rt-10* for the full text of this direction and for more detailed information).

Direction	Northern Rockies Lynx Management Direction	Consistency
Objective ALL O1	Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.	All alternatives are consistent. Some connections between habitat patches would be affected, but no major ridgeline or riparian connections would be affected. A mosaic of stands would still exist as travel corridors and would maintain connectivity for lynx.
Standard ALL S1	New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.	
Objective VEG O1	Manage vegetation to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx.	Natural succession and disturbance processes would be approximated in all alternatives.
Objective VEG O2	Provide a mosaic of habitat conditions through time that support dense horizontal cover, and high densities of snowshoe hare. Provide winter snowshoe hare habitat in both the stand initiation structural stage and in mature, multi-story conifer vegetation.	The mosaic would be provided over time.
Objective VEG O3	Conduct fire use activities to restore ecological processes and maintain or improve lynx habitat.	Prescribed burning would be consistent with restoration of ecological processes. Lynx habitat would be maintained.
Objective VEG O4	Focus vegetation management in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover.	Most of the vegetation management proposed in Alternatives 2 and 3 would occur in areas with poorly developed understories. Site productivity in this area is such that a high density of conifers and other vegetation would be created in younger stands.

Standard VEG S1	Unless a broad scale assessment has been completed that substantiates different historic levels of stand initiation structural stages, limit disturbance in each LAU as follows: If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects. This standard does not apply to fuel treatment projects within the Wildland Urban Interface (WUI) as defined by HFRA, subject to limitations.* In addition, fuel treatment projects may not result in more than three adjacent LAUs exceeding the standard.	All alternatives are consistent. Less than 30% of the LAU acres do not yet provide winter snowshoe hare habitat. Currently, 19% of the Upper Big and 4% of the Lakalaho LAU is in this condition. The Taylor Hellroaring project would increase this slightly in the Upper Big LAU and double it to 8% in the Lakalaho LAU under both action alternatives. When adding cumulative effects (the Whitefish Municipal Watershed Project), this remains at 8% for the Lakalaho LAU under both action alternatives. In all alternatives, far less than the FNF's 6% allowance (103,800 acres) would be used. FNF currently has 93,415 acres remaining. No more than 3 adjacent LAUs would exceed the standard under any alternative. See Project File Exhibits Rt-8 and Rt-15.
Standard VEG S2	Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands in an LAU in a 10-year period. This standard does not apply to fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to limitations.*	All alternatives are consistent. Less than 15% of lynx habitat by LAU would be regenerated in a 10-year period. The Taylor Hellroaring project would regenerate less than 1% of lynx habitat in the Upper Big LAU and 4% of the Lakalaho LAU under both action alternatives. When adding cumulative effects (the Whitefish Municipal Watershed project), this would be 4.3% for the Lakalaho LAU.
Standard VEG S5	Precommercial thinning projects that reduce snowshoe hare habitat may occur from the stand initiation structural stage until the stands no longer provide winter snowshoe hare habitat only under certain exceptions, such as daylight thinning of planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is retained. This standard does not apply to fuel treatment projects that use precommercial thinning as a tool within the wildland urban interface (WUI) as defined by HFRA, subject to limitations.*	All alternatives are consistent. No precommercial thinning is proposed in either action alternative.
Standard VEG S6	Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late successional forests may occur only: 1. Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements; 2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; or 3. For incidental removal during salvage harvest (e.g. removal due to location of skid trails). This standard does not apply to fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to limitations.*	All alternatives are consistent. Vegetation management in multi-story lynx feeding habitat would occur only inside of the Wildland Urban Interface (Alternatives 2 and 3, 74.17 acres) adjacent to Communication sites, for fuel reduction purposes as allowed under the NRLMD. Also see discussion under standards VEG S1 and VEGS2 and guideline VEG G10.
Guideline VEG G1	Vegetation management projects should be planned to recruit a high density of conifers, hardwoods, and shrubs where such habitat is scarce or not available. Priority should be given to stem-exclusion, closed-canopy structural stage stands for lynx or their prey (e.g. mesic, monotypic lodgepole stands). Winter snowshoe hare habitat should be near denning habitat.	All alternatives are consistent. Site productivity in this area is such that a high density of conifers and other vegetation would be created in younger stands; winter hare habitat remains close to potential lynx denning habitat.

Guideline VEG G4	Prescribed fire activities should not create permanent travel routes that facilitate snow compaction. Constructing permanent firebreaks on ridges or saddles should be avoided.	All alternatives are consistent. No permanent travel routes. Firebreaks would not be along ridges or saddles.
Guideline VEG G5	Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU.	All alternatives are consistent. A considerable amount of habitat for alternate prey would remain.
Guideline VEG G10	Fuel treatment projects in the WUI, as defined by HFRA, should be designed considering standards VEG S1, S2, S5, and S6 to promote lynx conservation.	These standards were considered for Alternatives 2 and 3. In the Upper Big LAU, 6,777 acres of multistory and 733 acres of stand initiation lynx feeding habitat would remain intact. In the Lakalaho LAU 9221 acres of multi-story and 1922 acres of stand initiation lynx feeding habitat would remain intact. Further, treatments would reduce risks from fire and insect and disease, consistent with the project's Purpose and Need. Also see discussion above under standards VEG S1, S2, S5 and S6.
Guideline VEG G11	Denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris, either down logs or root wads, or large piles of small wind thrown trees ("jack-strawed" piles). If denning habitat appears to be lacking in the LAU, then projects should be designed to retain some coarse woody debris, piles, or residual trees to provide denning habitat in the future.	All alternatives are consistent. Denning habitat will continue to be abundant. In harvest units, some of the coarse woody debris, piles, and trees would be retained.
Guideline HU O1	Maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat.	Motorized public over snow travel would not be allowed on new system roads.
Guideline HU O2	Manage recreational activities to maintain lynx habitat and connectivity.	All alternatives are consistent. Recreational activities promoted by this project are focused along narrow corridors.
Guideline HU O3	Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.	All alternatives are consistent. New trailhead would be located in developed area of Holbrook section of project.
Guideline HU G7	New permanent roads should not be built on ridge-tops and saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers.	No new permanent roads would be constructed on ridgetops, on saddles, or in areas important for lynx habitat connectivity. No permanent roads or trails would be constructed in or near forested stringers.
Guideline HU G8	Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.	All alternatives are consistent. Funding constraints limit this to the minimum necessary for safety.
Guideline HU G9	On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives.	All alternatives are consistent. Public motorized use would not be allowed on new roads and effective closures will be provided. All temporary roads would be rehabilitated. The project proposes adding new road segments to the system. These roads would be reclaimed and would not be passable to motorized vehicles. Permanent roads built for this project would be needed for other management objectives.

* Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 may occur on no more than six percent (cumulatively) of lynx habitat on each administrative unit (National Forest). For fuel treatment projects within the WUI, see guideline VEG G10.

As stated in *Chapter 2* under Design Features, if any active Canada lynx denning sites are discovered in or near any proposed vegetation management unit, area of road construction, trail construction, or similar activity, activities would be modified if needed to protect habitat conditions and maintain reproductive efforts. While other factors outside of the Forest Service's control (i.e. non-target trapping mortality and competing predator populations) may impede lynx recovery, in the context of the NRLMD, actions proposed in the project area are compatible with conserving lynx to a non-listed status and they are consistent with maintaining habitat for viable populations of lynx at the regional scale.

Consultation with the USFWS for Canada lynx will be completed on the selected alternative before the decision is finalized for the Taylor Hellroaring Project (*Project File Exhibits Rt-2, Rt-3, and Rt-4*).

Canada Lynx Critical Habitat

Introduction

The analysis for Canada lynx Critical Habitat (USDI FWS 2014) is separate from that applied above to the Northern Rockies Lynx Management Direction, although the scientific basis of the analysis is essentially the same (*Project File Exhibit Rt-20*). See the *Introduction, Information Sources, Analysis Area, Affected Area, and Environmental Consequences* subsections above on Canada Lynx and Canada Lynx Habitat for more information.

Affected Environment

As of the 2014 revision, on the Flathead National Forest, there are approximately 2,273,340 acres of designated critical habitat for lynx. The majority of both the Upper Big and Lakalaho Lynx Analysis Units (LAUs) is designated as Critical Habitat in Unit 3 (USDI FWS 2014 and *Project File Exhibit Rt-20*). A map of the proposed units, project Lynx Analysis Units, and critical habitat is located in *Project File Exhibit Rt-15*. The entire Flathead National Forest is within Unit 3 of designated lynx Critical Habitat and contains physical and biological elements essential for the conservation of the species, including its Primary Constituent Elements (PCEs) and its components (USDI FWS 2014). Unit 3 is 9,783 square miles (6,261,095 acres). In such areas, the "Primary Constituent Element" for the Canada lynx is "boreal forest landscapes supporting a mosaic of differing successional forest stages." These landscapes also contain snowshoe hares and their preferred habitats, winter snows that are generally deep and fluffy for extended periods of time, sites for denning that have abundant coarse woody debris, and a matrix of habitats that do not support snowshoe hares but lynx are likely to travel through within a home range (USDI FWS 2014).

By definition, critical habitat for Canada lynx contains the physical and biological features essential to conservation of the lynx, and is comprised of "primary constituent elements" (PCEs) in an appropriate quantity and spatial arrangement (USDI Fish and Wildlife Service 2008). Based on the current knowledge of the life history, biology, and ecology of the lynx, the primary constituent elements and its four components for lynx critical habitat are:

Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

- Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface (PCE 1a);
- Winter snow conditions that are generally deep and fluffy for extended periods of time (PCE 1b);
- Sites for denning that have abundant coarse woody debris, such as downed trees and root wads (PCE 1c); and

- Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range (PCE 1d).

See Table 3-62 for a summary of lynx critical habitat Primary Constituent Elements (PCEs) across critical habitat in the Upper Big and Lakalaho LAUs. All of the PCEs, including deep fluffy snows and connectivity, are abundant and well-distributed across this area (*Project File Exhibit Rt-20*).

Table 3-62. Current Conditions of Potential Lynx Habitats Relevant for Critical Habitat Analysis by Lynx Analysis Unit and Percentages of Potential Lynx Habitat in the LAU. (*Project File Exhibit Rt-20*).

Lynx Analysis Unit (LAU)	Total Acres LAU	Total Acres Critical Habitat (CH)	Stand Initiation ¹ (PCE1a) Acres (% of CH)	Multistory ² (PCE1a & PCE1c) Acres (% of CH)	Other ³ (PCE1c) Acres (% of CH)	Matrix ⁴ (PCE1d) Acres (% of CH)
Upper Big	19,611	19,223	723 (3.8%)	6,756 (35.1%)	5,168 (26.9%)	6,575 (34.2%)
Lakalaho	22,456	22,455	1,924 (8.6%)	9,296 (41.4%)	8,783 (39.1%)	2,452 (10.9%)

¹ Stand initiation structural stage that provides snowshoe hare habitat.

² Forested multi-storied structural stage with many age classes and vegetation layers that provides denning habitat and winter snowshoe hare habitat.

³ Stem exclusion structural stage: closed canopy with understory limited; does not provide snowshoe hare habitat but does provide potential denning habitat.

⁴ Matrix: hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No additional actions, such as timber harvest, fuel reduction, prescribed fire, road construction, or trail construction are proposed with this alternative. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by Canada lynx. See Table 3-68, below in the Cumulative Effects section. In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance of large wildland fires in adjacent areas, which could have mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat. Ecological disturbances are often favorable to lynx, but the net effects could be negative in a managed landscape.

Direct and Indirect Effects of Alternatives 2 and 3

The assumptions involved in the analysis of vegetation management effects on Lynx Critical Habitat (USDI FWS 2014) are detailed in *Project File Exhibits Rt-15* and *Rt-20*. These include a) trees would continue to grow, particularly affecting young sapling stands; and c) there would be a lack of other stand-level changes, such as wildland fire and insect epidemics.

All of the vegetation management proposed in Alternatives 2 and 3 would occur in stands identified as lynx Critical Habitat (*Project File Exhibits Rt-15* and *Rt-20*) except for Unit 48 and a portion of unit 44 in the Holbrook area of the project. Table 3-63 shows changes in lynx habitats due to vegetation

management. See Table 3-65, below in the Cumulative Effects section for the resulting percentages of lynx habitats and critical habitat across the Lynx Analysis Units.

Table 3-63. Changes through Vegetation Management in Potential Lynx Habitats relevant for Critical Habitat Analysis, Upper Big and Lakalaho LAUs, in acres. (Project File Exhibit Rt-20).

LAU	PCE1a (Presence of Snowshoe Hares and their Preferred Habitat Conditions)	PCE1c (Sites for Denning)	PCE1d (Matrix)
Upper Big		-21 acres	+21 acres
Lakalaho	-74 acres	-833 acres	+833 acres

In all action alternatives, the loss of denning habitat (PCE1c), which is plentiful in the area, would be partially balanced in that the removal of fuels would reduce the probability of fire spreading to remaining denning habitat of higher quality. In addition, tree planting and the removal of smaller-diameter downed wood in harvest units would accelerate regeneration into sapling stands preferred by snowshoe hares and hunting lynx (PCE1a).

Almost all of the road construction that would affect lynx Critical Habitat PCEs (Table 3-64) would go through “Other” habitat, which is included in denning habitat. Permanent road construction would have a greater impact because permanent road corridors are wider (approximately 30 feet) and those cleared for temporary roads are narrow (approximately 20 feet) and allowed to revegetate. PCE1b and PCE1d would not be impacted by road construction.

Table 3-64. Changes through Road Construction in Lynx Habitats relevant for Critical Habitat Analysis, in acres. (Project File Exhibit Rt-20).

LAU	PCE1a (Presence of Snowshoe Hares and their Preferred Habitat Conditions)	PCE1c (Sites for Denning)	PCE1d (Matrix)
Upper Big	-0.5 acres	-1.5 acres	+1.5 acres
Lakalaho	-0.5 acres	-10.1 acres	+10.8 acres

Trail construction and use would also have effects on lynx and lynx habitats. Most newly constructed trails will pass through areas of potential lynx habitat. Trail class was used to estimate acres of habitat effected by trail construction (typically 6-8 feet in width), however effects may be much greater where vegetation is removed adjacent to trails to maintain sight distances for safety purposes.

Table 3-65. Changes through Trail Construction on Lynx Critical Habitat by alternative, in acres, before vegetation management.

LAU	Alt.	PCE1a (Presence of Snowshoe Hares and their Preferred Habitat Conditions)	PCE1c (Sites for Denning)	PCE1d (Matrix)
Upper Big	2	-0.1 acres	-0.1 acres	+0.1 acres
	3			
Lakalaho	2	-3.1 acres	-8.0 acres	+8.8 acres
	3	-1.6 acres	-5.7 acres	+6.0 acres

Project activities affecting critical habitat would also occur in the Holbrook area of the project. Under both action alternatives, there would be approximately 32 acres of commercial thinning in “other” habitat located in critical habitat. The remaining 57 acres of commercial thinning along with the 4 acres of seed tree harvest in critical habitat would occur in “permanent non-lynx” habitat. All road construction in critical habitat in the Holbrook area would occur in “permanent non-lynx” habitat, with 0.2 miles of temporary road proposed. Proposed trail construction differs by alternative. Under alternative 2, 3.04 miles of trail are proposed in critical habitat, with 0.81 miles in “other” habitat and 2.23 miles in “permanent non-lynx” habitat. Under alternative 3, 2.30 miles of trail are proposed, with 0.81 miles in “other” habitat and 1.49 miles in “permanent non-lynx”. As noted above for proposed activities within the Lakalaho LAU, denning habitat is plentiful in the area and its loss of would be partially balanced by the reduced probability of fire spreading to denning habitat of higher quality.

Cumulative Effects

Most of the cumulative effects relevant to Canada lynx Critical Habitat (*Project File Exhibit Rt-6*) are described in the sections of this chapter on *Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat; and Commonly Hunted Big Game*. These include loss and alteration of habitat due to timber harvest, past wildland fires, and access for recreation, firewood cutting, hunting, and trapping. See also *Project File Exhibits Q-8, Rb-6, Rd-12, Rg-1, Rn-3, Rr-2, and Rt-6*.

Tables 3-66 and 3-67 take into account all ongoing, proposed, and reasonably foreseeable changes to vegetation relevant to Canada lynx Critical Habitat across the Upper Big and Lakalaho LAUs, including the Whitefish Municipal Watershed Project. Timber harvest, precommercial thinning, and fuel reduction across national forest, state, and private lands has removed or altered lynx habitat, typically leaving few smaller trees, low limbs, snags, or large downed wood (*Project File Exhibits Rg-1 and Rt-6*). Such areas can still function as lynx habitat but at reduced quality for a period of time. In the project area, much of the potential lynx habitat is in mature forest with very little understory vegetation and a relative scarcity of lynx multistory forage. Past fire suppression may have contributed to this as well as low levels of sapling feeding habitat. This has also led to an increased risk of a stand-replacement wildland fire. Actions that have affected PCE1a (snowshoe hares and their habitats) include timber harvest, precommercial thinning, fire, fire suppression, and road construction. Those same actions have affected PCE1c (sites for denning), as have firewood collection. Actions that may have affected PCE1b (deep fluffy snows) include over-snow recreation and snow plowing. Past prescribed fire, tree planting, shrub planting, noxious weed control, and beaver control had little or no long-term effects on lynx Critical Habitat.

Table 3-66. Changes to Potential Lynx Habitat in Critical Habitat through all Project Activities by Alternative and LAU, in acres. (*Project File Exhibit Rt-15*)

Lynx Analysis Unit (LAU) (Alternative)	Total Acres Critical Habitat (CH)	Stand Initiation ¹ (PCE1a) Acres (% of CH)	Multistory ² (PCE1a & PCE1c) Acres (% of CH)	Other ³ (PCE1c) Acres (% of CH)	Matrix ⁴ (PCE1d) Acres (% of CH)
Upper Big (Existing Condition)	19,223	723 (3.8%)	6,756 (35.1%)	5,168 (26.9%)	6,575 (34.2%)
Upper Big (Alt. 2)		723 (3.8%)	6,755 (35.1%)	5,146 (26.8%)	6,598 (34.3%)

Upper Big (Alt. 3)		723 (3.8%)	6,756 (35.1%)	5,146 (26.8%)	6,598 (34.3%)
Lakalaho (Existing Condition)	22,455	1,924 (8.6%)	9,296 (41.4%)	8,783 (39.1%)	2,452 (10.9%)
Lakalaho (Alt. 2)		1,922 (8.6%)	9,221 (41.1%)	8,009 (35.7%)	3,304 (14.7%)
Lakalaho (Alt.3)		1,923 (8.6%)	9,221 (41.1%)	8,010 (35.7%)	3,301 (14.7%)

Table 3-67. Summary of Changes to Potential Lynx Habitat in Critical Habitat through all Project Activities by Alternative, in acres. (Project File Exhibit Rt-15).

Potential Lynx Habitat	Alternative	
	Alt 2	Alt 3
Upper Big		
PCE1a (Snowshoe Hare Habitat)	-0.6	-0.5
PCE1c (Denning Habitat)	-22.6	-22.5
PCE1d (Matrix Habitat)	+22.6	+22.5
Lakalaho		
PCE1a (Snowshoe Hare Habitat)	-77.6	-76.1
PCE1c (Denning Habitat)	-851.1	-848.8
PCE1d (Matrix Habitat)	+852.6	+849.8

Roads constructed across lynx critical habitat in the Upper Big and Lakalaho LAUs (Table 3-64) facilitated access for timber harvest, firewood cutting, and other activities, as discussed in the *Snags and Downed Wood Habitat* section of this chapter. Firewood cutting along open roads has decreased downed logs particularly important for lynx and their prey. Brushing of saplings along most USFS roads in lynx habitat has reduced their value to snowshoe hares. Construction and maintenance of trails would require clearing of downfall.

Facilitation of human access, hunting, trapping, and predator control are likely to continue to occur with little or no effect on Canada lynx Critical Habitat. Other cumulative effects on lynx critical habitat are varied, but they do not differ by alternative. These include wildland fire suppression, timber harvest, prescribed burning, fuels reduction, road construction/maintenance/BMPs, trail construction/maintenance, and private land development.

Regulatory Framework and Consistency

Critical Habitat designation for Canada lynx (USDI FWS 2014) was revised on September 12, 2014 (*Project File Exhibit Rt-20*). The analysis done for lynx critical habitat is separate from that applied to the Northern Rockies Lynx Management Direction, although the scientific basis of the analysis is essentially the same. Consultation on lynx critical habitat is not tiered to Northern Rockies Lynx Management Direction. The Taylor Hellroaring project analysis considered the Primary Constituent Elements (PCEs) of lynx critical habitat and encompassed the appropriate landscape scale, consistent with the lynx critical habitat rule. Table 3-68 and *Project File Exhibit Rt-20* describe the effects of this project in the perspective of the LAUs and across Critical Habitat Unit 3.

The U.S. Fish and Wildlife Service concluded that “the effects of the NRLMD are not likely to result in the destruction or adverse modification of designated Canada lynx critical habitat” (USFWS 2017, Project File Rt-23). Under NRLMD, adverse effects on PCE 1a would be “limited in severity and in scale to the extent that critical habitat would continue to produce adequate densities of snowshoe hares and adequate levels of cover to support persistent lynx populations” across Critical Habitat Unit 3 and the unit would retain current functionality of the PCE (USFWS 2017). The conclusion in this BO was based primarily on the biological assessment on the effects of the NRLMD on lynx critical habitat (USFS 2017, *Project File Exhibit Rt-24*).

Table 3-68. Primary Constituent Elements of Canada Lynx Critical Habitat (USDI FWS 2014) and the Taylor Hellroaring Project (*Project File Exhibit Rt-20*).

Primary Constituent Element		Effect Across LAUs and Critical Habitat Unit 3
PCE1a	Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface.	The 76 to 78 acres of hare habitat that would be affected by vegetation management, road construction, and trail construction make up less than 1% of the available hare habitat in the LAUs and a miniscule part of Critical Habitat Unit 3.
PCE1b	Winter snow conditions that are generally deep and fluffy for extended periods of time.	The presence of deep fluffy snows would not be affected by this proposal.
PCE1c	Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.	Denning habitat would still be abundant (>60%) and well distributed across Lynx Critical Habitat.
PCE1d	Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.	The proposal would not alter the ability of lynx to access habitat within or between home ranges. There would be no negative impacts on any lynx linkage area (Squires et al. 2013).

The Taylor Hellroaring Project would not result in destruction of critical lynx habitat, nor would it impede movement through matrix habitat. All PCEs would remain abundant and well distributed across the Upper Big and Lakalaho LAUs before, during, and after implementation of all alternatives.

Consultation with the USFWS for Critical Habitat designated for the Canada lynx will be completed on the selected alternative before the decision is finalized for the Taylor Hellroaring Project (*Project File Exhibits Rt-2, Rt-3, and Rt-4*).

Grizzly Bear

Introduction

The grizzly bear (*Ursus arctos horribilis*) is the largest carnivore in northwest Montana and a species that could occur in any part of the Taylor Hellroaring project area. At the Forest level, meeting the needs of the grizzly bear is an indicator that the needs of other forest carnivores are met. Grizzly bears have large home ranges and use a wide variety of relatively undisturbed habitats that indicate relatively broad environmental limits (USDA Forest Service, 2017a). The high level of topographic and vegetative diversity allows grizzly bears to effectively use different habitats and leads to both their omnivorous or generalist feeding habit and an adaptable ability to eat a wide variety of plant and animal foods

Grizzly bears are opportunistic feeders and will prey or scavenge on almost any available food. Plants with high crude protein content and animal matter are the most important food items. Habitats with abundant grasses, forbs, sedges, shrubs, plant roots, and bulbs are heavily used by grizzly bears (e.g., avalanche chutes, riparian areas, shrub lands). Mace and Waller (1997), in their discussion of grizzly bear ecology in the Swan Mountains, describe how grizzly bears move to lower elevations after emerging from their dens to seek green vegetation and carrion. During mid-spring, bears move to median elevations in search of optimum forage. During early summer, the foraging elevation drops slightly, as bears exploit early ripening huckleberries at lower elevations, and then follow the pattern of ripening or green up to higher elevations. The elevations at which bears will forage decline again as food resources at higher elevations become unavailable due to frost and snow.

When grizzly bears are away from denning habitat or other areas that provide sufficient food and security, the effects of actions such as timber harvest, road construction and use, wildland fires, and insect epidemics are primarily limited to temporary displacement and changes in the availability of cover. Bears are most vulnerable in areas with high open road densities and limited cover and escape habitat (Claar, et al. 1999, Schwartz et al. 2010). Timber harvest and wildland fire can reduce cover for security and create short-term changes in food availability (Witmer, et al. 1998). See Exhibit Rt-13 for more background information.

Analysis Area

The Taylor Hellroaring Project is located in the Northern Continental Divide Ecosystem Grizzly Bear Recovery Area. The Northern Continental Divide Ecosystem has been divided into Bear Management Unit subunits. These subunits approximate the size of a female grizzly bear's home range. The grizzly bear analysis area for this project is the Lazy Creek (34,606 acres), Canyon McGinnis (33,239 acres), and Werner Creek (28,641 acres) Grizzly Bear subunits. Land ownership within the project subunits is shown below in Table 3-69 and Figure 3-12. These subunits were used to analyze direct, indirect, and cumulative effects to the grizzly bear and have been determined as the appropriate scale to analyze effects to grizzly bears by the Interagency Grizzly Bear Committee (IGBC). Conservation measures for the grizzly bear, including standards and guidelines, have been addressed at the subunit scale (Forest Plan Amendment 19).

Table 3-69. Land Ownership in Project Grizzly Bear Subunits.

Grizzly Bear Subunit	Total Acres	National Forest Service	Weyerhaeuser	Small Private	State DNRC
Lazy Creek	34,606	12.0%	42.5%	3.8%	41.8%
Canyon McGinnis	33,239	91.3%	0.0%	8.2%	0.0%
Werner Creek	28,641	98.7%	0.0%	0.0%	1.3%

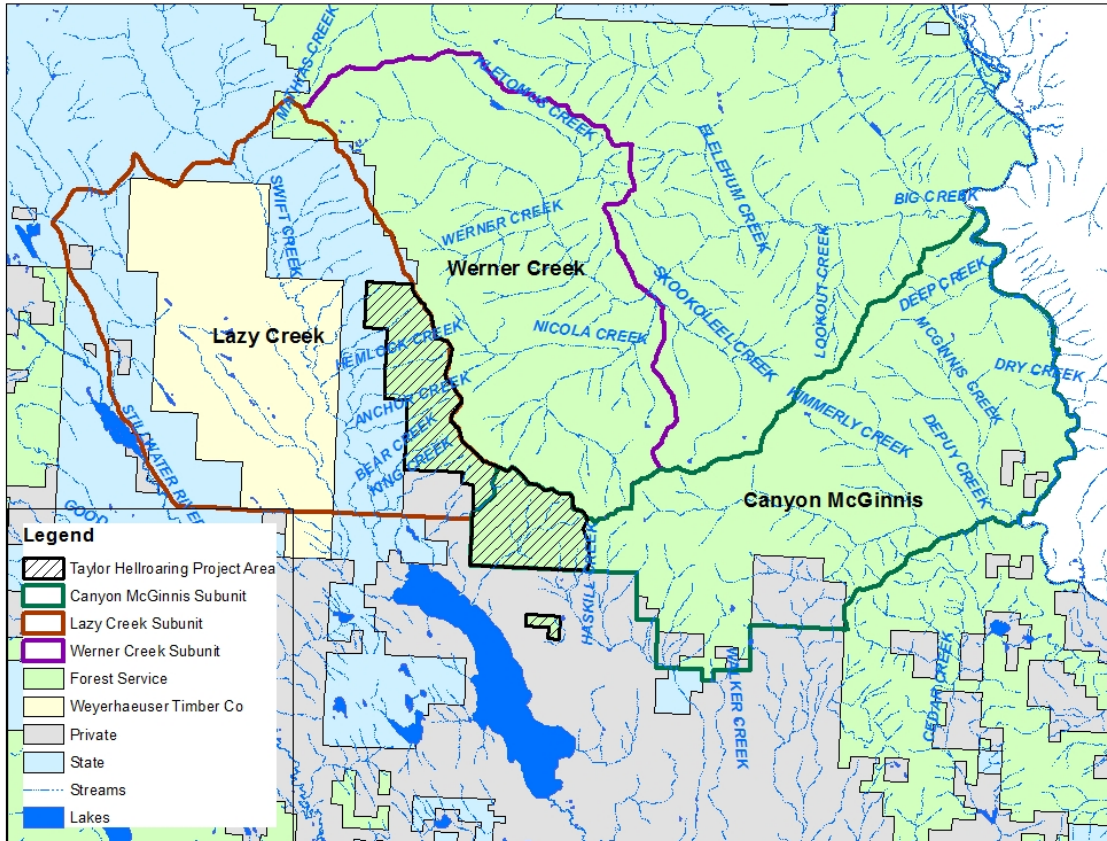


Figure 3-12. Land ownership in project grizzly bear subunits.

Temporal Bounds

The length of time for effects analysis is approximately ten years. This is based on the probable contract length for the proposed project, the timeframes for related activities, and the reasonably foreseeable actions identified. The temporal scale of the effects analysis extends 100 years into the future. The rationale for temporal bounds for specific activities are discussed below.

Information Sources

Data used for analysis included stand exams, VMAP data, aerial imagery, grizzly bear telemetry data, past grizzly bear mortality information, grizzly bear denning habitat model, and review of the best available science. In addition, site-specific information on habitat characteristics was collected during on-site visits of proposed treatment areas. Road density, hiding cover, effects to Security Core, levels of displacement, and risk of mortality were used to evaluate the effects of the project alternatives.

Affected Environment

Habitat

Grizzly bears have large home ranges and use a wide variety of relatively undisturbed habitats that indicate relatively broad environmental limits (USDA Forest Service, 2017a). The high level of topographic and vegetative diversity allows grizzly bears to effectively use different habitats and leads to their omnivorous or generalist feeding habit and an adaptable ability to eat a wide variety of plant and animal foods (Teisberg, Madel, Mace, Servheen, & Robbins, 2015). Information on grizzly bear food habits and habitat use in the Northern Continental Divide Ecosystem indicate that bears use a diverse array of habitats and consume a variety of foods, which can vary substantially by location and

season (Teisberg et al., 2015). Mixed shrub fields, seeps, grasslands, timbered side-hill parks, and burns are used for feeding and resting. A seasonal elevation gradient is often used, including low elevation riparian areas, avalanche chutes, meadows in spring and fall, and higher elevation habitats, such as subalpine forests, alpine tundra, and boulder fields in summer, early fall and winter.

The revised 1993 Recovery Plan for grizzly bear (USDI Fish and Wildlife Service, 1993) delineated grizzly bear recovery zones in six mountainous ecosystems. The proposed Taylor Hellroaring Project lies within the Northern Continental Divide Ecosystem. National Forest System lands encompass 63 percent of the Northern Continental Divide Ecosystem recovery zone. At 40 percent of the Northern Continental Divide Ecosystem, the Flathead National Forest is the majority Federal manager of lands within the Northern Continental Divide Ecosystem recovery zone (USDA Forest Service, 2017a).

Grizzly bears have been shown to have a negative relationship with human development and activity. High human activity levels may negatively affect grizzly bears by causing displacement from preferred habitats. Grizzly bears are highly dependent upon learned habitat; displacement into unknown territory may lead to sub-marginal nutrition, reduced reproduction, or greater exposure to adult predatory bears or human food sources, which can lead to human-caused mortality (R. D. Mace & J. S. Waller, 1997; USDA Forest Service, 2017a). Roads and their associated traffic are known to lessen the effectiveness and use of adjacent habitat, and expose bears that do travel on or near them to elevated risks from human-caused mortality (Kasworm & Manley, 1990; R. D. Mace & J. S. Waller, 1997; B. N. McLellan & Shackleton, 1989). Within the South Fork of the Flathead, Mace and Waller (1997) showed substantive blocks of roadless habitat as a component of adult female home ranges. Approximately 67.5 percent of composite home ranges for eight female bears was greater than 0.3 miles (0.5 kilometers) from a road. The least amount of core area used in the South Fork Study was roughly 55 percent (USDA Forest Service, 1994).

Since the South Fork Study, recent advances in radio-tracking technology have improved how to monitor grizzly bear habitat use. Instead of very high frequency radio collars used to locate bears (which could only be located once daily), GPS radio collars can document grizzly bear locations throughout a 24-hour period documenting movements and habitat use day and night. In Alberta, Roever, Boyce, and Stenhouse (2010) documented bear selection for movements along or near low volume forest roads. Northrup et al. (2012) documented bear movement near open forest roads during periods of low human activity. In British Columbia, Wielgus, Vernier, and Schivatcheva (2002) documented grizzly selection against open forest roads, but did not document any avoidance of restricted roads (forestry use only) by bears within the study. In the Swan Valley, Ruby (2014) found that grizzly bears did not select against high or low densities of restricted roads at the valley scale. Boulanger and Stenhouse (2014) found that road density did appear to influence population trend; however the authors note that survival rates and population trend compared to their study area in Canada were lower compared to the Northern Continental Divide Ecosystem. It should be noted that in Canada, many of the gravel forest roads are not closed to the public unlike on the Flathead Forest, which has strict objectives for open route densities and administrative travel behind gated roads. In the Flathead Valley of British Columbia and Montana, after three decades of monitoring grizzly bear vital rates, Bruce N McLellan (2015) found that industrial activities (logging and gas exploration) did not have a clear negative effect on population trend. While the highest bear densities were detected in the multiple use landscapes of the study area, bears likely avoided negative impacts of industrial activities by avoiding periods of human activities within the multiple use areas.

Recent human-caused mortality in Montana includes management control actions, defense of life, vehicle and train collisions, defense of property, mistaken identity by black bear or other big game hunters, poaching, and malicious killing. From 2000 through 2010, known grizzly bear mortality averaged about 21.5 bears per year. The greatest cause of mortality from 2000 through 2010 was from human-site conflict associated with food, garbage or stock (59 of the 236 deaths or 25 percent).

Other major causes of mortality were from illegal or malicious activities (17 percent), trains and vehicles (20 percent), and self-defense (11 percent). Mortality occurs in all parts of the Northern Continental Divide Ecosystem with most mortalities occurring on private lands ($139/236 = 59$ percent) and associated with human-site conflicts, which includes vehicle mortality. An increase in known human-caused or management-related mortality has been associated more with rural roaded areas, and primarily on private property adjacent to national forests (USDA Forest Service, 2017a).

There is the potential for displacing grizzly bears during implementation of proposed activities. Forest management has been found to displace grizzly bears (B. N. McLellan & Shackleton, 1989) and grizzly bears have been documented to use areas of dense cover for movement (Gibeau, Clevenger, Herrero, & Wierzchowski, 2002; Zager, Jonkel, & Habeck, 1983). In Alberta, Nielsen, Boyce, and Stenhouse (2004) found grizzly bears selected clear cuts during fall periods due to the high diversity of foods present. Boulanger, Cattet, Nielsen, Stenhouse, and Cranston (2013) documented bears that used regenerating forest after harvesting were most likely to see gains in their body condition; however, these gains were offset due to higher mortality risk in roaded environments. C. C. Schwartz, Haroldson, and White (2010) evaluated road densities and grizzly bear survival in the Greater Yellowstone Ecosystem and found that open road densities were associated with grizzly bear mortality. In summary, vast areas of no or low human activity to reduce mortality risk, and a mosaic of moist, open-land habitats in combination with timbered areas for cover are essential for optimum grizzly bear habitat.

Flathead Forest Plan Amendment 19 (A19) includes standards and objectives for Open and Total Motorized Access Densities as well as for Security Core. Table 3-70 includes the existing Open Motorized Access Density (OMAD), Total Motorized Access Density (TMAD) and Security Core (CORE) percentages in the project subunits. It is important to note that because the Lazy Creek Subunit consists primarily of non-NFS lands, it is not subject to A19 direction but rather managed under a Habitat Conservation Plan (HCP) by Montana DNRC (see the Regulatory Framework portion of this section)(*Project File Exhibit Rt-5*).

Table 3-70. Amendment 19 Existing Access Conditions in Project subunits.

Grizzly Bear Subunit	Access Density Parameter		
	OMAD (> 1 mi/mi ²)	TMAD (> 2 mi/mi ²)	CORE
Lazy Creek (not subject to A19)	N/A	N/A	N/A
Canyon McGinnis (amended 19-33-53)	19%	32%	50%
Werner Creek (amended 29-19-63)	29%	20%	63%

Grizzly bear habitat use varies throughout the year. Denning habitat has been characterized by looking at combinations of elevation, aspect, slope, and vegetation that matched known grizzly bear dens. The analysis area supports over 32,000 acres of habitat that appears to meet grizzly bear denning needs across the analysis area (*Project File Exhibit Rt-5*). Denning season in this area is considered to be from December 1 to March 31 each year. Spring (April 1 to June 30) is a key time for grizzlies because they are coming out of their winter dens, possibly with young cubs or yearlings, and it is the breeding season. Spring habitats typically emphasize avalanche slopes and other habitats supporting grasses and forbs; Richard D. Mace and Manley (1993) in a study of grizzlies in the South Fork of the Flathead River, found that grizzlies fed on grasses and sedges most heavily in June. In summer and fall, Richard D. Mace and Manley (1993) found that grizzlies switched to berries during the middle of July and continued to feed heavily on berries through September.

Availability of cover was recognized by the forest plan (USDA Forest Service, 1985) as a factor affecting grizzly bear habitat security, with direction to provide at least 40 percent cover within each subunit. In the project subunits, cover exceeds 40 percent and is well distributed throughout the area (See *Project File*). Hiding cover is defined as trees of sufficient size and density to obscure an animal at 200 feet (Forest Plan, p.VII-11).

Table 3-71. Existing Conditions for Seasonal Habitats and Cover within Project Subunits.

Grizzly Bear Subunit	Acres in subunit	Potential Key Spring Habitat <4,900 ft. elevation Acres (% of subunit)	Potential Denning Habitat >5,900 ft. elevation Acres (% of subunit)	Hiding Cover Acres (% of subunit)
Lazy Creek	34,606	28,387 (82.0%)	3,527 (10.2%)	25,626 (74.1%)
Canyon McGinnis	33,239	16,279 (49.0%)	8,567 (25.8%)	16,481 (49.6%)
Werner Creek	28,641	4,347 (15.2%)	13,245 (46.2%)	22,955 (80.1%)

Population Status

The grizzly bear was listed as a threatened species under the Endangered Species Act in the lower 48 States in 1975. The Grizzly Bear Recovery Plan was completed in 1982 and revised in 1993 (USDI Fish and Wildlife Service, 1993). The 1993 revised Recovery Plan delineated grizzly bear recovery zones and detailed recovery objectives and strategies.

In the Northern Continental Divide Ecosystem, grizzly bears are increasing their range and have a population beyond recovery plan levels (Robert D. Mace & Roberts, 2014; USDA Forest Service, 2002, 2017a). The Grizzly Bear Recovery Plan (USDI Fish and Wildlife Service, 1993) identifies a minimum Northern Continental Divide Ecosystem-wide grizzly bear population of 391 (211 bears outside Glacier National Park and 180 bears inside Glacier National Park). Grizzly bear population monitoring using a DNA sampling technique was carried out in 1998 and 2000 in approximately the northern one-third of the Northern Continental Divide Ecosystem. The sample area included the North Fork of the Flathead River and Glacier National Park. Adjusted for lack of study area closure, the average number of grizzly bears in 1998 was 241. In 2000, the average number of grizzly bears was also 241 (K. C. Kendall et al., 2008).

Many cooperators, including the Flathead National Forest, were involved in the 2004 U.S. Geological Survey (USGS) Northern Continental Divide Grizzly Bear Project, which was designed to derive a population estimate for grizzly bears in the entire Northern Continental Divide Grizzly Bear Ecosystem based on DNA sampling. The Northern Continental Divide Ecosystem grizzly bear population estimate was 765 animals, with the range estimated to be between 715 and 831 individuals (K. C. Kendall et al., 2008).

An ongoing Northern Continental Divide Ecosystem-wide population trend study conducted by the Montana Fish Wildlife and Parks has recently estimated that the Northern Continental Divide Ecosystem grizzly bear population increased at a rate of three percent per year between 2004 and 2010 (Richard D. Mace et al., 2012). Therefore, the total population size and the positive, increasing trend indicate that human-caused mortality in the ecosystem has been low enough (i.e., sustainable) to allow population growth (Richard D. Mace et al., 2012). The population demographics indicate high survival for female bears (95 percent) within the ecosystem, accredited in part to habitat security (R. Mace & Roberts, 2013; Richard D. Mace & Roberts, 2011). The Flathead National Forest represents 63 percent of the Northern Continental Divide Ecosystem. Both reproductive and survival rates in the

Northern Continental Divide Ecosystem are higher and the population growth rate is positive when compared to other grizzly bear populations further north in Alberta (Boulanger & Stenhouse, 2014). Richard D. Mace and Roberts (2011) attributed the high survival, reproduction and positive population growth in part to habitat security measures in the Northern Continental Divide Ecosystem. Costello, Mace, and Roberts (2016) refined the Northern Continental Divide Ecosystem trend calculation by including additional marked bear information from 2010 to 2014 and including bears that had been in conflict with humans in the analysis. Costello et al. (2016) calculated the trend of the population in the Northern Continental Divide Ecosystem to be growing at approximately 2.3 percent. The authors concluded that the difference in trend from that of Richard D. Mace et al. (2012) was not a result of a rate of change of population growth, but due to larger sample sizes, inclusion of conflict bears, and subtle differences in analysis methodology (Costello et al., 2016).

Current information suggests that the grizzly bear population in the Northern Continental Divide Ecosystem and on the Flathead National Forest, is expanding its range outside of the recovery zone (K. Kendall et al., 2009; Richard D. Mace et al., 2012). The U.S. Fish and Wildlife Service has concluded that it is unlikely that the movement of grizzly bears from inside to outside the recovery zone is driven by displacement from roads, human development, or activity alone (K. Kendall et al., 2009). A draft Conservation Strategy has been developed to guide cooperative approach to maintain and monitor a recovered grizzly bear population in the Northern Continental Divide Ecosystem and is currently being included in the ongoing revision of the Flathead Forest Land and Resource Management Plan.

The Taylor Hellroaring Project is located on lands that have been designated as management situation 1 (MS-1), MS-2, MS-3, and unclassified lands within NCDE for grizzly bears. Objectives for MS-1 lands are identified as areas needed for the survival and recovery of the species (IGBC Guidelines, Forest Plan Amendment 19). Objectives for MS-2 are to provide adequate habitat conditions for short-term occupancy, movement and dispersal, and low risk of mortality due to human/bear conflicts. Objectives for MS-3 are to discourage occupancy by grizzly bears and to minimize risk of human/bear conflicts. A summary of the amount of management situation lands in the project subunits are included in Table 3-72 below.

Table 3-72. Summary of Management Situation Lands within the Project subunits.

Grizzly Bear Subunit	MS-1 Acres (%)	MS-2 Acres (%)	MS-3 Acres (%)	Unclassified Acres (%)
Lazy Creek	497 (1.4%)	3,631 (10.5%)	0 (0.0%)	30,477 (88.1%)
Canyon McGinnis	23,012 (69.2%)	6,364 (19.2%)	989 (3.0%)	2,873 (8.6%)
Werner Creek	28,227 (98.6%)	23 (0.1%)	8 (0.0%)	384 (1.3%)

In the past 20 years, there have been four documented grizzly bear mortalities in the project subunits, not including dependent young (*Project File Exhibit Rt-7*). Three of these occurred in the Canyon McGinnis subunit, with only one occurring on NFS lands. This female had been killed by gunshot and was found along an NFS road. The three yearling cubs found near the carcass appeared to be fine. The other two mortalities occurred on private land. These two mortalities were connected. The first, a female, had been killed by gunshot and was discovered in a ditch by a hunter who was then charged by the second bear, a male. The second bear had been feeding on the first. The hunter shot the second bear in defense of life. The carcass of the second bear was never located but mortality was considered probable due to the amount of blood loss. The remaining mortality occurred in the Werner Creek subunit on NFS lands. This adult male mortality was also the result of a gunshot wound. The only documented mortality in the Lazy Creek subunit occurred in 1978 on what was then Plum Creek land (now Weyerhaeuser land) and was the result of a legal hunt.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

Since there would be no vegetation treatments or road/trail construction proposed under this alternative, there would be no direct effects to grizzly bears as a result of implementing the no-action alternative; there would be no loss of cover, no decrease in security, and no displacement from the management activities in the Taylor Hellroaring project subunits. Under the no-action alternative, no historic roads would be added to the road system. Activity on private lands including development, timber harvest, and road construction would continue to occur. Activities on NFS lands, such as recreation, firewood cutting, and road maintenance would also continue.

Motorized use would still occur on roads open to motorized use within the project subunits. A food storage order would still exist on NFS lands requiring appropriate storage of bear attractants to minimize risk of human-bear conflict. Not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the project area, which could result in a change in available forage and cover for grizzly bears over the short and long term. Fires have historically produced both positive and negative effects for grizzly bears. Loss of hiding cover would be a potential negative effect. On the positive side, forage habitat could potentially increase. Under Alternative 1, potential wildfire may burn to a more intense and severe degree than under natural conditions. Larger, more severe wildfire may increase the interval for grizzly bear forage to return.

Direct and Indirect Effects of Action Alternatives 2 and 3

Denning habitat

Mace and Waller (1997) found grizzly bear dens to occur on steep slopes greater than 5,900 feet on all aspects. The availability of such habitat is not likely to be a limiting factor for grizzly bears in the project subunits area. Vegetation management activities may occur in winter in the lower elevation units but not in those that overlap with modeled grizzly bear denning habitat (Project File Exhibit Rt-5). Therefore, winter harvest activities that could occur in the Taylor Hellroaring project would not have the potential to affect denning by grizzlies. Approximately 470 acres of burning, 282 acres of hazardous fuel reduction, 155 acres of timber harvest, 0.7 miles of system road construction, 0.1 mile of temporary road construction, and 13 to 17 miles of new trail construction would occur in modeled denning habitat (*Project File Exhibit Rt-5*), but these would not alter the suitability of these areas for use as denning habitat.

Hiding Cover

Aerial imagery, stand data, and field visits were used to estimate hiding cover within the project subunits. The proposed vegetation management activities would decrease the amount of hiding cover in the project subunits. Commercial thin and hazard fuel reduction treatments are assumed to continue to provide hiding cover after project implementation. Shelterwood, seed tree, and clear cut treatments would not continue to provide hiding cover. Upland prescribed fire is expected to maintain the majority of hiding cover throughout the majority of the burn areas. Fire would be implemented to achieve moderate burning conditions, which are assumed to result in mortality to small diameter trees and tall shrubs, but retain the majority of large trees. Tree boles, snags, and burned vegetation would still provide some visual obstruction for cover. The prescribed fire units are expected to decrease hiding cover by 20 percent.

Under both action alternatives, vegetation management activities would decrease hiding cover by approximately 800 acres in the project subunits. Most of this decrease would occur in the Lazy Creek subunit (Table 3-73). Both action alternatives would also result in five openings greater than 40 acres

in size. These openings would be the result of the proposed regeneration harvests. The openings would range in size from 41 to 94 acres. The action alternatives would not create any point further than 600 feet to cover and 75 percent of the perimeter of natural openings would be retained in cover. Hiding cover could take approximately 20 years to return after treatment, depending on stand conditions.

Table 3-73. Effects of Proposed Vegetation Management on Hiding Cover in Project Subunits.

Grizzly Bear Subunit	Acres in Subunit	Hiding Cover Acres (%)	Hiding Cover Affected Acres	Percent of Subunit Hiding Cover Affected
Lazy Creek	34,606	25,626 (74.1%)	672	2.6%
Canyon McGinnis	33,239	16,481 (49.6%)	106	0.6%
Werner Creek	28,641	22,955 (80.1%)	21	0.1%

Foraging Habitat

The project subunits provide potential foraging habitat for grizzly bears throughout the spring, summer, and fall. Proposed vegetation management in both alternatives would decrease the amount of available forage temporarily due to ground disturbance in treatment units and the construction of roads and trails. The decrease of forage would be temporary and would return in all treatment areas within five years. Forage has potential to increase on the forest floor after activities in all treatment areas. Potential displacement from higher quality foraging habitats by recreationist use of trails is discussed below.

Project design features would provide timing restrictions and would minimize disturbance in spring habitat during the spring period (April 1 to June 30). These design features would reduce the potential to displace bears foraging on spring foods located in the lower elevations (while snow may still cover the higher elevations) of the project subunits.

Riparian areas, including streams, lakes, small wetlands, and ponds or potholes, provide high quality grizzly bear forage. There are management guidelines and BMPs in place (e.g., INFISH) to mitigate effects to riparian habitat. Riparian habitat conservation areas restrict activities within a designated distance from streams, lakes, and wetlands (see Aquatics section of this EA for more information). The riparian guidelines in place for proposed vegetation treatments and road and trail construction under each alternative would help protect important riparian habitats for grizzly bears.

In the long term, fire disturbance would likely restore vegetative diversity conditions and early seral food sources for grizzly bears. Post-fire disturbance plant succession time is related to fire intensity and severity (Bartuszevige & Kennedy, 2009). Waller (1992) documented a loss of food sources such as huckleberries for at least 15 years after fire disturbance, but sites within northwestern Montana without fire disturbance for 60 years have been documented to be least productive for huckleberry production (Martin, 1983).

Forage (grasses, shrubs, and forbs) production of understory vegetation would occur in vegetative treatment units as a greater amount of sunlight and moisture reach the forest floor. Over time, the openings and thinned areas would be expected to again produce quality forage for grizzly bears. In some areas, forage production would be expected to increase over the long-term due to increased grass, forb, huckleberry, and shrub production on the forest floor (Braid, Manzer, & Nielsen, 2016; Martin, 1983; Nielsen et al., 2004). Evaluating regeneration harvest and the low/moderate severity of

burn activities (including upland prescribed fire), the proposed activities would increase grass and shrub abundance in the project area over the duration of the 15 years.

Displacement / Habitat Security / Mortality risk

Human-activity levels could negatively affect grizzly bears by causing displacement from preferred habitats. Grizzly bears are highly dependent upon learned habitat; displacement into unknown territory may lead to sub-marginal nutrition, reduced reproduction, or greater exposure to adult predatory bears or human food sources, which can lead to human-caused mortality (R. D. Mace & J. S. Waller, 1997; USDA Forest Service, 2017a). Displacement of bears during vegetation management may occur due to mechanical/motorized activity and crew activities. Potential displacement directly related to vegetation management activities would be short-term, limited to the length of the proposed sale activity (approximately five years). Specific amounts of disturbance to grizzly bears is difficult to predict from vegetation management activities, as motorized use and human activity may occur intermittently localized in one unit or another, then relaxed as activity and disturbance shift to implement proposed activities elsewhere. This is also true of trail construction activities, which may take a decade or more to complete.

It is a different situation when considering the increased human activity in the project area that will be the result of proposed trail construction included in the project (Table 3-74, below). This displacement would be long-term and increasing over time. The access points for these proposed trails are located close to the town of Whitefish and would tie into a larger system of trails in the Whitefish area. The potential for human encounters with bears along newly constructed trails is discussed below.

Alternative 2 has the greatest potential for displacing grizzly bears both during implementation of proposed activities and into the future resulting from increased human activity in the project area due to the additional miles of trail proposed for construction, especially the trail immediately adjacent to the ski and summer resort (Trail 2) and the two connector trails (C3 and C4) that would facilitate access to the Smoky Range National Recreation Trail (NRT), which passes directly through the center of a large area of Security Core. This trail could become a high-use trail in the future, particularly if access is facilitated through the construction of either or both of these two connector trails.

Table 3-74. Proposed Trail Construction and Grizzly Bear Concerns (Project File Exhibits Rr-3 and Rt-5)

Trail	New Trail Construction through Huckleberry Areas (in feet)		New Trail Construction in and across Riparian Habitats		New Trail Construction with Secure Habitat Concerns	
	Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3
1	1,815	1,815				
2	0	0	>200 feet of riparian habitat		>11,000 feet adjacent to ski/summer resort	
3	99	99	>100 feet of riparian habitat			
4	2,733	2,733	>625 feet of riparian habitats and Hellroaring Creek			
C2	278	278				
C3	2,146	0			Facilitate access to trails in core security area	
C4	2,954	0				

Trail	New Trail Construction through Huckleberry Areas (in feet)		New Trail Construction in and across Riparian Habitats		New Trail Construction with Secure Habitat Concerns	
	Alt. 2	Alt. 3	Alt. 2	Alt. 3	Alt. 2	Alt. 3
C5	6,142	6,142				
L3	6,970	7,682				
L4	4,196	4,251				
L5	4,436	0				
L6	9,526	9,526	>200 feet of riparian habitat and Smith Creek			
L7	3,100	3,100	175 feet of riparian habitat and King Creek			
L8	4,347	2,646	>150 feet of riparian habitat and Anchor Creek (twice); very close to King Creek	>150 feet of riparian habitat and Anchor Creek (once)		
L9	5,184	0	Hemlock Creek and perennial tributaries of Taylor Creek			
R1	28,872	28,872				
Total	81,797	58,069	Cross >1,500 feet of riparian habitat; 8 perennial creek crossings	Cross >1,300 feet of riparian habitat; 4 perennial creek crossings	3 trails with habitat security concerns	0 trails with habitat security concerns

Road Construction, Road Maintenance, and Restricted Road Use

Human and mechanical activity may displace bears from the areas surrounding proposed vegetation treatment units, road work, haul routes, aquatic improvements on roads, and other activities. Both action alternatives propose to build 0.5 miles of temporary road (0.3 miles on existing templates) and 4.0 miles of system road (3.2 miles on existing templates). Temporary, system, and restricted roads used for project activities would remain closed to public motorized use.

Open Motorized Access Density (OMAD), Total Motorized Access Density (TMAD), and Security Core (CORE) direction in A19 do not apply in the Lazy Creek subunit, where all road construction would occur. Nevertheless, at completion of project activities, all temporary roads (0.5 miles) would be rehabilitated and system roads (4.0 miles) would be treated to meet the reclaimed definition under amendment 19 of the forest plan (see Regulatory Consistency section) and placed in storage. At completion, new and historic roads added to the system would be impassable to motorized vehicles, as described in Chapter 2. The result of the treatment to make the road impassable would have the same on-the-ground effect as a historic road template, but would have a road number and be part of the system road database.

Helicopter Ignition of Prescribed Burns

Helicopter ignition would be used to ignite upland prescribed burning units. A Level 1 team reviewed literature on aviation effects to grizzly bears and produced a guide to effects in grizzly bear habitat (Anderson et al. 2009). While the aerial ignition would include low-altitude helicopter flights, the displacement effects of this activity would not be prolonged as the helicopter activity would occur for one to three days per year for up to five years. While some bears may be displaced by helicopter activity and burning, it is unlikely that the displacement would be long term or would interfere with patterns of breeding, feeding or sheltering. Effects of helicopter disturbance would be short-term

and relaxed immediately after ignition is completed. The aerial ignition would occur outside of breeding or denning seasons during the fall period when bear foods can be widespread and not concentrated on a particular aspect or elevation. Low-elevation flight would not occur within 0.4 miles of security core.

Security Core

No vegetation management activities are proposed in Security Core. No road construction, road use, or trail construction would occur in or within 500 meters of existing Security Core. Two connector trails proposed for construction under Alternative 2 would provide easier access to the Smoky Range National Recreation Trail which could indirectly affect Security Core.

Recreational Improvements

Alternative 2 proposes to construct nearly 40 miles of new trails to be added to the system, while alternative 3 proposes nearly 26 miles (Table 3-74, above). It is likely that the trail system would receive a high level of use soon after construction, as they are accessed close to the town of Whitefish and would be tied into a larger system of trails that currently receive high levels of use. The most easily accessible trails (1, 2, 3, 4, 5, C1, L1A, L1B, and L1C) are expected to have the highest level of recreational use.

Two connector trails proposed in Alternative 2 would provide easy access for trail users to the Smoky Range National Recreation Trail, which passes directly through a large area of Security Core. The trail is currently accessible via a road open only two months of summer, with travel from Whitefish of over 32 miles of mostly gravel roads. The remainder of the year, the southern terminus of the NRT is 11 miles up roads closed to motorized use. This trail could reach high levels of use as a result of the construction of these two connector trails. Under Alternative 3, these two trails would be excluded from the proposal along with several other trails and sections of trail.

The addition of trails to the NFS trail system would result in non-motorized use into the future. Human recreation in grizzly bear habitat increases the likelihood of conflict with bears. In general, available literature and reports either reviewed/summarized the circumstances and outcomes surrounding documented grizzly bear-human encounters or evaluated the effects to grizzly bear use of habitat associated with more traditional recreational activities such as hiking, hunting, and camping (Coltrane & Sinnott, 2015; Fortin et al., 2016; Herrero & Fleck, 1990; Herrero & Higgins, 1999, 2003). The reviews of human-bear encounters identified common factors or situations that tended to result in the encounters and often ended in an injury to the recreationist(s).

Public comment identified a specific concern about potential conflict between grizzly bears and mountain bikers using the trails proposed for addition to the NFS trail system. Few examples of literature exist specific to mountain biking and grizzly bears, though mountain biking in grizzly habitat is not new and has potential for encounters with bears. Herrero and Fleck (1990) state that the sudden encounter is the most common situation associated with grizzly bear-inflicted injury. Based on the reviews of the authors listed above, the sudden encounter generally occurs at close range, which is influenced by factors such as reduced visibility, lack of sufficient noise to identify human presence to the bear, small party size, recreating in areas of known bear use especially in high quality foraging habitat, and recreating in back-country areas. Mountain biking can heighten the effects of reduced visibility and lack of noise due to an increase in speed and greater concentration in carrying out the activity compared to hiking.

Management recommendations include evaluating the potential trail locations with respect to the presence of grizzly bear food sources, other known bear use areas, and consideration of visibility related to understory vegetative condition and trail configuration (Coltrane & Sinnott, 2015; Fortin et

al., 2016; Herrero & Fleck, 1990). Also, public education is an important tool to target mountain bikers and provide measures they can take to reduce their risk of an encounter with a bear that would also minimize the potential impacts of the activity to bears (Fortin et al., 2016). Therefore, the following discussion will address the common factors listed above in relation to the proposed trails and the potential risk for a human-grizzly bear encounter.

Herrero and Higgins (1999, 2003) considered whether incidents with grizzly bears occurred in back country or front country locations, with front country including those areas within 2 kilometers of a travelled route. They found that incidents involving grizzly bears were more likely to occur in back country locations as compared to front country locations. Most of the proposed trails are located on the south and west sides of the Whitefish Divide. These areas are considered front country, especially near Whitefish and the Whitefish Mountain Resort ski area. Those trails proposed on the north and east sides of the divide, including the two connector trails previously discussed as well as the ridge trail, are located in a back country setting. Although they are just over the ridge and attached to front country. All trails proposed for construction are located within 2 kilometers of open roads within the project subunits.

The majority of the documented incidences of human-grizzly bear encounters resulting in a defensive attack by the bear involved adult females with young (Herrero & Higgins, 1999, 2003; Schmor, 1999). Based on telemetry data, all of the proposed trails are located in an area with known use by both male and female grizzly bears, including females with cubs.

Bear use of a particular area can be influenced by the presence of high quality foraging habitat, such as berry-producing shrub fields or riparian habitats, and the occurrence of such sites along or in close proximity to recreational use areas appears to be a factor in human-grizzly bear encounters (Coltrane & Sinnott, 2015; Herrero & Higgins, 2003). Telemetry data show that areas where proposed trails would be located saw high use by marked bears in late June, when huckleberries start to ripen. The bears then followed the ripening of huckleberries up to the Whitefish divide and then onto the northeast facing slopes from July through September. Much of the proposed trail system would intersect known concentrations of berry producing shrubs and the southwest side of the project area already receives high levels of human use for berry picking. Herrero and Higgins (2003) notes that “moister habitats can result in denser tree and understory growth and more opportunity for sudden encounters between people and bears.” Riparian areas and areas of dense berry-producing shrubs would be avoided during trail construction to the extent possible so the final effect is expected to be somewhat less than shown in Table 3-74 above.

Reviews and research by Herrero and Higgins (1999), Herrero and Higgins (2003), and Schmor (1999) indicate that the majority of the incidents involving grizzly bears were the result of a close encounter, generally within about 50 meters. The startled bears then responded in a defensive attack. Visibility along a trail is influenced by the habitat type that the trail moves through and management that has influenced the stand structure. Design features for the proposed trails include the removal of some vegetation to reduce the likelihood of recreationists startling a bear. In addition, the trails would not be designed for higher-speed non-motorized activities that could increase the chance of a surprise encounter.

Some of the common factors that appear to contribute to human-grizzly bear encounters are included in recommendations provided by the Forest Service, however it is the responsibility of the recreationist to follow these recommendations in order to reduce risks when recreating in bear country. The proposed trails would have signs at the trailheads providing education to all types of recreationists on how to reduce the likelihood of surprising a bear and bear conflict.

Should a potential encounter occur between human users on the trails and a grizzly bear in the future, management actions to further reduce potential risk would be considered based on the factors involved in the encounter. For example, if an area is found to have seasonal bear use, a seasonal restriction could be implemented during the period of expected use. No seasonal restrictions are proposed in this project. An encounter involving a serious injury or death would likely trigger an investigation into the incident such as occurred last year on the Flathead National Forest. For attacks determined to be a defensive response to surprise encounter, bears “are not captured or removed in most cases” (Servheen, Manley, Mucklow Starling, Jacobs, & Waller, 2017). Reviewing past grizzly bear mortalities on the Flathead Forest to gauge likelihood of potential bear mortality caused by a non-motorized user conflict on the trails, no records of bears destroyed by agencies after a resultant defensive encounter with a grizzly bear could be located. The draft Grizzly Bear Conservation Strategy notes that there is no data or research indicating that non-motorized trail use results in disproportionate grizzly bear mortality or population impacts (NCDE, 2013).

Given that many of the trails are proposed in areas known to receive seasonal use by bears due to high quality forage, the likelihood of a human-bear conflict is moderate, particularly along trails that pass through huckleberry patches or riparian habitats or that cross loud streams (Table 3-74 above), in addition to trails that receive a high number of users. Project design features for maintaining sight distances along trails, educational signage at trailheads, and design of the trails would contribute to decreasing the potential for human-bear conflict and associated grizzly bear mortality. See *Chapter 2* for specific Design Features.

Cumulative Effects

Human activities currently occurring in the project subunits include vegetation management, road management, private land development, agriculture, hunting, firewood gathering, berry picking, hiking, mountain biking, horseback riding, driving, motorcycle/ATV riding, snowmobiling, camping, and other recreational uses. Whitefish Mountain Resort has an array of ski runs, ski lifts, trailheads, and buildings, which includes the Summit House Restaurant. There is a State DNRC lookout cabin on Werner Peak which is accessed by the Taylor Road NFSR 9790. The Great Northern Flats and Big Creek River Accesses are on the east edge of the Canyon McGinnis Subunit. Human development in the Whitefish area on private property has increased grizzly bear-human conflict due to increased presence of human attractants to bears. Winter activities in potential denning habitat, such as ski area operation, snowmobiling, and communication tower maintenance, may have reduced denning in some parts of the analysis area. Few grizzly bear mortalities have been documented in the project subunits and most of these occurred on private lands.

Human activities on NFS lands in the project area increase the chance of conflict with bears and thus the chance for grizzly bear mortality. Road closures, decommissioning and creation of Security Core in the project subunits have decreased grizzly bear mortality risk and increased habitat security in the project subunits. Annual monitoring occurs to evaluate effectiveness of road closures to motorized use within the project subunits and on the Flathead National Forest.

Past timber harvest on NFS lands within the project subunits include both regeneration and intermediate treatments that occurred in 1962 in the Lazy Creek subunit. All of these past harvest units fall within units currently proposed for treatment under both action alternatives. One regeneration treatment occurred in 1967 in the Werner Creek subunit. Timber harvest has also occurred in the past on DNRC, Weyerhaeuser, F.H. Stoltze, and small private lands. Recent timber harvest activities on non-NFS lands in the Lazy Creek subunit include the King Hemlock and Antice-Stryker sales on DNRC land. The King Hemlock sale was directly adjacent to the Taylor Hellroaring project area with some DNRC harvest units abutting proposed units. These activities were taken into consideration when adjusting units to maintain 600 feet to cover for grizzly bears. Past timber harvest

has decreased cover and altered both the forest mosaic and the juxtaposition of travel cover within the project subunits. Timber harvest on private property is currently unknown. Lands owned by DNRC and Weyerhaeuser are expected to continue to have vegetation management in the foreseeable future.

Past and future prescribed burning may increase grizzly bear forage in the project subunits. Upcoming prescribed fire for the Whitefish Municipal Watershed Project will use a helicopter for ignition of the units within the Canyon McGinnis subunit. Overall helicopter activities in the WMWFRP are expected to be short-term (one to three) days in the fall season. No adverse cumulative effects to grizzly bears are expected because effects would be short-term and relaxed after ignition is completed.

The Whitefish Municipal Watershed Fuel Reduction Project (WMWFRP), including vegetation and road management, is ongoing within the Canyon McGinnis subunit. Vegetation management will reduce cover in the Canyon McGinnis subunit by two percent. In combination with vegetation management in the Taylor Hellroaring action alternatives, cover would be reduced in this subunit by a total of 2.6 percent, with 47 percent of the subunit still providing cover. The WMWFRP will result in potential displacement during implementation of project activities.

A Special Food Storage Order on the Flathead National Forest has contributed to improved conditions for grizzly bears. The Food Storage Order requires all users of NFS lands to store food, garbage, and other bear attractants in a bear-resistant manner. Contractors and others implementing the Taylor Hellroaring Project would be required to comply with this order.

Summary

The grizzly bear is listed as a “Threatened” species under the Endangered Species Act (*Project File Exhibit Rt-1*). A biological assessment will be prepared and submitted to the U.S. Fish and Wildlife Service (*Project File Exhibits Rt-2, Rt-3, and Rt-4*).

Regulatory Framework and Consistency

Amendment 19 (USDA 1995) of the Flathead Forest Plan is a comprehensive programmatic strategy that addresses grizzly bear habitat security. It was developed to minimize negative impacts of motorized access identified in the 1987 Grizzly Bear Compendium (IGBC, 1986), and was based on recommendations of the 1994 Interagency Grizzly Bear Committee Taskforce Report and the 1993 Progress Report for the South Fork Grizzly Bear Project (Richard D. Mace & Manley, 1993), commonly referred to as the South Fork Study. The South Fork research examined effects of motorized use along roads on grizzly bear habitat selection. The Interagency Grizzly Bear Committee issued guidance on motorized access management in 1994 and revised this guidance in 1998 to provide a consistent approach to motorized access management for grizzly bears.

Amendment 19 provides motorized access standards and objectives for grizzly bear habitat management. The forest standard includes “no net increase” in total or open motorized access density and “no net decrease” in Security Core and “Forest Service actions will result in a net gain towards the objectives on National Forest System lands.” For subunits that have greater than 75 percent NFS lands, the Flathead Forest Plan objectives include the following: 1) limit high density (greater than 1 mile/square mile) open motorized access to no more than 19 percent of a Bear Management Unit subunit; 2) limit high density (greater than 2 miles/square mile) total motorized access to no more than 19 percent of a Bear Management Unit subunit; and 3) provide Security Core areas that equal or exceed 68 percent of each Bear Management Unit subunit (referred to as 19/19/68 objectives). The Canyon McGinnis subunit has so little USFS land it is managed by Montana DNRC under a Habitat Conservation Plan (discussed in separate section below). The Canyon McGinnis and Werner Creek subunits are composed of more than 75 percent NFS lands. Both of

these subunits have amended standards, 19/33/53 for Canyon McGinnis and 29/19/63 for Werner Creek. The existing condition of these subunits does not meet the amended standards.

Amendment 19, Appendix D, describes types of roads and how they should be used to calculate motorized access densities. Reclaimed roads are defined as roads treated in such a manner as to no longer function as a road (A19 Appendix D, pg. 2). Amendment 19 lists the minimum treatments to a reclaimed road (pg. 2). Roads that fully satisfy the definition of a reclaimed road are not included in calculations of Open Motorized Access Density, Total Motorized Access Density, and Security Core. System roads proposed for storage would be managed to be completely impassable to motorized traffic and for forest entrances to be unattractive to forest users. All stream aligned culverts would be removed. The first 200 to 600 feet would be recountoured and the remainder of the road would have placement of debris, so that the road prism would no longer function as a road. Stored roads would remain on the road system. After completion of project activities and success of road treatments, there would be no on-the-ground difference to a grizzly bear between stored roads and decommissioned roads. The only difference between these two would be that stored roads would retain a road number in the road database. These road treatments would be monitored over time for effectiveness of treatments.

The forest plan includes objectives for timber management within MS-1, MS-2 and MS-3 lands. All activities under both action alternative are consistent with the management situation lands in the Flathead Forest Plan (1986 pg. II-31). Objectives for MS-1 are to provide high-quality habitat for seasonal foraging needs, free-ranging movement and dispersal of resident grizzly bears, and low risk of mortality due to human/bear conflicts. Objectives for MS-2 are to provide adequate habitat conditions for short-term occupancy, movement and dispersal, and low risk of mortality due to human / bear conflicts. Objectives for MS-3 are to discourage occupancy by grizzly bears and to minimize risk of human / bear conflicts.

Under Alternative 2, approximately 3.8 miles of trails are proposed on MS-1 designated lands, which are identified as areas needed for the survival and recovery of the species. The majority of this mileage (2.5 miles) would be along the ridgeline trail. This trail is proposed under both action alternatives and would be located along the boundary between MS-2 and MS-3 lands. The other 5.8 miles of this trail would fall on MS-2 lands. The remaining miles of trail on MS-1 lands would be contributed by the two connector trails (C3 and C4), which could indirectly reduce Security Core. These two trails are not proposed under Alternative 3. Most of the proposed trail construction (31.6 miles) would be located on MS-2 lands (Table 3-75). The risk of human/bear conflicts would be minimized through trail design and education. Vegetation would be removed along trails where necessary to maintain adequate sight distance and safety recommendations would be posted at trailheads. A small section of one trail included only in Alternative 2 would be located on MS-3 lands.

Table 3-75. Miles of Proposed Trail by Management Situation.

Management Situation	Alternative 2 (miles of trail)	Alternative 3 (miles of trail)
MS-1	3.76	2.49
MS-2	31.59	22.60
MS-3	0.05	0.00

The Taylor Hellroaring Project would mitigate effects to bears by limiting activities in spring habitats, maintaining road closures to the public during project activities, ensuring cover is well distributed throughout the project subunits, and maintaining 600 feet to cover where openings are created by vegetation management. No project activities would occur in Security Core. Prescribed upland

burning and some vegetative treatments would enhance grizzly bear forage in the project subunits. Recreational improvements are proposed in areas known to receive seasonal use by bears due to high quality forage, therefore the likelihood of a human-bear conflict is moderate. Project design features for maintaining sight distances along trails, educational signage at trailheads, and design of the trails would contribute to decreasing the potential for human-bear conflict and associated grizzly bear mortality, consistent with other Flathead Forest Plan direction.

Maintenance of habitat security for grizzly bears in the Hellroaring drainage through limitations on human activity was a mitigation measure of the 1995 Big Mountain Expansion decision (*Project File Exhibits Rt-21 and Rt-22*). Because little other unroaded habitat exists in the southern end of the Whitefish Range, this drainage has added value as security habitat immediately adjacent to an area of relatively high levels of human use, although because it is not large enough to be considered Security Core, Amendment 19 parameters do not apply. From April 1 to November 30, the Hellroaring drainage has been managed to provide grizzly habitat security. Human access into the Hellroaring Drainage during the non-ski season has been discouraged through the placement of slash and stumps near the top of ski runs and lift corridors. One section of proposed Trail 2, which would switchback down from the southern ridge into the lower drainage, has the potential to affect grizzly bear security in this area. The remainder of trails proposed in the Hellroaring drainage (Trails 4, 5, C2, L3, L4, and L) are on the periphery and are not likely to affect this security habitat value for grizzly bears.

Portions of the Lazy Creek subunit are covered under the Montana DNRC Habitat Conservation Plan (HCP) (*Project File Exhibit Rt-5*). The HCP only applies to DNRC lands. However, the HCP was taken into consideration during project planning to insure that no activities proposed in the Taylor Hellroaring project would violate the terms of the HCP. No new roads open to public motorized use would be constructed under either action alternative. All new and restricted roads used for project activities would be closed to public access during and after activities. All temporary and system roads would be reclaimed after completion of project activities.

Wolverine

Introduction

In the contiguous United States, deep, persistent, and reliable spring snow cover (April 15 to May 14) is the best overall predictor of wolverine (*Gulo gulo luscus*) occurrence (Aubry, et al. 2007; Copeland, et al. 2010; USDI FWS 2013a), although evidence of a requirement for deep snow beyond a den site is lacking (USDI FWS 2014b). Wolverines are opportunistic, consuming a variety of foods but primarily scavenged carrion (Hornocker and Hash 1981). Wolverines in Glacier National Park had average adult male home ranges of 193 square miles and adult female home ranges of 55 square miles (Copeland and Yates 2006). In Montana, natal dens occur above 7,874 feet and are located on north aspects in avalanche debris, typically in alpine habitats near timberline (Inman, et al. 2007). Female wolverines forage close to their den in early summer, ranging further from dens as kits become more independent (May, et al. 2010). Wolverines seem to be able to move successfully through highly altered landscapes. For more information, see *Project File Exhibit Rt-18*.

According to the USDI FWS (2014b), “Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat” to the conservation of the species. The available scientific and commercial information does not indicate that potential stressors such as land management, recreation, infrastructure development, and transportation corridors pose a threat to the wolverine in the contiguous United States. Additionally, the scale at which most land

management decisions (including Forest Service vegetative management activities) occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USDI FWS 2014b).

Analysis Area

The spatial extent of analysis of effects on wolverines is the same as that used for grizzly bears, as described above. At 96,486 acres (150 square miles), it is large enough to include all or of a large portion of a wolverine home range, but is not so large as to obscure the effects of alternatives. It is representative of the effects of wildland fire, natural tree mortality, timber harvest, roads/road management, recreation activities, and other effects factors across the landscape. For this project, the analysis of effects on wolverines spans as far as 20 years, at which time areas affected by this project are likely to provide hiding cover. In addition, human activities associated with vegetation management in this project that could disturb or displace wolverines would have ceased.

Affected Environment

Population Status

Wolverines occur at low population densities in remote places and are rarely and unpredictably encountered where they do occur (Ruggiero, et al. 2007). Current population levels and trends are not definitely known (USDI FWS 2014b), but there is evidence of increase in both their population and geographic extent (USDI FWS 2014b). The Western Association of Fish and Wildlife Agencies is currently conducting a multi-state occupancy study to address conservation of the wolverine including restoring, connecting, and monitoring wolverine populations and their habitat in the U.S. Rocky Mountains and Cascade Mountains. Preliminary results for the 2016/17 monitoring season indicate there were 157 detections of wolverine in grid cells across Montana, Idaho, Wyoming, and Washington. Wolverines are listed as a Species of Concern in Montana and have a state ranking of S3: “Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas” (*Project File Exhibit Rg-4*). Wolverines are occasionally reported in the Analysis Area (*Exhibit Rs-5*). There have been several confirmed sightings over the past five years in the Whitefish Divide, as well as in the drainages of the North and Middle Forks of the Flathead River in Glacier National Park, upper Grave Creek, and Ten Lakes area (*Project File Exhibit Rt-7*). For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see *Project File Exhibits Rg-1, Rt-17, and Rt-19*.

Habitat

This project used the wolverine habitat model of Copeland and others (2010) as well as that of Inman and others (2013)(*Project File Exhibit Rs-18*). The model of primary wolverine habitat (suitable for survival and use by resident adults) from Inman and others (2013) was used to assess effects to wolverine habitat. The model by Copeland and others (2010) was used to assess effects to maternal and natal denning habitat, including areas providing persistent spring snow at least five years out of seven (on average), herein referred to as “maternal denning habitat”. The Analysis Area contains 22,344 acres (approximately 35 square miles) of habitat that is modeled to receive persistent spring snowpack five or more years out of seven (Copeland, et al. 2010)(*Project File Exhibit Rt-18*). The Inman 2013 approach, which is based on snowpack but also incorporates other habitat variables such as terrain ruggedness and some aspects of human development, results in 13,915 acres (about 22 square miles) of “primary wolverine habitat” (*Project File Exhibit Rt-18*). The Flathead National Forest has approximately 1.4 to 1.7 million acres of modeled wolverine habitat, depending upon which habitat model is used. The analysis area has no barriers to movement between habitat patches for dispersing wolverines. About 67 percent of the area currently functions as cover (*Project File Exhibit Rt-12*). For more information about the distribution of vegetative cover see the *Commonly Hunted Big*

Game; Old Growth, Snags, and Downed Wood Wildlife Habitat; and Vegetation sections in this chapter.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, burning, or road or trail construction, are proposed with this alternative. Overall, availability of carrion and other food sources would not be measurably affected and the availability of hiding sites used by wolverines during dispersal would gradually increase. The fuel loading in many stands would increase the chance of large intense wildland fires in adjacent areas, which could have mixed results for wolverines.

Direct and Indirect Effects of Alternatives 2 and 3

Proposed vegetation management would remove some cover in areas modelled as primary wolverine habitat and as maternal denning habitat (Table 3-76 and *Project File Exhibit Rt-18*), but once areas become revegetated with grasses, forbs, and shrubs they would provide foraging habitat for mammals that wolverines are known to feed upon. The effects of proposed vegetation management would be minor (USDI FWS 2014b) because wolverines are not known to avoid logged or burned areas. Across the analysis area, the action alternatives would remove or reduce the effectiveness of a relatively small amount of cover, although the probability of large stand-replacing wildland fires would be reduced. Some of this may create forest edges and smaller openings. Considering the large scale of wolverine home ranges and dispersal, these effects would not be measurable, nor would availability of carrion and other food sources be measurably affected. Temporary displacement of individual wolverines could occur as a result of activities associated with the vegetation management.

Table 3-76. Alternatives 2 and 3 Summary of Vegetation Management in Maternal Denning and Primary Wolverine Habitats (*Project File Exhibit Rt-18*).

	Acres of Primary Wolverine Habitat (Inman et al. 2013)	Acres of Maternal Denning Habitat (Copeland et al. 2010)
Timber harvest	0 acres	37 acres
Understory Fuel Reduction	19 acres	144 acres
Burning	152 acres	319 acres
	171 acres	500 acres

Wolverines would be disturbed or displaced to some degree by trail use on all 26 (Alternative 3) to 40 miles (Alternative 2) of new trails across the analysis area. In both Alternatives 2 and 3, several trails would be constructed in areas modelled as primary wolverine habitat and as maternal denning habitat (Table 3-77 and *Project File Exhibit Rt-18*). Impacts of trail development would be long term. No road construction would occur in areas modelled as primary wolverine habitat or as maternal denning habitat, and new roads constructed for this project are not expected to receive use by over-snow recreationists.

Table 3-77. Alternatives 2 and 3 Summary of Trail Construction in Maternal Denning and Primary Wolverine Habitats, in miles (Project File Exhibit Rt-18).

	Acres of Primary Wolverine Habitat (Inman et al. 2013)		Acres of Maternal Denning Habitat (Copeland et al. 2010)	
	Alt. 2	Alt. 3	Alt. 2	Alt. 3
Standard Trail Construction	2.8	2.3	10.0	8.1
Trails on Existing Roads	1.4	1.4	6.3	6.3
	4.2	3.7	16.3	14.4

Project activities, including changes in road use and management, would not affect habitat connectivity or wolverine dispersal, and would not create barriers to wolverine movement. Timber harvest, prescribed burning including helicopter ignition, road construction, trail construction, culvert replacement, BMP roadwork, the parking area upgrade, and parking pullouts, and other actions could cause temporary disturbance to wolverines, with possible temporary displacement from the immediate area. Other actions would not have measurable effects on this species.

Cumulative Effects

Human activities in the analysis area include vegetation management, road management, private land development, agriculture, hunting, firewood gathering, berry picking, hiking, mountain biking, horseback riding, driving, motorcycle/ATV riding, snowmobiling, camping, and other recreational uses (Project File Exhibit Rt-6). Winter activities in wolverine habitat, such as ski area operation, snowmobiling, and communication tower maintenance, may have displaced wolverines from denning in some parts of the analysis area.

Past timber harvest include both regeneration and intermediate treatments have occurred on USFS, DNRC, Weyerhaeuser, Stoltze, and small private lands. Recent timber harvest activities include the King Hemlock and Antice-Stryker sales on DNRC land. Past timber harvest has decreased cover and altered both the forest mosaic and the juxtaposition of cover and this is expected to continue. Whitefish Municipal Watershed Fuel Reduction Project (WMWFRP), including vegetation and road management, is ongoing in the analysis area. Vegetation management will reduce cover by a small amount in combination with vegetation management in the Taylor Hellroaring action alternatives, as described above for grizzly bear. The WMWFRP will result in potential displacement during implementation of project activities but will increase wildlife security elsewhere in the analysis area. Past and future prescribed burning may increase the availability of food for wolverine. Upcoming prescribed fire for the WMWFRP will use a helicopter for ignition of the units within the Canyon McGinnis subunit. Overall helicopter activities are expected to be short-term.

The analysis area is within wolverine management unit 1 (northwest Montana), which had a quota of three wolverines (with a maximum of one female) in 2010 and has had a quota of 0 since then (Project File Exhibit Rt-6). In December 2012, a state district court judge in Helena granted a temporary restraining order that blocked the opening of Montana's 2012-2013 wolverine trapping season, and it has remained closed since then. Access during the winter season may indirectly affect the area accessible for trapping but it does not vary between alternatives in this project. With respect to connectivity and highways, there are no high-elevation paved highways in the analysis area, although Highway 93 lies along the western edge and could affect dispersing wolverines. On public lands across the analysis area, road closures and decommissioning have decreased wolverine mortality risk.

Regulatory Framework and Consistency

The wolverine was proposed for listing as threatened on February 4, 2013 (USDI FWS 2013a), but on August 13, 2014, the USFWS withdrew its proposal to list the wolverine as a threatened species (USDI FWS 2014b). On May 24, 2016, the U.S. Fish and Wildlife Service again listed wolverine as a proposed species on the Flathead National Forest (*Project File Exhibit Rt-1*) pending status review. *Project File Exhibit Rt-18* includes a project programmatic biological assessment review for wolverine for the Taylor Hellroaring Project, supporting the conclusion that the project will not jeopardize the continued existence of the Distinct Population Segment. The *Sensitive Wildlife Species* section of this chapter and *Project File Exhibit Rs-3* include sensitive species determinations for this species in the event the wolverine is determined by the USFWS to not warrant listing.

Flathead Forest Plan direction that is relevant to wolverine conservation includes winter motorized direction, grizzly bear Management Situations, motorized access, lynx habitat direction for recreation and ridgetop roads, and snags and downed wood. The Taylor Hellroaring Project is consistent with all of these.

Sensitive Wildlife Species

This section, on Sensitive Wildlife Species, is divided into separate subsections with direct and indirect effects following the affected area description for each. Information about cumulative effects and regulatory framework and consistency is at the end of this section. Due to similarities in most aspects of their habitat needs and many potential effects, two species that typically use both wetland riparian and upland habitats (boreal toad and Townsend's big-eared bat) were combined below. The bighorn sheep, northern bog lemming, northern leopard frog, common loon, harlequin duck, peregrine falcon, and bald eagle are sensitive wildlife species that would not be affected by this project and thus will not be discussed further (Table 3-50 in the wildlife introduction); *Project File Exhibits Rs-7, Rs-21, Rs-22, and Rs-23*. For information specific to the wolverine, which is currently proposed for listing under the Endangered Species Act, see the Threatened and Proposed Wildlife Species section of this EA and Project File Exhibit Rs-12. The Biological Evaluation for Sensitive Wildlife Species has been incorporated into the text of this document with a separate signature/summary page in the project file (*Project File Exhibit Rs-3*).

Sensitive wildlife species (Table 3-48 in the *Wildlife Introduction* section and in Project File Exhibit Rs-1) are designated by the Regional Forester (FSM 2670.5) and managed under the authority of the National Forest Management Act. Several of these species are listed by the Montana Department of Fish, Wildlife, and Parks (FWP) as "Montana Animal Species of Concern" (*Project File Exhibit Rg-4*).

Information Sources

For most sensitive wildlife species, existing conditions and effects were analyzed using GIS-generated predicted habitat overlain by proposed vegetation management, roads, and trails (*Project File Exhibits Rs-2, Rs-4, Rs-7, Rs-8, Rs-10, Rs-11, Rs-12, Rs-13, Rs-15, Rs-22, and Rt-18*). Data used include 2016 and 2017 wildlife field surveys (*Project File Exhibit Q-2 and Rt-8*), vegetation data (*Project File Exhibit Rg-9*), old growth habitat information (*Project File Exhibits Q-2 and Q-5*), snag and downed wood habitat information (*Project File Exhibit Rd-3*), the FACTS activity tracking database, forested connectivity (*Project File Exhibit Rg-7*), riparian habitat information (*Project File Exhibit Rr-3*), big game information (*Project Record section Rb*), potential downstream effects (*Project Record section G*), wildfire history and projections (*Project Record section O*), aerial imagery, topographic feature information, road and trail GIS data and summaries (*Project File Exhibit Rg-5*), and research literature. Observations, monitoring, and habitat use information for these species in and near the project area are found in *Project File Exhibit Rs-5*. For more information about effects analysis methods, conclusions and cumulative effects for sensitive wildlife species, see the *Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat; Commonly Hunted Big Game; Forest Vegetation; and Aquatic* sections of this chapter. Larger-scale assessments for these species were also reviewed to assess population diversity concerns (*Project File Exhibits Rg-1, Rs-6, Rs-10, Rs-16, Rs-18, Rs-20, Rt-17, and Rt-18*).

Analysis Area

The analysis area for sensitive wildlife species is the Taylor Hellroaring Wildlife Analysis Area (Figure 3-9, in the *Introduction*). At approximately 45.6 square miles (about 29,000 acres), it is large enough to include the home range of most of these species and to represent the effects of wildland fire, natural tree mortality, timber harvest, prescribed fire, fuel reduction, firewood cutting, and recreation across the landscape. All habitat attributes used by these species are distributed across this area, within the bounds of natural physiographic variation. It is sufficiently large to evaluate the ability of the habitat to support populations of these species but small enough to not obscure the

effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect these species are contained within this area. No known or suspected population sinks for these species occur in or near the area. Larger-scale assessments were also conducted to address population viability concerns (*Project File Exhibits Rd-9 and Rg-1*). See also *Project File Exhibits Q-11, Rd-9, Rg-3, Rs-6, Rs-16, Rs-18, and Rs-20* for Region-wide assessments of some key species. The temporal span of the effects analysis for sensitive wildlife varies by species, as described below.

Black-Backed Woodpecker

Introduction

In western Montana, black-backed woodpeckers (*Picoides arcticus*) may depend on one- to six-year-old forest burns with a resultant abundance of beetles and wood-boring insects (Hejl and McFadzen 2000; Hitchcox 1996; Hutto 1995a; Hutto 1995b; Saab, et al. 2004), although they have been known to make use of unburned areas that have high numbers of bark beetles (Dudley 2005). Population spurts associated with large fires and insect epidemics may be necessary for maintaining black-backed woodpecker populations across the landscape (Hutto 1995a and 1995b, Dixon and Saab 2000). Hutto (2008), in a study of bird use of habitats burned in the 2003 fires in northwest Montana, found fire severity outstrips the influence of any other variable on the distribution of birds. Some species, including the black-backed woodpecker, were relatively abundant only in the high-severity burned areas. Based on findings by Hejl and McFadzen (2000), black-backed woodpeckers prefer areas where 50 percent or more of the trees were killed by fire that had at least 40 percent canopy closure before the fire and were at least 200 acres in size (Russell, et al. 2007).

Analysis Area

The spatial extent of analysis of effects on black-backed woodpeckers is the same as that used for all sensitive wildlife species, as described above. The temporal scale of the effects analysis extends 100 years into the future, enough time for areas of dense trees to develop, with the potential for becoming black-backed woodpecker habitat if they burn.

Affected Environment

Population Status

Evidence suggests the black-backed woodpecker is increasing in numbers in the United States (as cited in Dixon and Saab 2000). Samson (2006) concluded that habitat in the USFS Northern Region exceeds amounts needed for a minimum viable population (*Project File Exhibit Rs-20*) and numerous large fires have burned in the area since then. Hutto, with the Avian Science Center, collected bird survey data from within each of 17 separate fires in western Montana in each of the four years following the fires of 2003, including six fires on the Flathead National Forest. They found that many bird species are relatively common in burned forests, with the black-backed woodpecker more restricted to burned forest conditions than any of more than 100 other bird species for which they had sufficient data. In 2001, Black-backed woodpeckers were observed in the Werner Fire Area just inside the northern edge of the Taylor Hellroaring Wildlife Analysis Area (*Project File Exhibit Rs-5*).

There is a substantial amount of black-backed woodpecker habitat on the forest due to the increasing number of large, high-intensity fires in the last decade (*Project File Exhibit Rg-1*). An analysis of vegetation composition, structure, and landscape pattern on the Forest (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010; *Project File Exhibit Rg-8*, monitoring item #68) found that 15 percent of the Forest has had wildfire since 1999. An analysis of ten large fires indicated that an average of 47 percent of the area within the fire perimeter burned with high intensity, creating high

quality habitat for black-backed woodpeckers. These large, stand replacing wildfires have been part of the natural processes which have shaped historic conditions on the Forest and are moving areas towards larger patch sizes which have been the norm historically. For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see *Project File Exhibits Rg-1, Rg-3, Rs-18, and Rs-20*.

Habitat

Since the most recent fires burned in 2001 and 2006, no part of the Taylor Hellroaring Wildlife Analysis Area drainage currently supports post-fire black-backed nesting or feeding habitat (*Project File Exhibit Rs-10*). Areas that would provide habitat for black-backed woodpecker habitat in the case of a future large wildland fire are well distributed across the analysis area. Nearly 22,000 acres of mid- and late-seral forest have the potential to support 89 black-backed woodpecker home ranges, assuming a future fire could burn with the fire severities most used by this species. The section on *Old Growth, Snags, and Downed Wood Wildlife Habitat* further discusses the potential of the area to provide components of black-backed woodpecker habitat.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, burning, or road or trail construction, are proposed with this alternative. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires to occur. This could result in large areas of highly suitable habitat for this species, depending on the size and intensity of such a wildland fire.

Direct and Indirect Effects of Alternatives 2 and 3

These alternatives would reduce the likelihood of the creation of new post-fire habitat for black-backed woodpeckers. Due to the lack of recent post-fire habitat in any of the proposed units, implementation of the action alternatives would not remove any current potential post-fire feeding or nesting habitat for black-backed woodpeckers. Timber harvest and burning would remove some trees infested with mountain pine beetle, Douglas-fir beetle, and other insects sought after by woodpeckers. Other areas that support such prey species would be left intact, as described in the Forest Vegetation section of this document. Timber harvest, fuel treatments, and road construction would remove some potential future nesting and feeding trees on approximately 518 acres and reduce the approximate number of future potential home ranges from 89 to 84 (*Project File Exhibit Rs-10*). Burning may create some habitat. Other actions, such as helicopter use, culvert replacement, BMP roadwork, the parking area upgrade, parking pullouts, trail construction and use, and designation of new trails on road templates, would not have measurable effects on this species.

Fisher

Introduction

The fisher (*Pekania [Martes] pennanti*) is a larger, weasel-like predator that seems to do best in lower- to mid-elevation areas with shallower snow, partly due to relatively small feet for its body size (Garroway, et al. 2011; Raley, et al. 2012). In the Northern Rockies, fishers evolved under a disturbance regime that created numerous openings in a matrix of moister, mature forested habitats, although large open areas, including large wetlands, are avoided (Weir and Corbould 2010; Schwartz, et al. 2013; Sauder and Rachlow 2014). Fishers seem to require the complex structure that often occurs in late-seral forests – dense canopies; large trees, snags, and logs; tree cavities and branch platforms (Aubry, et al. 2013; Raley, et al. 2012; Olson, et al. 2013). Areas of otherwise suitable

habitat can be isolated when cover between home ranges is removed (Fisher and Wilkinson 2005; Garroway, et al. 2011). The average home range for a female fisher in this area is expected to be about 15 square miles (Jones 1991, Heinemeyer and Jones 1994).

Fishers appear to be vulnerable to loss of overhead cover and habitat fragmentation due to factors such as wildland fire, timber harvest, and timber salvage (Powell and Zielinski 1994, Weir and Corbould 2010, Sauder and Rachlow 2014). Fishers seem able to tolerate some level of timber harvest and fuel reduction, although it is recommended to protect large trees with disease or defects, promote diverse multi-stage stands, and maintain habitat connectivity (Garroway, et al. 2011, Schwartz, et al. 2013). Fishers are apparently tolerant of human activity, but the ease of human access into an area correlates with fisher mortality through direct or incidental trapping (Claar, et al. 1999). Habitat for the species is expected to expand under future climate scenarios as long as fishers can disperse through unsuitable habitat (Olson, et al. 2013).

Analysis Area

The spatial extent of analysis of effects on fishers is the same as that used for all sensitive wildlife species, as described above. For this project, the analysis of effects on fisher spans as far as 100 years, enough time for affected stands to develop into fisher habitat and for snag and downed wood habitat to develop as well.

Affected Environment

Population Status

The U.S. Fish and Wildlife Service analyzed potential factors that may affect the habitat and range of the fisher in the U.S. Northern Rocky Mountains, including climate change, development, forestry, fire, trapping, poisoning, and predation, (Boyd et al. 2017). This review found no evidence of significant impacts, leading to a conclusion that it is not in danger of extinction and does not need protection under the ESA. The project area lies within the larger Trapping District One, which had a quota of two fishers before the season was closed. No fishers were trapped in Flathead County from 1996 to 2017 (*Project File Exhibit Rg-1*).

The fisher is a Montana Species of Concern (*Project File Exhibit Rg-4*). Fishers are distributed in northwest and west central Montana and northern and north-central Idaho, but are believed to occur at low densities. Fishers were translocated from the Midwest and British Columbia to the northern Rocky Mountains between 1959 and 1991 in five separate efforts. One effort about 30 years ago occurred partially within the Taylor Hellroaring Wildlife Analysis Area. Fishers are difficult to monitor due mostly to their low population density. Efforts to collect fisher hair for DNA confirmation have been conducted on numerous portions of the Flathead National Forest since 2007, but fisher presence has not been confirmed through that effort (*Project File Exhibit Rs-5*). Montana FWP conducts winter track surveys for forest carnivores throughout the Flathead National Forest, which resulted in 0 to 2.5 fisher detections annually from 1990 to 2000, with no apparent trend in the data (*Project File Exhibit Rg-8*). For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see *Project File Exhibits Rg-1, Rg-3, and Rs-6*.

Habitat

Across the Northern Rocky Mountains, an estimated 30,000 km² provide habitat for fisher (Boyd et al, 2017). On the Flathead National Forest, forest that is modeled as suitable for fisher totaled 43.5 percent (8.6 percent for summer habitat and 34.9 percent for winter habitat) with 90 percent confidence intervals of two to three percent (*Project File Exhibit Rg-1*).

Defining potential fisher denning/resting habitat for this analysis applied the approach of the 2013 USFS Full Model for fisher habitat (Olson 2013). This looked at areas of older forest with high canopy cover in patches of at least 160 acres and connected to other patches by mid-to-late seral riparian and upland forest (Project File Exhibits Q-12 and Rg-7). The resulting potential fisher habitat is made up of over 5300 acres of denning/resting habitat, providing two potential female home ranges (Project File Exhibits Rs-8). Mapped fisher denning/resting habitats in this analysis area are highly likely to have abundant large trees and large downed wood. It appears the current distribution of habitat for fishers would allow dispersal to continue between the home ranges in the Taylor Hellroaring Wildlife Analysis Area and neighboring areas. Suitable denning and feeding habitats occur in adjacent drainages. The section on *Old Growth, Snags, and Downed Wood Wildlife Habitat* further discusses the potential of the area to provide habitat components.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, burning, or road or trail construction, are proposed with this alternative. In lieu of wildland fire or other stand-replacing disturbance, the availability of forested connectivity and of denning and hiding sites would generally increase, as would habitat used by numerous species preyed on by the fisher. The fuel loading in some stands would increase the chance of large hot fires in adjacent areas, increasing the potential for destruction or isolation of fisher habitat. Such wildland fires would be less acceptable than if the area had experienced little or no timber harvesting in the past.

Direct and Indirect Effects of Alternatives 2 and 3

The action alternatives would manage vegetation in potential fisher denning and resting habitat as shown in Table 3-78. Several units would remove potential denning/resting habitat attributes (Units 1, 2, 3, 6, 7, 8, 17, 19, 21, 22, 27, 30, 32, 33, and 34). In most units, wind-firm live trees and snags would be left standing, thus helping to maintain the potential for future fisher habitat. Early seral/structural stage stands created by logging would provide habitat for some fisher prey species, increasing sources of food. Fuel reduction and site preparation would remove some potential den structures. However, along with tree and shrub planting, this would also accelerate regeneration of canopy cover and reduce the probability of fire spreading to fisher habitat of higher quality. Effects of timber harvest and burning on forested connectivity habitat for fishers would be minor (Project File Exhibits Rg-7 and Rs-8).

Table 3-78. Potential Fisher Habitat and Vegetation Management Effects by Alternative (Project File Exhibit Rs-8).

	Alternative 1	Alternatives 2 and 3
Change from Denning/Resting to Forested Connectivity	0 ac	339 ac
Change from Denning/Resting to not fisher habitat	0 ac	199 ac
Total Denning/Feeding Habitat (and % habitat change)	5,307 ac (0%)	4,768 ac (-10%)

Approximately 2.1 miles of permanent and temporary road construction would occur through potential denning/resting fisher habitat in Alternatives 2 and 3 (Project File Exhibit Rs-8). In Alternative 2, nearly 15 miles of trails would pass through 7 of the 8 patches of fisher denning/resting habitat. In Alternative 3, this would be reduced to 9.4 miles of trails through 6 of the habitat patches. No additional motorized public travel is expected on any of these roads or trails.

Timber harvest, burning including helicopter ignition, road construction, trail construction, culvert replacement, BMP roadwork, the parking area upgrade, and parking pullouts, and other actions could cause temporary disturbance to fisher, with possible temporary displacement from the immediate area. However, impacts of trail development would be long term, and fisher would be disturbed to some degree by trail use on 26 (Alternative 3) to 40 miles (Alternative 2) of new trails. Seeding, tree and shrub planting, and shrub slashing would enhance habitat values for a variety of species preyed upon by fishers. Other actions would not have measurable effects on this species. Fishers, while currently rare, should see eventual improved habitat overall with the implementation of the project, even if there is some temporary reduction of fisher habitat quality.

Flammulated Owl

Introduction

In western Montana and Idaho, the tiny flammulated owl (*Otus flammeolus*) often nests in older, open, and relatively dry mixed-species forests. These stands nearly always support ponderosa pine, but sometimes have large Douglas-fir instead. Flammulated owls prey on small birds, moths, and grasshoppers for at least part of their life cycle. These prey species use more open forests or are more easily caught by flammulated owls in such open stands. Special habitat features used by flammulated owls include large-diameter trees with cavities at least as large as those made by northern flickers, occasional clusters of thick understory vegetation, and small open areas used for foraging (*Project File Exhibits Rs-2*). Wright (1996) and Wright, et al. (1997) found that flammulated owls nested in areas with a higher proportion of low/moderate canopy cover assessed at a landscape scale and that occurrence correlates with the number of ponderosa pine trees over 15 inches DBH. Home ranges in this area are expected to exceed 14 acres (Samson 2006, *Project File Exhibit Rs-20*) and average about 37 acres (McCallum 1994).

Timber harvest, wildland fire, and fire suppression can affect this species in positive and negative ways. Timber harvest and stand-replacing fire can destroy nest structures and prey supplies. Flammulated owls disappear from stands after the large tree component is removed (Hayward and Verner 1994). On the other hand, frequent low-intensity fire in ponderosa pine/Douglas-fir stands can maintain open conditions required by flammulated owls (McCallum 1994). Flammulated owls have been located in selectively logged stands where the logging was relatively light and where numerous large trees and pockets of smaller trees remained, although the elimination of understory trees would remove thickets needed for foraging, roosting, singing, and cover (Wright, et al. 1997). Wright, et al. (1997) found that flammulated owls were present in approximately half of the selectively logged stands in her study area south of Missoula, Montana. Howie and Ritcey (1987), in a British Columbia study, found that most owls occurred in mature and old stands of Douglas-fir with 35 to 65 percent canopy closure that had been selectively harvested two to three decades prior.

Analysis Area

The spatial extent of analysis of effects on flammulated owls is the same as that used for all sensitive wildlife species, as described above. For this project, the analysis of effects on flammulated owls spans as far as 100 years, at which time areas regenerated by this project are likely to be used by this species.

Affected Environment

Population Status

In Montana, the flammulated owl is a Species of Concern (Project File Exhibit Rg-4). Numerous sightings within the last five years and indirect evidence of breeding are well distributed across this portion of the state. The 2005 Forest Service Region 1 survey effort yielded a 243 flammulated owl detections which were widely distributed across western Montana and north-central Idaho. This owl is believed to have very low relative abundance on the Flathead National Forest and was detected on 4.9 percent of the suitable habitat survey plots (Project File Exhibit Rs-5); this equates to a low rate of detection (Cilimburg 2006). Wright (1996) conducted a two-year study of flammulated owls on the Bitterroot National Forest. Using a “callback survey,” she recorded approximately 100 flammulated owl observations. There is no evidence the flammulated owl is decreasing in numbers in Region One (Project File Exhibit Rg-1). Habitat modeling showed that flammulated owl habitat is naturally limited on the Flathead National Forest (Samson 2006 [updated 2008]), but there is currently no evidence that their population on the Flathead Forest is in decline.

Flammulated owl presence in the project area has not been confirmed. Flammulated owls are particularly difficult to locate because they are nocturnal and display secretive behavior, with a call that is difficult to detect at a distance. Information about survey effort and findings is in Project File Exhibit Rs-5. For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see *Project File Exhibits Rg-1, Rg-3, and Rs-16*.

Habitat

Habitat modeling done by the Forest Service suggests habitat for the flammulated owl is abundant and well-distributed in USFS Region One. Samson (2006 [updated 2008], *Project File Exhibit Rs-20*) estimated that 0.3 percent of the Flathead National Forest provided suitable habitat based on FIA on-the-ground plot data. On the Flathead National Forest, the stands preferred for nesting by flammulated owls are naturally limited by climate, terrain, and soil conditions.

Approximately 867 acres across the Taylor Hellroaring Wildlife Analysis Area appear to be potential habitat for potential flammulated owls, which is warm and dry late-seral/structural stage forest dominated by Douglas-fir or ponderosa pine with moderate canopy cover levels (*Project File Exhibits Rs-2*). In addition, flicker and pileated woodpecker-sized nest and roost cavities are common across the analysis area (*Project File Exhibits Q-2 and Rd-3*). Most of the potential habitat is on State or private lands in the lower elevations of the analysis area. Assuming a home range of about 40 acres, potential home ranges well distributed across the area, although only one of these is on USFS lands. Fire suppression in the area continues to result in many older forests becoming filled in with thick understories and mid-stories. This increases the risk of extensive tree mortality due to stand-replacing fire or pathogens.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, burning, or road or trail construction, are proposed with this alternative. Continued accumulation of plant growth in the understory and mid-story over time would further reduce habitat value for this species while increasing the chance that potential nest structures would be consumed by stand-replacing fire.

Direct and Indirect Effects of Alternative 2 and 3

Alternatives 2 and 3 would have 37 acres of understory fuels reduction (all of Unit 101) in an area of potential flammulated owl habitat that appears to be part of a currently functional home range, and 18 acres of commercial thinning (Units 44, 45, and 46) and 1 acre of shelterwood harvest (Unit 49) in a somewhat isolated area of potential flammulated owl habitat (*Project File Exhibit Rs-2*). This could make these stands more likely to support flammulated owl nesting in the future. With the reduced tree density and more open canopy, remaining trees would be subject to less competition for limited water and nutrients, improving their ability to withstand long-term drought and improving their resilience to stand replacing wildland fire and to other causes of a changing environment. All live or dead ponderosa pine would be retained, as would all hardwoods, live larch over 18" DBH, and live Douglas-fir over 25" DBH (See design features in chapter 2 and *Project File Exhibit Rd-5*). Silvicultural prescriptions were designed to retain many or all of the larger, wind-firm trees wherever they exist, and also some of the understory and mid-story trees. Opening up stands and removing understory vegetation would generally benefit flammulated owls in the long term, although harvesting itself could remove some nest trees. See the *Forest Vegetation* section of this chapter for more information. If active flammulated owl nesting is discovered in any proposed unit, activities would be modified if needed to protect nest stand conditions and maintain reproduction efforts.

Although no road construction would occur through potential flammulated owl habitat, 0.48 miles of trails would be constructed through potential flammulated owl habitat in both Alternatives 2 and 3. These are Trails 1, L1A, and L1C, all in the Holbrook Area, and all in an area that appears to be too far from other potential habitat to currently be part of a functional home range. Effects on habitat would be minimized by design criteria that would limit tread to an average of 2 feet wide and minimize removal of trees larger than 6" DBH.

Other actions, including prescribed burns with helicopter ignition, the parking area upgrade, parking pullouts, trail use, roadwork, culvert replacement, seeding, and shrub planting, would not have measurable effects on this species.

Gray Wolf

Introduction

For gray wolves (*Canis lupus*), adequate prey base and security from risk of mortality are the two major components that provide survival and recovery value (USDI FWS 1987; Witmer, et al. 1998). Wolves in the Rocky Mountains appear to select landscapes with relatively lower elevation and flatter terrain. Habitat preferences appear to relate more to prey than to cover. The predominant prey of wolves in the northern Rockies is white-tailed deer, with lesser amounts of moose, elk, beaver, and smaller animals. A wolf pack would usually move up to six miles to a number of rendezvous sites, typically meadows, until the pups can travel with adults. Within their home ranges in and near Glacier National Park, wolves concentrated their hunting in wintering areas of white-tailed deer (Kunkel and Pletscher 2001). The effects of timber harvest, insect epidemics, and fire on wolves are best defined by effects on their prey, much of which depend on early seral/structural stages interspersed with cover, shelter, and water. Although lesser-used roads and trails can facilitate wolf travel, frequently used roads can reduce wolf habitat security and increase the potential for mortality (Thiel 1985).

Analysis Area

The spatial extent of analysis of effects on gray wolves is the same as that used for all sensitive wildlife species, as described above. This analysis spans up to 20 years, at which time areas affected

by this project are likely to provide hiding cover. In addition, human activities associated with vegetation management in this project that could disturb or displace wolves would have ceased.

Affected Environment

Population Status

Five areas in mountainous regions of Washington, Idaho, Montana, and Wyoming currently support populations of wolves (*Project File Exhibit Rs-14*). Wolf population trend is stable or upward, and the population in northwestern Montana continues to expand (*Project File Exhibits Rg-1 and Rs-14*). Most of the increases in Montana's wolf population occurred in the northwest Wolf Management Unit 1, which includes the project area. Montana laws allow wolves to be killed during official hunting and trapping seasons, if the wolf is seen killing or threatening to kill livestock or dogs, to protect human life, and for wolf-livestock conflicts. The Taylor Hellroaring Wildlife Analysis Area has sufficient prey to support denning wolves year round. Records of wolves in and near the analysis area are in *Project File Exhibit Rs-5*. For more detailed population, monitoring, management, and legislation information, see *Project File Exhibits Rg-1 and Rs-14*.

Habitat

The project area contains key habitat components in sufficient abundance and distribution on an annual basis to sustain a viable wolf population. Approximately 88 percent of the Taylor Hellroaring Wildlife Analysis Area currently functions as hiding cover and/or thermal cover, well distributed across most of the analysis area (*Project File Exhibit Rb-3*). Potential wolf prey is plentiful and well distributed in the analysis area, primarily ungulates (white-tailed deer, mule deer, moose, and elk) and beavers (*Project File Exhibits Rb-2 and Rr-4*). No specific ungulate calving or fawning sites have been identified in the analysis area, as these appear to be dispersed. The network of roads in the Taylor Hellroaring Wildlife Analysis Area provides many opportunities for wolves to forage on road kill, while also posing a danger to the wolves themselves (*Project File Exhibit Rg-5*). Road restrictions on Federal lands in the analysis area are generally effective (*Project File Exhibit Rg-6*). For more information about potential prey species, cover, and security from disturbance, displacement, and mortality, see sections in this chapter on *Commonly Hunted Big Game* and *Neotropical Migratory Birds and Riparian Habitat*.

Environmental Consequences

Indirect and Direct Effects of Alternative 1 (No Action)

No actions, such as timber harvest, burning, or road or trail construction, are proposed with this alternative. The lack of new openings and canopy thinning could mean less forage available for prey eaten by wolves, but this does not appear to be limited in the Taylor Hellroaring Wildlife Analysis Area. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires to occur, which could result in large areas of decreased suitability or unsuitable habitat, and possibly mortality associated with heat intensity. The level of effects would be dependent on the size and intensity of such a wildland fire. See the *Commonly Hunted Big Game* section of this chapter for more information.

Indirect and Direct Effect of Alternatives 2 and 3

Timber harvest, fuel reduction, and road construction in these alternatives would affect cover used by large mammals such as wolves and their prey, as discussed in the section in this chapter on *Commonly Hunted Big Game*. The short-term loss of hiding cover would occur on approximately 500 acres (*Project File Exhibit Rb-3*). In both action alternatives, this includes some units that would alter forested connections, although alternate routes would remain in all cases (*Project File Exhibit Rg-7*).

There would be an eventual increase in the quality of hiding cover in many harvest units. Several commercial harvest units would remove hiding cover, but hunting season security habitat usable by wolves and several of their prey species would remain unchanged. Prescribing the retention of many large live trees, snags, and downed wood help provide for some cover in the units. In all action alternatives, shrubs would be planted if funding is available. This would enhance big game forage, feeding and nesting sites for songbirds, and hiding cover values for a wide variety of wildlife species.

Temporary displacement of individual animals might occur during implementation of activities, including timber harvest, fuel reduction, burning including helicopter ignition, road or trail construction, culvert replacement, BMP roadwork, the parking area upgrade, and parking pullouts. There would be no direct or indirect effects on wolves from disturbance to key habitat areas such as den sites, rendezvous sites, or whelping sites in or beyond the area where this project is proposed. However, impacts of trail development would be long term, and wolves would be disturbed to some degree by trail use on 26 (Alternative 3) to 40 miles (Alternative 2) of new trails. Over-snow motorized travel would not occur on new temporary or system roads. Based on the nature and duration of the proposed project, the mortality risk for wolves would remain low-to-moderate. If gray wolf denning or rendezvous sites are identified in the project area in the future, existing Forest Plan standards and guidelines would be implemented to ameliorate potential adverse effects. Other aspects of the project would not have measurable effects on wolves.

Western (Boreal) Toad and Townsend's Big-eared Bat

Introduction

The western (boreal) toad (*Anaxyrus [bufo] boreas*) and Townsend's big-eared bat (*Plecotus townsendii*) are discussed together because of similarities of many aspects of their habitat needs and many potential effects. The **western (boreal) toad** breeds in lakes, ponds, streams, and road ditches, with a preference for shallow, warm areas with mud bottoms. Adult western toads are largely terrestrial and can travel considerable distances from water (Muths 2003, Schmetterling and Young 2008). After the breeding season, toads select habitat that includes open forest canopies or openings in the landscape that are close to water, often on south facing slopes, and with a high density of burrows, rocks, logs, or root wads. **Townsend's big-eared bats** (*Project File Exhibit Rs-11*) forage on insects high in living forest canopy near wet meadows (Dobkin, et al. 1995). Caves, tree cavities, rock outcrops, buildings, or mines may provide sites for roosting, communal nurseries, or winter hibernation (Reel, et al. 1989; Tuttle and Taylor 1994).

Timber harvest, insect epidemics, wildland fires, and road construction and maintenance can affect these two species through soil compaction, changes in vegetative cover, or by altering the quantity and quality of water flowing into wet areas. In addition, timing of recruitment of large woody material into wetland edges can be altered. Snags used by bats as roosting structures can be removed, as can live trees and shrubs used as foraging substrates (Hayes and Loeb 2007). Because they use upland habitats for much of their lives, individual toads can be killed directly by timber harvest activities, road construction or maintenance activities, and wildland fire. Roads can be obstacles for toads as they are slow moving and vulnerable to being run over by vehicles, and they may also be more susceptible to predation when crossing roads. Other factors associated with amphibian population decreases include pollution, pesticides, habitat destruction and alteration, increases in UV radiation, the introduction of predators or competitors, and infectious bacteria and fungus (Carey 1993; Muths 2003; Pilliod, et al. 2003).

Analysis Area

The spatial extent of analysis of effects on western toads and Townsend's big-eared bats is the same as that used for all sensitive wildlife species, as described above. This area was chosen because of the mobility of these species. For the western toad, the analysis of effects extends out 5 years, based on the probable contract length for the proposed project and the timeframes for related activities. The analysis of effects on the bats and their habitat extends out 50 years, enough time for new trees to grow and for some of the trees left in the units to acquire decay and other characteristics that make them useful to bats as roosts.

Affected Environment

Population Status

According to historical records, the **western (boreal) toad** (*Project File Exhibit Rs-13*) was widely distributed and very common in Montana and other western states. Across the Flathead National Forest, juvenile or adult boreal toads have been observed in nearly half of the 65 sub-watersheds (6th-code HUCs) surveyed on the Forest during annual citizen-science surveys since 1994. These observations included more than 150,000 tadpoles and nearly 500 adult toads. Toad observations during these surveys fluctuate considerably from year to year depending upon a variety of factors, including naturally fluctuating water levels at individual sites, weather variations and events, and a variable level of observer effort. Western toad adults and high numbers of tadpoles have been found in numerous locations in and near the Taylor Hellroaring Wildlife Analysis Area (*Project File Exhibit Rs-5*).

Townsend's big-eared bats have a widespread distribution but they have not been recorded in the Taylor Hellroaring Wildlife Analysis Area. There are numerous wet meadow feeding areas with adjacent snags for roosting within the analysis area (See *Project File Exhibit Rs-11*). In Montana, this bat is a Species of Concern (*Project File Exhibit Rg-4*). Intensive population surveys of bats are difficult to conduct because of the nocturnal behavior of bats, their large home ranges, and difficulty of species identification while in flight. Montana Natural Heritage Program records include documented observations of about 40 bats from six sites across the Flathead National Forest, based upon cave surveys and observations in buildings (*Project File Exhibit Rs-5*).

Habitat

In the Taylor Hellroaring Wildlife Analysis Area, less than 37 acres appear to provide breeding habitat for western toads and prime feeding sites for Townsend's big-eared bats (*Project File Exhibits Rr-3, Rs-11, and Rs-13*). This potential habitat was identified as Riparian Landtypes NL1A and NL1E (USDA Forest Service 1995b), which are relatively level areas in flat valley bottoms with relatively fine substrates (Table 3-89). Western toad reproduction has been found in over 86 locations on Flathead National Forest lands and over 80 percent of these have been in NL1E or NL1A. All land in the project and cumulative effects area is close enough to potential breeding ponds to be potential upland habitat for western toads and potential foraging habitat for Townsend's big-eared bats.

Table 3-79. Riparian Landtypes NL1A and NL1E in the Taylor Hellroaring Wildlife Analysis Area (Project File Exhibit Rr-3).

Landtype	Gradient	Substrate Material	Vegetation Community	Total Acres	% of Analysis Area
NL1A	Nearly level, valley bottom 2-4% slopes	Clays, silts, fine and medium sand	Subalpine fir	0	0.0%
NL1E	Nearly level, valley bottom 2-4% slopes	Clays, silts, fine and medium sand	Willow and sedges	37	0.1%

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

Alternative 1 would have no direct effect on western toads or Townsend's big-eared bats, or on their habitats. No actions, such as timber harvest, fuel reduction, burning, or road or trail construction, are proposed with this alternative. This would leave riparian and upland habitats across the Taylor Hellroaring Wildlife Analysis Area to continue with relatively natural processes. The isolated area of wetland habitat suitable for these species would not be affected whether or not the proposed BMP improvements or culvert replacement occur. Ongoing upland actions such as firewood cutting and motorized access that may impact western toads and big-eared bats would continue at current levels. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires, which could result in areas of less suitable or unsuitable habitat and possible fatalities. For more information about the effects of no action on wildlife that use riparian areas and snag and downed wood habitats, see the *Aquatics* and *Old Growth, Snags, and Downed Wood Wildlife Habitat* sections of this chapter.

Direct and Indirect Effects of Alternatives 2 and 3

Part of proposed understory fuel reduction Unit 108 is within 1/10 mile of the area that appears to provide breeding habitat for western toads and prime feeding habitat for Townsend's big-eared bats (Project File Exhibit Rr-3). The *Neotropical Migratory Birds and Riparian Habitat* section of this chapter summarizes these effects, and more detail is provided in *Project File Exhibits Rr-3, Rs-11, and Rs-13*. Western toads and big-eared bats are inactive during the winter and typically hibernate in subterranean burrows or roost in snags, caves, or buildings. Project activities that occur during this period would have less impact on these species and their habitat than activities occurring during the spring or summer. The isolated area of wetland habitat suitable for these species would not be affected by proposed BMP improvements or culvert replacement. Protection of riparian habitats would occur through a combination of protective measures in the Montana Streamside Management Zone Law, Montana Water Quality Act, and INFISH standards (See *Aquatics* section of this chapter).

Timber harvest, road and trail construction, increased vehicle use, road maintenance, and road construction may kill individual adult and juvenile boreal toads using upland habitats. Such mortality would be infrequent and would not be expected to affect this species at the population level (Project File Exhibit Rs-13).

Specific to the Townsend's big-eared bat, proposed activities could reduce potential feeding habitat by removing live trees used as foraging substrates. Similarly, roosting habitat could be reduced by the removal of snags or live trees with roost characteristics. Disturbance or mortality of bats could occur if bats were using a roost snag or tree that was cut down. Effects would be site-specific, affecting individuals rather than colonies, and are not likely to lead the Townsend's big-eared bats towards listing (Project File Exhibit Rs-11).

Other actions, including helicopter use, tree planting, culvert removal, slashing, dust abatement, and trail construction and use, would not have measurable effects on these species.

Cumulative Effects — Sensitive Wildlife Species

Cumulative effects relevant to sensitive wildlife species (Project File Exhibit Rs-9) are described in the sections of this chapter on *Old Growth, Snags, and Downed Wood Wildlife Habitat*; *Neotropical Migratory Birds and Riparian Habitat*; *Commonly Hunted Big Game, Threatened Wildlife*; and *Aquatics*, as displayed in Table 3-80. These include loss and alteration of habitat due to vegetation management and road construction; past wildland fires; hunting; recreational disturbance; and access for firewood cutting and furbearer trapping. Also see *Project File Exhibits Q-8, Rb-6, Rd-12, Rg-1, Rn-3, Rr-2, and Rt-14*. For an assessment of these species' viability at the Forest level, see the Final Environmental Impact Statement for the Forest Plan Amendment 21 (USDA 1999a) and *Project File Exhibit Rg-1*.

Table 3-80. Cumulative Effects Sections in this Chapter and Project File Exhibits for Cumulative Effects for Sensitive Wildlife Species (Project File Exhibit Rs-9).

Sensitive Wildlife Species	Relevant Cumulative Effects Sections in this Chapter	Project File Project File Exhibits
Black-backed Woodpecker	<i>Old Growth, Snags, and Downed Wood Wildlife Habitat</i>	Rd-12
Boreal Toad	<i>Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat; Aquatics</i>	Rd-12, Rr-2
Fisher	<i>Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat; Aquatics; Threatened Wildlife</i>	Rt-6, Q-8, Rd-12, Rr-2
Flammulated Owl	<i>Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat</i>	Q-8, Rd-12, Rn-3
Gray Wolf	<i>Commonly Hunted Big Game, Threatened Wildlife</i>	Rt-6, Rb-6
Townsend's Big-eared Bat	<i>Old Growth, Snags, and Downed Wood Wildlife Habitat; Neotropical Migratory Birds and Riparian Habitat; Aquatics</i>	Rd-12, Rr-2

While other factors outside of Forest Service control may affect individuals of these sensitive wildlife species, the direct, indirect, and cumulative effects of the Taylor Hellroaring project, considered singly or in concert, would not likely result in a trend toward federal listing nor reduced viability for the populations or species. In addition, no geographic or man-made barriers exist within or near the Taylor Hellroaring Wildlife Analysis Area that would preclude movements by these species to adjacent populations.

Regulatory Framework and Consistency — Sensitive Wildlife Species

In accordance with FSM 2673.42, determinations have been made on the degree of impact the proposed activities may have on sensitive species (Table 3-81 and *Project File Exhibits Rs-1 and Rs-3*). Along with Chapter 1, Chapter 2, and the sub-section above on each species, these determination statements meet the requirements of the Biological Evaluation for Sensitive Wildlife Species. These statements are based on available information on the distribution, presence in the project area, habitat requirements, and management strategies for these species, as well as the project design and location. These determination statements are for the segment of the population using the Affected Area, not the entire population, and an additional analysis that assessed viability at the forest scale (*Project File Exhibit Rg-1*). All alternatives are consistent with NFMA diversity requirements for wildlife, as described in the *Old Growth, Snags, and Downed Wood Wildlife Habitat* section of this

chapter. For information specific to the wolverine, which is currently proposed for listing under the Endangered Species Act, see the *Threatened and Proposed Wildlife Species* section of this EA and *Project File Exhibit Rs-12*.

Table 3-81. Biological Evaluation Determinations for Sensitive Wildlife Species (Project File Exhibit Rs-3).

Sensitive Wildlife Species	Alternative		
	1	2	3
Bald eagle	NI	NI	NI
Bighorn sheep	NI	NI	NI
Black-backed woodpecker	BI	MIIH	MIIH
Western (boreal) toad	MIIH	MIIH	MIIH
Common loon	NI	NI	NI
Fisher	MIIH	MIIH	MIIH
Flammulated owl	MIIH	MIIH	MIIH
Gray wolf	MIIH	MIIH	MIIH
Harlequin duck	NI	NI	NI
Northern bog lemming	NI	NI	NI
Northern leopard frog	NI	NI	NI
Peregrine falcon	NI	NI	NI
Townsend's big-eared bat	MIIH	MIIH	MIIH
Wolverine (currently proposed for listing under ESA)	MIIH	MIIH	MIIH

NI = "No Impact"; MIIH = "May Impact Individuals or Habitat but would not likely result in a trend toward federal listing or reduced viability for the population or species"; BI = "Beneficial Impact."

Bald eagles, peregrine falcons, and gray wolves no longer receive protection from the Endangered Species Act, but this project is consistent with the Forest Plan and all other applicable direction, such as the Bald and Golden Eagle Protection Act of 1940 and the Migratory Bird Treaty Act.

Wildlife - Old Growth, Snags, and Downed Wood Habitat

Introduction

Old growth forests, snags and downed wood provide key habitats for a wide variety of wildlife species. Old growth forests are typically distinguished by: 1) large trees for the species and site; 2) accumulations of large snags and fallen trees; 3) decay or breakage of tree tops, boles, or roots; 4) multiple canopy layers; 5) wide variation in tree size and spacing; and 6) canopy gaps and understory patchiness (Helms 1998). Interior habitat shelters wildlife and plants and provides protection from predators, competitors, and parasites. Closed-canopy forest reduces snow depths, insulates plants and animals from cold winds, and provides protection from predators. Open understories or patches of open canopy provide foraging opportunities for prey and predatory species alike. Snags, downed logs, rotting wood, fungi, mosses, lichens, and green tree canopy are essential for innumerable species of wildlife and plants (*Project File Exhibit Rd-4*; Bull, et al. 1997, Carey 1996). In addition, large snags and downed wood play central roles in diverse ecosystem processes and functions such as nutrient recycling, shelter for growing trees, and habitat for wildlife and fish (Rose, et al. 2001, Rochelle 2008, *Project File Exhibit Rd-4*).

Amendment 21 to the Forest Plan listed 31 old growth associated wildlife species, including some sensitive wildlife species and Neotropical migratory birds (*Project File Exhibits Q-4, Q-6, Rn-2, and Rs-1*). This amendment also named threatened, endangered, and sensitive wildlife species as Management Indicator Species (MIS), several of which represent the spectrum of old growth, snag, and downed wood habitats on the Flathead National Forest (*Project File Exhibits Rd-2 and Rg-2*).

The old growth stage of forest development is temporary, as are other forest stages. This increases the importance of maintaining and managing late-seral stands that are nearing old growth habitat conditions (Green, et al. 1992 [updated 2011]; *Project File Exhibits Q-1 and Q-2*). It is prohibitively difficult and costly to artificially restore snags or downed logs (Spring, et al. 2008), and natural restoration of old growth and snag or downed wood habitat can take decades. In addition, cavity-using birds and many ant species that need large-diameter downed logs have been proven to substantially reduce tree mortality and damage caused by forest pest insects (Beebe 1974; Otvos 1979; Torgersen, et al. 1990; Torgersen and Bull 1995; Torgersen 1996; Bull, et al. 1997).

Information Sources

For this project, “Old-Growth Forest Types of the Western Montana Zone” were used to identify stands that qualify as old growth habitat (Green, et al. 2011; *Project File Exhibits Q-1, Q-2, and Q-5*), including considerations such as tree age and size, stand structure, snags, and downed logs. Data used in this analysis included surveys for old growth, snag, and downed wood habitats; aerial imagery; stand exams; wildlife monitoring and observations (*Project File Exhibits Q-6 and Rd-11*); the FACTS activity tracking database; the R1 Vegetation Map; and data sets for features such as old growth habitat, general forest attributes, slope, aspect, habitat types, insects and disease, past timber harvest and wildland fires, and road and trail locations. For more information, see project record Sections Q and Rd and *Project File Exhibit Rg-9*. Population diversity concerns at the Flathead National Forest and larger scales are assessed in *Project File Exhibit Rg-1*. *Project File Exhibit Q-10* details compliance with attributes of the Flathead Forest Plan related to old growth habitats. This analysis covered the standing and downed dead wood resource in terrestrial areas. See the *Aquatics* section of this chapter for consideration of large wood recruitment in aquatic systems. See sections

in this chapter on *Forest Vegetation* and on Black-backed Woodpeckers (in the *Sensitive Wildlife Species* section); and *Project File Exhibits Rd-1, Rd-3, Rd-5, Rd-8, and Rd-11*. See also the section on *Forest Vegetation* in this chapter for more information about forest conditions, understory vegetation, noxious weeds, snags, and downed logs.

Analysis Area

The analysis area for old growth associated wildlife species and on snags and downed woody material wildlife habitat is the Taylor Hellroaring Wildlife Analysis Area (Figure 3-9, in *Introduction*). At approximately 45.6 square miles (about 29,000 acres), it is large enough to include the home range of numerous wildlife species that use old growth habitats, snags, and downed woody material and to represent the effects of wildland fire, natural tree mortality, timber harvest, prescribed fire, fuel reduction, firewood cutting, and recreation across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of wildlife and plant species using old growth and dead wood habitats, but small enough to not obscure the effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect old growth and dead wood associated species are contained within this area. No known or suspected population sinks for these species occur in or near the area. Larger-scale assessments were also conducted to address population viability concerns (*Project File Exhibits Rd-9 and Rg-1*). See also *Project File Exhibits Q-11, Rd-9, Rg-3, Rs-6, Rs-16, Rs-18, and Rs-20* for Region-wide assessments of some key species. The temporal scale of the effects analysis extends 100 years into the future, enough time for some mature stands to develop into old growth habitat and for some of the trees to grow and die or to acquire decay and other characteristics that make them useful to numerous wildlife species.

Affected Environment

Population Status

Numerous wildlife species make use of old growth snag and downed wood habitat in the Taylor Hellroaring Analysis Area. *Project File Exhibits Q-4, Q-6, Rd-2, and Rd-11* display occupation by old growth and dead-wood associated species and provides more information about these species' habitat components, population trends, and risk factors. Monitoring results and other sightings suggest that these species are relatively common (*Project File Exhibits Q-6 and Rd-11*). For other information about the monitoring of these and other bird species, see the section in this chapter on *Neotropical Migratory Birds and Riparian Habitat*. For more information about populations of wildlife using old growth and dead-wood habitat across the Flathead National Forest, see the Final Environmental Impact Statement for the Forest Plan's Amendment 21 (USDA 1999a) and *Project File Exhibit Rg-1*.

Habitat

On Forest Service lands in the Taylor Hellroaring Wildlife Analysis Area, 2,071 acres appear to qualify as old growth habitat (*Project File Exhibit Q-5*) as defined in Green, et al. (2011; *Project File Exhibit Q-1*). This is 13.9 percent of 14,881 acres of USFS land capable of producing old growth habitat. Old growth habitat similarly delineated on DNRC land brings the acreage of this habitat up to 2,961 acres across the Taylor Hellroaring Wildlife Analysis Area (Figure 3-9 and *Project File Exhibit Q-5*). See the *Forest Vegetation* section of this chapter for more information about stands containing larger trees and other features typical of old growth habitat. For the context of old growth habitat across time and space, see *Project File Exhibits Q-8, Q-9, Rg-1, and Rg-8*.

Over 10,750 acres are Forest Service lands that appear to be moving toward old growth habitat (*Project File Exhibit Q-5*). These areas contain an older, larger overstory tree layer and with snags and downed logs. They are expected to develop a full complement of old growth characteristics (*Project*

File Exhibit Q-1) sooner than most other stands. However, in many stands, dense understories and mid-story canopies (that are largely the result of wildland fire suppression) increase the risk of stand-replacing wildland fire in the remaining old growth habitat.

Some forested connections between old growth patches have been narrowed or severed by past timber harvest and wildfires (*Project File Exhibit Rg-7*). All patches of old growth habitat in the Taylor Hellroaring Wildlife Analysis Area are connected via pole-sized or older forested habitat. Scattered across the analysis area are patches of early-seral/structural stage habitat that require travels of as much as 1.4 miles to cross in some directions (*Project File Exhibit Rg-7*). Landscape-wide data based on ecological sub-region data metrics for connectivity appear to illustrate local trends in the distances between patches of younger stands and between patches of older forests (*Project File Exhibit Q-9*).

Snag and downed wood habitat vary across the Taylor Hellroaring Wildlife Analysis Area, largely depending on disturbance history (*Project File Exhibits Q-9, Rd-3, and Rd-12*). Wildland fire was the dominant disturbance in the area prior to timber management, and extensive areas of snag habitat often occurred in areas dominated by a stand-replacing fire regime. In mixed-severity fire regime areas, underburns occasionally killed large trees and stand-replacement fires were infrequent. Although their overall numbers appear to have decreased, large larch snags are well distributed across the area from fires early in this century. Whitebark pine was likely an important component of the high elevation areas before the introduction of white pine blister rust, along with mountain pine beetle and fire suppression (Keane et. al 2012). "Recruitment snags" (live trees) are abundant across the landscape, although in many stands desirable tree species for snags are sparse or do not occur. This would include dense pole-sized stands. Although stands dominated by subalpine fir and spruce are most common across the analysis area, much of the analysis area is dominated by mesic mixed conifer species. Western larch is an important component of mid and low elevation stands in the analysis area. Ponderosa pine, another species valuable for cavity nesters, has widely scattered individuals in the low elevations, particularly near Whitefish Lake. See the *Forest Vegetation* section of this chapter for more information.

Past logging and firewood cutting reduced the availability of snags and large downed logs for wildlife. Most timber harvesting activities left few snags and large pieces of downed wood, particularly when lodgepole pine stands were cut. Blowdown occurred in some areas where past logging created abrupt edges. The network of roads in the Taylor Hellroaring Wildlife Analysis Area makes old growth dependent species vulnerable to road mortality, trapping, firewood cutting, and other disturbance.

Amounts of downed wood are highly variable across the Across the Taylor Hellroaring Wildlife Analysis Area, ranging from less than one ton per acre to over 130 tons per acre (*Project File Exhibit Rd-3*). The distribution of sizes, species, and condition of downed wood also vary dramatically within and between stands, forest types, seral/structural stages, and fire regimes. Approximately 8,011 acres (27 percent) of "late" seral-structural stage corresponds to the areas of high-quality downed log habitat and 13,744 acres (47 percent) of "mid" seral-structural stage corresponds to the areas of moderate-quality downed log habitat (*Project File Exhibit Rd-3*). These levels are not indicative of historical conditions because they reflect many years of fire suppression, tree harvest, and firewood cutting across the landscape. For the context of snag and downed wood habitat across time and space, see *Project File Exhibits Rd-3, Rd-4, Rd-8, Rd-9, Rd-12, Rg-1, and Rg-8*.

Additional information about the ability of components of old growth and snag and downed wood habitat to provide habitat for wildlife species can be found in other sections of this chapter such as *Forest Vegetation, Threatened Wildlife Species, and Sensitive Wildlife Species*.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, fuel reduction, burning, or road or trail construction, are proposed with this alternative. This would leave existing old growth habitat plus other developing stands across the analysis area to continue with relatively natural processes. Barring future disturbance, old growth associated species and communities would eventually return to much of the area, and succession would progress until a late seral or “old growth” structure again develops in approximately 100 years or more. However, Alternative 1 would not reduce the risk of old growth stands to loss from insect, disease, or stand-replacement wildland fire.

Selection of this alternative would also leave snag and downed wood habitat across the area to continue with relatively natural processes, along with fire suppression, occasional felling of hazard trees, and firewood gathering. Trees would continue to succumb to a variety of causes, and in some areas high amounts of downed woody material would slow or prevent regeneration of trees. As discussed in the *Forest Vegetation* and *Fire, Fuels, and Air Quality* sections of this chapter, the probability of stand-replacing wildland fire would increase as dead trees fall and new understory growth contributes more fine fuels. Such fire would increase the availability of snag habitat over the short term, along with the reduction of living tree canopy over large areas. Large stand-replacement fires would favor species associated with recent burns and the resulting large numbers of snags and woody debris.

Direct and Indirect Effects of Alternatives 2 and 3

Effects on Old Growth Habitat and Other Mature Late-seral Stands

No timber harvest, understory fuel reduction, or burning would occur in old growth habitat (*Project File Exhibit Q-7*). As shown in Table 3-82, vegetation management in Alternatives 2 and 3 would occur in 93 acres of mature late-seral forests that appear to be moving toward old growth conditions (Units 38, 44, 100, and 101), which are abundant across the analysis area (*Project File Exhibit Q-5*). Intermediate treatments on 47 acres would have mixed results on old growth associated wildlife, but are expected to enhance the stands’ longevity and development into old growth. Opening the understory for stand management or fuel reduction can have negative short-term effects on many old growth associated species such as the pileated woodpecker, red-backed vole, or golden-crowned kinglet. Conversely, the resultant open-canopy forests tend to favor other old growth associated species such as the flammulated owl, northern goshawk, Hammond's flycatcher, and various nuthatches. Regeneration harvest would set back progression towards old growth habitat on 46 acres that appear to be progressing towards old growth habitat. This is 0.4 percent of the 10,750 acres of similar habitats across the analysis area. Overall, timber harvest and fuel reduction in this project would reduce the risk of loss of current and future old growth stands from future wildland fire or insect outbreak as discussed in the *Forest Vegetation* and *Fire, Fuels, and Air Quality* sections of this chapter.

Table 3-82. Timber Harvest or Burning in mature late-seral forests that appear to be moving toward old growth conditions (Project File Exhibit Q-7), in acres and percent of these habitats across the analysis area.

	Alternative 1	Alternatives 2 and 3
Ecosystem Burn	0 acres	0 acres
Commercial Thin	0 acres	9.1 ac (0.1%)
Understory fuel reduction	0 acres	38.3 ac (0.4%)
Regeneration Harvest	0 acres	46.4 ac (0.4%)
Total	0 acres	93.8 ac (0.9%)

New high-contrast edge would be created when stands immediately adjacent to old growth habitat are converted from a late or mid-seral/structural stage to an early seral/structural stage (Chen, et al. 1992; Harper, et al. 2005; *Project File Exhibit Q-12*). Removing intact mature forest directly adjacent to a half mile of old growth habitat in Alternatives 2 and 3 could cause the loss or reduction of a variety of habitat features on approximately 17 acres. Old growth habitat adjacent to three units (3, 7, and 8), would be vulnerable to blowing down. (*Project File Exhibit Q-12*).

In Alternatives 2 and 3, approximately 0.4 miles of new road construction (System Road N2 and Temporary Road N3) would affect mature habitats (not old growth) that appear to be approaching old growth conditions (Project File Exhibit Q-7). This would require the harvest of approximately 0.8 acres of this habitat outside of timber harvest units. (*Project File Exhibits Q-7 and Q-10*). No public motorized access would be allowed on any of these roads during use for this project, and they would not facilitate access for trapping, hunting, or over-snow vehicle use.

New trail construction (not on existing road templates) would pass through old growth habitats. Alternative 2 would have 2.7 miles of this and Alternative 3 would have 1.5 miles. Effects on old growth habitat itself would be minimized by design features listed in Chapter 2 of this EA. Trails are generally laid out to minimize removal of trees less than 6 inches in diameter at breast height.

Although alternate routes would persist, regeneration treatments in Alternatives 2 and 3 would alter forested connections as shown in Table 3-83 (*Project File Exhibit Rg-7*). Leaving larger-diameter snag and downed-wood "legacy material" as required by the Forest Plan's Amendment 21 would improve the ability for recovering stands to provide connectivity. Several other aspects of the design of the Taylor Hellroaring Project reduced effects on wildlife connectivity, such as design for distance to cover, visual screening, buffering of Riparian Management Zones, and consideration of recent timber harvest units and connectivity corridors on adjacent Montana DNRC lands.

Table 3-83. Proposed Units that would Affect Important Forested Connections (Project File Exhibit Rg-7).

	Alternatives 2 and 3
Units affecting forested connectivity between old growth habitat areas	22 and B3
Units affecting forested connectivity on minor ridgelines	22, 33, 34, and B3
Units affecting forested connectivity on major ridgelines	None
Units narrowing forested riparian connectivity to 300 feet or less	None

Activities may have direct effects on individual animals associated with old growth habitat. Noise from the various proposed activities may impact juvenile dispersal, cause premature displacement of young, or cause young to be prematurely abandoned. This would be expected to be limited since most project activities would not occur from April 1st to June 30th. Design features for vegetation

management also include measures to reduce effects on active dens or nests of several species associated with old growth (i.e. fisher, northern goshawk, and flammulated owl). However, impacts of trail development would be long term. Wildlife associated with old growth habitats would be disturbed by trail use on 2.4 (Alternative 3) to 3.6 miles (Alternative 2) of trails that would pass through old growth habitats.

Possible shrub planting or slashing and seeding would enhance feeding, nesting, and hiding cover for a wide variety of wildlife species that use old growth habitats. Wildlife tree signing along roads that are open to public motorized use is expected to reduce losses to firewood cutting. Other aspects of the project, such as culvert replacement, BMP roadwork, the parking area upgrade, parking pullouts, and designation of new trails on road templates would not have measurable effects on old growth habitat or old growth associated wildlife species.

Effects on Snag and Downed Wood Habitats

Alternatives 2 and 3 propose timber harvest, fuel reduction, or burning in approximately 95 acres of late seral/structural forest and about 1,725 acres of mid-seral/structural forest (*Project File Exhibit Rd-3*). The “late” seral-structural stage corresponds to the areas of high-quality downed log habitat and “mid” seral-structural stage corresponds to the areas of moderate-quality downed log habitat. Along with the 90 acres of more intense burning in Unit B3, about 425 acres of regeneration harvest would remove much of the cover needed by many species that use snags and downed wood. Intermediate harvest, understory fuel reduction, and the less intense burning would maintain functional habitat for most of these species. Opening the tree canopy can also result in new regeneration of shade-intolerant tree species such as western larch, which seems to be preferred by many cavity-using species.

The site-specific snag/live tree prescriptions for the Taylor Hellroaring Project (in *Chapter 2* of this document and *Project File Exhibits Rd-5* and *Rd-6*) were based on silvicultural objectives; habitat needs of wildlife species that use snags and downed wood; field data on the expected availability of live and dead trees; scientific literature; and experts in ecological processes, timber harvest systems, and safety. Leaving some piles unburned, as specified in *Project File Exhibit Rd-6*, and the design features in *Chapter 2* of this EA, would provide cover and nesting or denning sites for a variety of species. Additional snags and downed logs are expected as the retained trees die over time. Insect and disease populations may decrease, and fewer new snags created by bark beetle infestations would be expected over the larger landscape in the next few years, as described in the *Forest Vegetation* section of this chapter. For more information, see *Project File Exhibit Rd-5*.

All road construction may require the felling of hazard trees along the road corridors. Most of the road construction (3.3 miles) would occur on existing templates, also necessitating some removal of downed wood that has fallen across the templates since they were last used. Of the four new roads (1.0 mile), only System Road N2 would affect snags and downed wood habitat outside proposed timber harvest units, with about 0.8 acres of mature habitat cleared (*Project File Exhibit Rd-3*).

Trail construction would have minimal effect on snag and downed wood habitats due to design features listed in *Chapter 2* of this EA.

Activities occurring between May and August may have direct effects on individual cavity-nesting birds. If a cavity-nesting bird were using a snag at the time of operations, the nest and/or birds could be destroyed. However, very few snags would be felled purposely unless for safety reasons. Noise from the various proposed activities may impact juvenile dispersal, or may cause premature displacement of young or cause young to be prematurely abandoned. This would be expected to be limited since most project activities would not occur from April 1st to June 30th. However, impacts of

trail development would be long term. Wildlife associated with snag and downed wood habitats could be disturbed by trail use on all 26 (Alternative 3) to 40 miles (Alternative 2) of proposed trails.

Possible Shrub planting or slashing and seeding would enhance feeding, nesting, and hiding cover for a wide variety of wildlife species that also use snag and downed wood habitats. Wildlife tree signing along roads that are open to public motorized use is expected to reduce losses to firewood cutting. Other aspects of the project, such as culvert replacement, BMP roadwork, and the parking area upgrade, parking pullouts, and designation of new trails on road templates would not have measurable effects on these species.

Cumulative Effects

Human-caused and natural changes in the past century have had an extensive effect on old growth, snag, and downed wood wildlife habitats in and near the Taylor Hellroaring Wildlife Analysis Area (figure 3-9).

Past regeneration harvest across varying ownerships converted former old growth into stands of younger trees, ski runs, utility corridors, livestock pasture, and a variety of smaller developed sites (*Project File Exhibit Q-8*). Other intermediate timber harvests removed all or most of the larger trees that might have later become components of old growth habitat. Regeneration treatments in the Taylor Hellroaring project would add cumulatively to effects on forested connectivity, as detailed in *Project File Exhibit Rg-7*.

Most timber harvesting activities left few snags or large pieces of downed wood, particularly when lodgepole pine, subalpine fir, and/or spruce stands were harvested. Regeneration harvests also dramatically reduced the potential of those sites to provide large snag or downed wood habitat in the event of fire or other disturbance. On NFS lands, most of this harvesting was done before Forest Plan's Amendment 21 (USDA 1999a) came into effect (See *Project File Exhibit Rd-10* for implementation monitoring elsewhere on the Flathead National Forest to meet these standards). Timber harvest on NFS lands under the recent Whitefish Watershed Municipal Project decision would follow these standards. Overall, mid- and late-seral forests in the Taylor Hellroaring Wildlife Analysis Area are likely to have a snag situation similar to the nearby Logan Creek analysis area, where 11,243 acres of regenerated stands (18 percent of the analysis area) have no snags visible on recent aerial photographs (*Project File Exhibit Rd-8*). Construction of campgrounds, communication towers, ski lifts, residences, and other structures also required felling of many trees and snags.

Past wildland fires are reflected in a lack of old growth in some areas with a corresponding increase in snag and downed wood habitat since these areas were not salvaged, although only about 3% of the Taylor Hellroaring Wildlife Analysis Area burned in the past 25 years. Insects and tree diseases continue to impact a variety of conifer species across the analysis area, making some stands no longer able to meet old growth definitions (*Project File Exhibit Q-1*), although some level of dead and dying trees are important components of old growth habitat. All of these factors have cumulatively led to the current amount and patchiness of old growth habitat.

Wildland fires have been actively suppressed in the Taylor Hellroaring Wildlife Analysis Area since the 1930s. This has contributed to a change in the structure of some old growth habitat by increased understory growth and denser mid-canopy trees (Lesica 1996). While enhancing habitat value for species like pileated woodpeckers and American marten, this reduced foraging habitat for species preferring a more open understory such as flammulated owls and northern goshawks. These structural changes have resulted in an increased risk of a stand-replacement wildland fire in old growth areas and affected snag and downed wood habitats through denser tree stocking, slower tree growths, and more intense fires, as described in the *Forest Vegetation and Fire, Fuels, and Air Quality*

sections of this chapter. On all ownerships, the removal of live and dead vegetation for the purpose of reducing wildland fire intensity is expected to continue.

Table 3-84 displays the cumulative result of past stand-replacement events. At least 50 percent of non-Forest Service lands have had regeneration harvest over the past 50 years. Where this converted forest into ski runs and residential development, very few or no snags are expected to exist (*Project File Exhibit Rd-12*).

Table 3-84. Early, Mid, and Late Seral/structural Stages, by Alternative, for All Ownerships across the Taylor Hellroaring Wildlife Analysis Area (*Project File Exhibit Rd-3*).

Seral/structural Stage	Alternative 1	Alternatives 2 and 3
Early (Seedling and sapling areas generated by timber harvest or wildland fire, plus small natural openings)	25%	27%
Mid (Pole-sized)	27%	26%
Late* (Mature)	47%	47%

* "Late-seral/structural Stage" is not synonymous with "Mature Late-Seral Forests that Appear to be Moving toward Old Growth Conditions" as detailed in *Project File Exhibit Q-5*.

In many places across the Taylor Hellroaring Wildlife Analysis Area, past timber harvest and wildland fires created a substantial amount of "edge effect," where sun, wind, predators, and competitors, can penetrate further into what was previously interior forest. Table 3-85 displays the cumulative impact of the alternatives.

Table 3-85. Cumulative Abrupt Edge on Old Growth Habitat and Acres Old Growth Affected (*Project File Exhibit Q-12*).

Alternative	Miles of Abrupt Edge on Old Growth Habitat	Old Growth Habitat Affected by Edge Effects	% Of Old Growth Habitat Affected by Edge Effects
1	8.2	298 acres	10.1%
2 and 3	8.7	315 acres	19.6%

Across the Taylor Hellroaring Wildlife Analysis Area, roads dissected and fragmented old growth habitat and required the felling of trees and snags and the removal of downed wood. They also formed physical and habitat barriers, created vehicle-caused mortality, and increased risk of predation and access for trapping, and hunting. Open roads facilitate access for firewood cutters, which can decrease snags and downed woody material. Research suggests that about half of the snags within 200 feet of open roads are felled for firewood (Bate and Wisdom 2004, Wisdom and Bate 2008), although firewood cutting is prohibited within 300 feet of any stream, river, or lake across the Flathead National Forest (*Project File Exhibit Rd-7*). All non-NFS lands are assumed to be vulnerable to this habitat loss. There are currently approximately 35 miles of road under USFS jurisdiction within the Taylor Hellroaring Wildlife Analysis Area; of which 12 miles are open year-long, 13 miles are open seasonally, and 10 miles are closed yearlong. Records show that there are also approximately 128 miles of non-Forest Service road within the Wildlife Analysis Area. The Taylor Hellroaring Project would increase USFS yearlong closed roads to 14 miles, increasing all roads in the Analysis Area by 2 percent. Approximately three miles of temporary roads would be constructed by the Taylor Hellroaring Project.

System and user-created trails occur across the Wildlife Analysis Area, with far fewer in the higher elevations. Many of these miles pass through old growth habitats and near snag and downed wood used by wildlife.

Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on old-growth and dead-wood associated wildlife while increasing tree growth and diversity of plant species.

Other cumulative effects on wildlife using old growth and snag and downed wood habitats are varied, but they do not differ by alternative. Probably due to trapping, lynx were extremely scarce in the first half of the last century in Montana, with specimen records restricted to two western counties. The lynx trapping season is currently closed in Montana. The Taylor Hellroaring Wildlife Analysis Area is part of MDFWP's Region 1, which now has an annual trapping quota of two fishers. Recreation and other permitted activities include hunting, trapping, hiking, fishing, boating, river floating, camping, snowmobiling, dog sledding, cross-country skiing, horseback riding, motorized trail and road use, bicycling, gathering of forest products, and maintenance and use of communication towers and other utilities. All of these can disturb or displace wildlife, as can work on roads and road decommissioning. Human settlement occurs in and around the town of Whitefish and on many of the private land holdings, and subdivision continues to increase, which can cause a direct loss of these habitats and indirect effects on wildlife from dogs and cats left at large. A variety of research and monitoring efforts are likely to continue to occur with little or no effect on species that use old growth or snag and downed wood habitats.

For more information about many of the past, present, and reasonably foreseeable actions described above, see the *Introduction* to Chapter 3 of this document and *Project File Exhibits Q-8 and Rd-12*. Other past, present, and reasonably foreseeable actions and activities would have minor or negligible effects on old growth habitat and old growth associated species and snags and downed wood habitat (*Project File Exhibits Q-8 and Rd-12*). For more information, see the *Sensitive Wildlife Species; Threatened Wildlife Species; Forest Vegetation; Aquatics; Fire, Fuels, and Air Quality; and Soil* sections in this chapter.

Regulatory Framework and Consistency

The Forest Service is required by the National Forest Management Act (NFMA) to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives,” 16 USC 1604(g)(3)(B). To implement NFMA, the Forest Service’s regulations, implemented on April 21, 2008, state that “the overall goal of the ecological element of sustainability is to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in the plan area.” All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability. A **goal** under the Forest Plan, as directed in Amendment 21 (USDA Forest Service 1999a), is to “ensure that Forest Service actions do not contribute to the loss of viability of native species.”

Forest Plan Amendment 21 named all sensitive wildlife species as Management Indicator Species, several of which represent the spectrum of old growth and snag and downed wood habitats on the Flathead National Forest (*Project File Exhibits Q-4 and Rg-2*). These are the bald eagle, flammulated owl, boreal owl, black-backed woodpecker, fisher, wolverine, Townsend's Big-Eared Bat, and Canada lynx. Conditions favorable to these species would generally also benefit other old-growth and dead-wood associated species found within the Taylor Hellroaring Wildlife Analysis Area, such as brown creepers, Townsend’s warblers, winter wrens, and northern flying squirrels, all of which are considered under the umbrella of MIS evaluation.

Standards given in Amendment 21 include managing for wildlife dependent on old growth by protecting old growth forest consistent with the Vegetation Standard Section H6. Vegetation management within old growth shall be limited to actions necessary to: 1) “maintain or restore old

growth composition and structure consistent with native succession and disturbance regimes” or to 2) “reduce risks to sustaining old growth composition and structure.” Vegetation Standard Section H6 also states that “Road construction associated with vegetation management actions shall avoid or minimize impacts to old growth to the extent feasible.” Implementation of all alternatives would be consistent with the standards in the Forest Plan related to old growth management (*Project File Exhibit Q-10*).

Amendment 21 has objectives to “manage landscapes to attain the 75 percent range around the median amount of old growth that occurred historically,” “maintain ecological processes and provide for natural patch size distribution,” and to “manage landscape patterns to develop larger old growth patch sizes where needed to satisfy wildlife habitat requirements (*Project File Exhibit Q-10*).” Sufficient mid-seral/structural stage stands are to be maintained to allow for recruitment of old growth within the historical range of variability, emphasizing old growth development “in stands that are most likely to persist under native disturbance regimes, and that provide a patch size and pattern most advantageous to old growth associated wildlife species.” Across the landscape, “sufficient retention of forest structure (large diameter live trees, snags, and coarse woody debris)” should be left to provide for future wildlife movement through the matrix surrounding old growth forests. Alternative 1 would not reduce risk of loss of old growth stands from future wildland fire or insect outbreak. Alternatives 2 and 3 would have regeneration harvest in mature late-seral forests that appear to be progressing towards old growth habitat (*Project File Exhibit Q-7*), as well as creating new abrupt edge along old growth habitat (*Project File Exhibit Q-12*). The Analysis Area is within the 75 percent range around the historic range of variability for old growth habitat and would remain so under any action alternative (*Project File Exhibit Q-9*).

An analysis of vegetation composition, structure, and landscape pattern on the FNF (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2012, monitoring item #68) reported on changes in vegetation since the Amendment 21 analysis in 1999 (*Project File Exhibit Rg-8*). During this time, approximately 0.9 percent of the Flathead National Forest was changed from a mid- or late-seral condition to an early-seral condition due to regeneration harvest and 0.8 percent of the Forest had undergone fuels treatment. Late-seral habitat would continue to provide for future old growth recruitment.

Direction specific to snag and downed wood habitat is also provided by the Forest Plan’s Amendment 21. Sufficient vegetation structure is to be retained, including large diameter trees, in timber harvest areas other than personal-use firewood permits. To comply with Amendment 21, the retention amount must be consistent with native disturbance and succession regimes and provide for long-term snag and coarse woody debris recruitment, essential soil processes, species habitat (including feeding and dispersal habitat for small mammals and birds), and long-term structural diversity of forest stands. In the absence of a site-specific landscape analysis to derive retention levels for this standard, minimum retention levels apply beyond 200 feet from roads open to the public. These are as shown in Table 3-86, and include a requirement for five live replacement trees over 12 inches DBH for each snag over 20 inches DBH. If existing snag densities are below the following densities, live trees are to be retained as future snags where possible. Although the minimum diameters are not always present in a given stand, these would be retained to meet or exceed the intent of the Forest Plan under all alternatives wherever they exist (*Project File Exhibits Q-10 and Rd-5*). Implementation monitoring for these standards is provided in *Project File Exhibits Rd-10 and Rg-8*.

Table 3-86. Forest Plan Amendment 21 Snag and Downed Wood Standards.

Potential Vegetation Group	Snags per acre		Live Replacement trees >12" DBH	Pieces of downed wood >6 feet long/acre	
	12-20" DBH	20+" DBH		9-20" diameter	20+" diameter
Dry	2	1	5	15	10
Moist	6	2	10	32	15
Cold	6	1	5	30	15

All alternatives would comply with standards in the Flathead LRMP for general nongame wildlife and snag and downed wood habitat, as described in *Chapter 2* under Features Common to Action Alternatives (*Project File Exhibits Rd-3 and Rd-5*). In addition, relatively few large live trees would be harvested, as the Taylor Hellroaring Project emphasizes retention of the largest trees and removal of the understory and/or mid-story trees. Unharvested live trees would be available to provide a fairly uniform distribution of future snags. Site-preparation prescriptions would be designed to maintain as much of the larger downed material as possible and practicable, given other resource objectives such as fire hazard reduction and reforestation. Trees retained after harvest would provide recruitment of future downed wood.

This page intentionally left blank.

Commonly Hunted Big Game

Introduction

The three most common ungulates (white-tailed deer, mule deer, and elk) are used as Management Indicator Species (MIS) for the commonly hunted big game species. At the forest level, meeting these species' habitat needs indicates that the needs of species such as black bear, moose, and mountain lion will also be met. Their basic habitat needs of cover, forage, and security are similar and may be altered by human actions in similar ways (Joslin and Youmans 1999; Witmer, et al. 1998).

Timber harvest and fire typically alter the amount and distribution of hiding cover, thermal cover, and forage as well as habitat security. These disturbances create temporary foraging areas with associated increases in diversity and edge, which typically allow for proliferation of big game species. In northwest Montana, the extent that large animals will make use of a natural or man-made opening depends on an animal's experience, seasonal forage quality, proximity of security cover, presence of roads, and pressure by predators, and intensity of human use. Openings can decrease ungulates' ability to travel within their home ranges, as well as making them more vulnerable to predation and hunting. When sufficient downed woody material, understory trees, and wind-firm live trees and snags are retained, timber harvest and fuel reduction actions can maintain adequate hiding cover values. Research indicates that white-tailed deer in open forage areas prefer to have hiding cover within approximately 165 feet, and elk approximately 500 feet (Thomas and Toweill 1982). See *Project File Exhibit Rb-3* for a discussion of the definition and measurement of cover.

During hunting season, elk appear to require contiguous, nonlinear hiding cover patches over 250 acres in size, and more than one-half mile from open roads (Hillis, et al. 1991) in order for the elk population to provide continued hunter opportunity and a diverse bull age structure (Youmans 1991). It has been recommended that for a stable or increasing population, and for opportunities to maintain or harvest large bull elk, at least 30 percent of an elk herd unit should be in hunting season security areas (Hillis, et al. 1991). Vehicle traffic on forest roads evokes an "avoidance response" by elk that can be used to estimate Elk Habitat Effectiveness through densities of roads open to public motorized use (Lyon 1983). Christiansen, et al. (1993) suggest that in Forest-level planning "all forms of motorized vehicles and all uses, including administrative use" should also be recognized.

Information Sources

Data used in this analysis included wildlife monitoring and observations (*Project File Exhibit Rb-2*); aerial imagery; stand exams (FSVeg database); the FACTS activity tracking database; the R1 Vegetation Map; and GIS coverages and data sets for features such as riparian areas, general forest attributes, habitat types, past timber harvest and fires, and road locations. For more information, see *Project File Exhibit Rb* section, *Project File Exhibit Rg-9*, and the *Forest Vegetation* section of this chapter. Aerial photographs and other assumptions for cover status were verified via field visits. Winter habitat use by ungulates is based on mapping conducted by the Montana Department of Fish, Wildlife and Parks (MDFWP) (*Project File Exhibit Rb-8*). Hunting season security/vulnerability values were derived through GIS procedures that detected areas of continuous cover further than one-half mile from open roads and motorized trails (*Project File Exhibit Rb-1*). Effects on connectivity cover are in *Project File Exhibit Rg-7*.

Analysis Area

The analysis area for commonly hunted big game is the Taylor Hellroaring Wildlife Analysis Area (Figure 3-9, in the *Wildlife Introduction* chapter). At approximately 45.6 square miles (about 29,000

acres), it is large enough to include the home range of big game species and to represent the effects of wildland fire, natural tree mortality, timber harvest, prescribed fire, fuel reduction, firewood cutting, and recreation across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of big game and the species under their MIS “umbrella,” but small enough to not obscure the effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect these species are contained within this area. No known or suspected population sinks for these species occur in or near the area. Past actions and current conditions beyond this area that could affect wildlife in the analysis area were considered, such as open roads and motorized trails that could have affected elk hunting season security areas (*Project File Exhibit Rb-1*). For this project, the analysis of effects on big-game habitat for cover and security/vulnerability span 100 years, at which time areas regenerated by this project are likely to regain thermal cover value. An additional assessment was also conducted to address population diversity concerns at the Forest scale (*Project File Exhibit Rg-1*).

Affected Environment

Population Status

Throughout the area, white-tailed deer use is extensive due to the intact riparian cover, stands of conifer trees, and the abundance of available forage in past timber harvest units and in meadows (*Project File Exhibits Rb-3 and Rr-1*). Elk and mule deer that use the analysis area are relatively common and their populations appear to be stable. Moose use of the area is also relatively extensive, and many riparian sites in the analysis area support vegetative types preferred by moose (*Project File Exhibit Rr-3*). Mountain lion and black bear are also frequently reported. At a broader scale, the State of Montana manages big game species to provide a surplus of animals that can sustain harvest by hunters. For population information for big game and other species under their MIS umbrella, see *Project File Exhibit Rb-2*.

Habitat

The Taylor Hellroaring Wildlife Analysis Area provides year round habitat for elk, mule deer, white-tailed deer, moose, mountain lions, and black bears. Nearly 3,500 acres (5.5 square miles) of the lower elevations north and east of Whitefish Lake are mapped as winter habitat for elk, mule deer, and white-tailed deer (*Project File Exhibit Rb-8*). Nearly the entire Taylor Hellroaring Wildlife Analysis Area provides summer habitat for elk and deer and year-round habitat for moose. No part of the Analysis Area was designated as an ungulate winter range Management Area for the Forest Plan (USDA Forest Service 1986, *Project File Exhibit Rb-8*).

Over 88 percent of the Taylor Hellroaring Wildlife Analysis Area currently functions as hiding cover and/or thermal cover and both are well distributed and connected across the analysis area (*Project File Exhibit Rb-3*). About 20% of the area is open and more likely to provide forage for ungulates. Less than 700 acres appear to support elk foods but are over 500 feet from hiding cover and are thus less likely to be used by elk; nearly 2,800 acres of forage are over 165 feet from cover and thus less likely to be used by white-tailed deer (*Project File Exhibit Rb-3*). This unavailable forage is about 47 percent of the forage potentially available for deer, and 12 percent of forage potentially available for elk. Although most open areas average 23 acres, two irregularly shaped but continuous open patches exceed 1,000 acres (*Project File Exhibit Rb-3*).

The road mileages and densities on lands administered by the Forest Service in the Taylor Hellroaring Wildlife Analysis Area are shown in Table 3-87. According to Lyon 1983, this indicates a Habitat Effectiveness level for elk of 60 percent or higher, a level deemed appropriate for “areas where elk are one of the primary resource considerations” (*Project File Exhibit Rb-9* and Christiansen, et al.

1993). Road restrictions across the Taylor Hellroaring Wildlife Analysis Area are generally effective (*Project File Exhibit Rg-6*). See the *Snags and Downed Wood Habitat* section of this chapter and *Project File Exhibit Rg-5* for road miles and densities on other ownerships.

Table 3-87. Open Road Densities Across Forest Service Lands (*Project File Exhibits Rb-9 and Rg-5*).

	Open Roads in Summer (USFS Only)	Open Roads Fall through Spring (USFS Only; Includes big game hunting season)
Moist sites and associated habitats	0.64 miles/square mile	0.27 miles/square mile
Taylor Hellroaring Wildlife Analysis Area	0.97 miles/square mile	0.42 miles/square mile

The Taylor Hellroaring Wildlife Analysis Area contains all or parts of four elk hunting season security areas (*Project File Exhibit Rb-1*) which are defined as at least 250 acres of contiguous nonlinear cover, all farther than one-half mile from a road or trail that is open to motorized use. The security areas are well distributed across the analysis area. Hillis, et al. (1991) recommended that at least 30 percent of an elk herd's area should provide hunting season security area for elk. The existing security areas currently make up 17 percent of the analysis area.

Moist sites are also an important characteristic of elk habitat. About 187 acres of seeps and springs appear to meet the definition of "elk moist sites" as defined by the Forest Plan and Lyon, et al. (1985) and over 10,000 acres support moist habitats associated with these types of sites (*Project File Exhibits Rr-3 and Rb-7*). These areas are well distributed across the Taylor Hellroaring Wildlife Analysis Area except for the lower-elevation front-country areas near Whitefish Lakes. Some of them are more remote, upper-drainage perched sites, which provide the best habitat. Approximately 80 percent of the Taylor Hellroaring Wildlife Analysis Area is within one-quarter mile of water (*Project File Exhibit Rr-1*). Road densities associated with these sites are shown in Table 3-89 above.

Environmental Consequences

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, fuel reduction, burning, or road or trail construction, are proposed with this alternative. Selection of this alternative would allow ungulate habitat across the Taylor Hellroaring Wildlife Analysis Area to continue with relatively natural processes. If no further timber harvest or wildland fire occurs over the next five years, over 88 percent of the area would continue to function as hiding cover and the availability of high-quality grazing and browse forage would decrease slightly. Motorized access would remain as is and the elk security areas would retain their current levels of effectiveness. The probability of intense wildland fire would continue to increase in some areas as dead trees fall and new understory growth contributes fine fuels. Such a fire could result in the loss of extensive areas of cover. See the Cumulative Effects section below for more information, including public access and elk security areas.

Direct and Indirect Effects of Alternatives 2 and 3

Table 3-88 displays the amounts of hiding and thermal cover that would be removed or altered by timber harvest, fuel treatment, and burning. Slash levels would not impede ungulate movement. An uncut buffer would be left around all riparian areas. Both action alternatives propose to retain most of the large wind-firm trees and snags in all units and some of the smaller trees, which would help provide cover over time. As big game animals are common in the area, some disturbance and

displacement is likely to occur. Overall, there could be an effect on ungulate species' movements or habitat use patterns, but no appreciable change would be expected in ungulate population numbers or their availability to hunters, predators, or carrion eaters due to management actions.

Table 3-88. Vegetation Treatment that Would Temporarily Negate Cover Values for Large Mammals or Reduce the Effectiveness of Cover Values for Large Mammals (*Project File Exhibit Rb-3*).

Alt.	Acres of Cover Removed		Acres of Hiding/Thermal Cover Altered
	Hiding Cover	Hiding/Thermal Cover	
1	0 ac	0 ac	0 ac
2 and 3	31 ac	474 ac	1,242 ac

Most of the regeneration treatments would be expected to stimulate grasses and shrubs but 209 acres of this would be over 165 feet from cover and thus less likely to be used by deer. Similarly, 26 acres of this new forage would be over 500 feet from cover and unlikely to be used by elk (*Project File Exhibit Rb-3*). Regeneration harvest in both action alternatives would affect forested connections, although longer alternate routes would persist. See the *Old Growth, Snags, and Downed Wood Wildlife Habitat* section of this chapter above for more information and see maps and details in *Project File Exhibit Rg-7*.

Three vegetation management units would be in mapped winter range for elk, mule deer, and white-tailed deer, temporarily reducing these areas' value as winter habitat. These are 18 acres in Unit 101 (understory fuel reduction) and 52 acres in Units 44 and 48 (commercial thinning), none of which would occur during winter. All other proposed units and activities could occur in winter and may displace wintering moose. No public motorized access would be allowed on any roads constructed for this project, and they would not facilitate access for over-snow vehicle use.

In Alternatives 2 and 3, four commercial timber harvest units (Units 4, 6, 30, and 34), one understory fuel reduction unit (Unit 38), and two burn areas (Units B1 and B2) would occur near areas that appear to be "elk moist sites", but only Unit B1 would be near remote areas suspected to function as wallows. In both action alternatives, road construction (Roads E1, E2, and N2) would occur near three of these sites. All of this would be near a road that is currently open to public motorized use yearlong and all would be system roads that would be left in reclaimed condition. Because of the cool and moist nature of this landscape, approximately half of the vegetation management and road construction would overlap with the 10,470 acres of cool moist or cool wet riparian habitat types. See *Project File Exhibit Rb-7* for more information.

Both action alternatives would cause short-term displacement of deer and elk during vegetation management and road construction activities as animals avoid areas of high human activity, including administrative use (Christiansen, et al. 1993; Lyon, et al. 1985). All public road closures would remain in effect during and after management operations and the transport of hunters or game would be prohibited by timber, road building, or other contract workers while working on or off all roads closed to motorized vehicle use by the general public.

The extent of areas that fit the definition of hunting season elk security (Hillis, et al. 1991) would not be affected by the project, as no regeneration treatment would occur in elk security area and no road access changes are proposed (*Project File Exhibit Rb-1*). The security area in the Hellroaring/Smith drainages would be less effective due to anticipated non-motorized but heavy use of the trails constructed in Alternatives 2 and 3. In Alternative 2, approximately 4.3 miles of trail construction would be in this security area (Trails 2, 3, 4, 5, C2, L3, and L4). Alternative 3 would construct the same trail segments except form Trail 2, with a total of 4.0 miles.

Trail construction effects would be both short and long term. Wildlife could be disturbed or displaced from the proposed 40 miles of trails in Alternative 2 and the proposed 26 in Alternative 3. In both alternatives, Trails 3, 4, and L7 would pass through “elk moist sites”, including remote areas suspected to function as wallows. Alternative 2 would construct substantially more trails near moist sites, including Trails C4, L8, L9, and M3 (*Project File Exhibit Rb-7*). From 1.6 (Alternative 3) to 2.5 (Alternative 2) miles of new trail would be constructed in mapped ungulate winter range (*Project File Exhibit Rb-8*).

Possible shrub slashing, tree and shrub planting, and seeding of bare areas would enhance big game forage and hiding cover values. Other activities, such as culvert replacement, BMP roadwork, and the parking area upgrade, parking pullouts, and designation of new trails on road templates, would not have measurable effects on ungulates in the Taylor Hellroaring Wildlife Analysis Area.

Cumulative Effects

Past wildland fires and timber harvest on national forest, state, and private lands across the Taylor Hellroaring Wildlife Analysis Area have resulted in a complex matrix of forested interior habitat, edge, and openings in various stages of succession. Past timber harvest and fires converted a considerable amount of the hiding and thermal cover into seedling and sapling stands important for forage, although most of these areas have progressed to hiding cover. Other timber clearing for ski runs, utility corridors, livestock pasture, and a variety of smaller developed sites have also reduced hiding cover. Wildland fire suppression has also been largely beneficial to ungulates in this area, as it helps maintain dense cover in a network of foraging habitat existing in natural openings or created by timber harvest. The cumulative effects of these factors on cover values are shown in Table 3-89.

Table 3-89. Cover Remaining Across the Taylor Hellroaring Wildlife Analysis Area after Regeneration Harvest, and Cover with Altered Effectiveness (*Project File Exhibit Rb-3*).

Alt.	% Cover Remaining Across Analysis Area			% Altered Across Analysis Area
	Hiding Cover	Hiding/Thermal Cover	Total Cover	
1	11.8%	68.0%	79.8%	0%
2 and 3	15.9%	62.2%	78.1%	4.3%

Despite the increase in open areas from Alternative 2 and 3 regeneration harvest and burning, some areas would be unavailable to deer and elk (Table 3-90, *Project File Exhibit Rb-8*). This is a result of the distance to cover, as a cumulative effect of this project with past timber harvest, wildfire, and other disturbances. One regeneration unit in Alternatives 2 and 3 would reduce available forage in a recently harvested area on DNRC land (*Project File Exhibit Rb-3*). Past events have affected forested connections, as discussed in the *Old Growth, Snags, and Downed Wood Wildlife Habitat* section of this chapter and detailed in *Project File Exhibit Rg-7*. The two largest openings in the analysis area were due to development near Whitefish Lake and the 2001 Werner Fire.

Table 3-90. Forage Across the Taylor Hellroaring Wildlife Analysis Area Unavailable to Elk and Deer after Vegetation Treatments (*Project File Exhibit Rb-3*).

Alt.	White-tailed Deer (available forage is < 165 feet from cover)		Elk (available forage is < 500 feet from cover)	
	Acres	% of potential forage	Acres	% of potential forage
1	2,767 acres	46.9%	692 acres	11.7%
2 and 3	2,993 acres	50.8%	729 acres	12.4%

Past, present, and future precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, noxious weed control, and tree insects and disease had little or no long-term effects on big game while increasing tree growth and diversity of plant species available for cover and forage.

Numerous recreational opportunities across the Taylor Hellroaring Wildlife Analysis Area, particularly motorized trail and road use, snowmobiling, hiking, cross-country skiing, and bicycling, can cause displacement of big game species. The trail construction and other recreation upgrades in this project would cumulatively to these effects. Miles of system and user-created trails occur across the Analysis Area, with far fewer in the higher elevations. Big game hunting takes a portion of the ungulate population every year (*Project File Exhibit Rb-2*), as do road collisions and predation. Human population and access are dramatically increased over historical conditions. Development of private land has permanently altered habitats and displaced deer and elk from prime areas near Whitefish Lake. Dogs that run free may kill many deer directly or cause deer to waste their energy reserves (Sime 1999).

There are currently approximately 35 miles of road under USFS jurisdiction within the Taylor Hellroaring Wildlife Analysis Area; of which 12 miles are open year-long, 13 miles are open seasonally, and 10 miles are closed yearlong (*Project File Exhibit Rg-5*). According to Lyon 1983, this indicates a Habitat Effectiveness level for elk of 60% or higher (*Project File Exhibit Rb-9*), a level deemed appropriate for “areas where elk are one of the primary resource considerations” (Christiansen, et al. 1993). Records show that there are also approximately 128 miles of non-Forest Service road within the analysis area. Overall, roads have resulted in vehicle-caused mortality of ungulates, and increased access for hunting. Neither the Taylor Hellroaring Project nor the Whitefish Watershed Municipal Project would increase public motorized travel routes. Although it would be limited by the locations of open roads and natural permanent openings, the available elk hunting season security area is expected to increase over the next 15 to 30 years, as most of the harvested stands would have regrown hiding cover (*Project File Exhibit Rb-3*).

Other cumulative effects on commonly hunted big game are varied, but they do not differ by alternative. A reasonably foreseeable action would be measures to control tansy ragwort and other weed species, which would have positive effects on ungulates by improving forage availability. On private land, grazing and fencing has reduced forage and altered movement patterns. Predator control in the early part of the last century reduced or negated the selective pressures provided by predators. Beaver control reduced the amount of wetland habitat that white-tailed deer and elk often prefer. A variety of research and monitoring efforts are likely to continue to occur with little or no effect on species that use these habitats.

These species’ affected environment described above has been shaped by past and present cumulative effects. Past, ongoing, and planned timber harvest and further cumulative effects relevant to big game species are discussed in sections on *Neotropical Migratory Birds and Riparian Habitat* and *Old Growth, Snags, and Downed Wood Wildlife Habitat* in this chapter, and in *Project File Exhibit Rb-6*. These effects would be cumulative to those discussed above for each alternative. Other past, present, and reasonably foreseeable actions and activities would have minor or negligible effects on big game or other species under their MIS umbrella.

Regulatory Framework and Consistency

All alternatives are consistent with NFMA biodiversity requirements for wildlife, as described in the *Old Growth, Snags, and Downed Wood Wildlife Habitat* section of this chapter. The analysis for Forest Plan Amendment 21 assessed the forest-level viability of elk, white-tailed deer, and mule deer (USDA Forest Service 1999a). Regardless of scale, species viability is not a concern for elk or deer. These

species are habitat generalists, and all indications are that healthy populations are well distributed across the western states, Montana, and the Flathead National Forest. In Montana and on the Flathead National Forest, this is evidenced by the hunting seasons administered by the MDFWP. In northwest Montana, the rapid recovery of the gray wolf is also evidence of substantial ungulate populations, which comprise their primary food source. See Project File Exhibit Rg-1, a multi-scale evaluation of NFMA requirements to provide a diversity of plant and animal communities on the Flathead National Forest, for more information.

Flathead National Forest Plan, Amendment 21, establishes a Forest-wide goal to “provide appropriate habitat and access to maintain desired hunting, fishing, and viewing opportunities, in coordination with the Montana Department of Fish, Wildlife, and Parks.” The Forest Plan has identified white-tailed deer, elk, and mule deer as Commonly Hunted Big Game Management Indicator Species (MIS) that use general forest habitat. Conditions favorable to these species would generally also benefit other big game species, such as moose, black bear, and mountain lion, which are considered under the umbrella of Forest-level MIS evaluation.

The MDFWP includes habitat goal recommendations in their big game management plans, specifically the Montana Statewide Elk Management Plan (MDFWP 2004). The state elk plan calls for an increase in elk populations in the Whitefish Elk Management Unit, which includes the Taylor Hellroaring Wildlife Analysis Area, with an emphasis on maintaining a diverse bull age structure. As stated in the 2010 Statewide Elk Status Report (*Project File Exhibit Rb-2*), elk populations in Hunting District 110 of the Whitefish Elk EMU are 0 to 10% below “objective range”. The Habitat Management Strategies for this area emphasize the need for consideration of elk security and hunter access in planning activities (MDFWP 2004; *Project File Exhibit Rb-4*). All alternatives fully meet these objectives. The Forest Plan Amendment 21 objective to provide sufficient habitat to contribute toward meeting the objectives of MDFWP’s management plans is met by both action alternatives.

Moist sites are also identified as an important characteristic of elk habitat and management considerations have been outlined in the Forest Plan (pages II-22 and 23). This direction is met by all alternatives (See *Project File Exhibit Rb-1* for more information):

- Management in moist sites would continue to be consistent with habitat type/moist site recommendations (*Project File Exhibit Rr-3*).
- Motorized access would not be increased near any elk moist site.
- Open road densities near moist sites would be consistent with the Forest Plan.
- The alternatives would not change the relationship between these moist sites and elk security areas (*Project File Exhibit Rb-1*).
- Slash would not impede elk movement in or near moist sites.
- As shown in the *Threatened and Proposed Wildlife* section in this chapter, all alternatives would meet all Forest Plan direction for motorized road access. In addition, design features for this project (*Chapter 2*) that keep new roads closed to public motorized use and prohibit transport of hunters, firearms, or game are consistent with other recommendations adopted by the Flathead Forest Plan.

This page intentionally left blank.

Neotropical Migratory Birds and Riparian Habitat

Introduction

Neotropical migratory birds regularly summer in North America and winter south of the Tropic of Cancer. Population declines in some of these species may be due to loss, modification, and fragmentation of breeding habitat; loss of wintering and migratory habitat; and brood parasitism (Montana Partners in Flight 2000). *Project File Exhibit Rn-2* lists the 73 species of Neotropical migratory birds on the Flathead National Forest. Two of these are Management Indicator Species, the flammulated owl and the peregrine falcon. Six are old-growth associates, at least 13 are associated with snags or downed wood, and 43 are associated with riparian habitats. In western Montana forests, two especially important habitats to nesting birds are: 1) “riparian habitat, because of the availability of water and the variety of plant communities, and 2) old growth habitat, which has the highest density and diversity of birds nesting in tree cavities. Snags, broken-topped live trees, downed logs, and other woody material required by a wide variety of these bird species for nesting, roosting, perching, feeding, and cover are often abundant in old growth habitat” (McClelland and Schmidt 1995).

Riparian habitats occur along lakes, rivers, streams, springs, and seeps where the vegetation and microclimate are influenced by year-round or seasonal water and associated high water tables. Most plant and animal species in riparian habitat are more productive and diverse than on nearby uplands, making these areas very important to many wildlife species. On the Flathead National Forest, 36 bird, four mammal, three reptile, and two amphibian species are recognized as dependent upon riparian marsh habitat; 23 bird, seven mammal, and four amphibian species are recognized as dependent upon forested riparian areas (Forest Plan, Planning record 219.12[g], 1980). These include threatened and sensitive species (bald eagle, harlequin duck, common loon, western toad, northern leopard frog) and some Neotropical migrants.

Timber harvest, fuel reduction, insect epidemics, and wildland fire can impact wildlife using riparian habitats, including changes in plant species, hiding cover, downed wood recruitment, water temperature, shading, humidity, erosion, water quality, and predator-prey interactions. Bird populations that breed in the western United States appear to be affected by forest fragmentation in breeding habitat (Rotenberry, et al. 1995; Hejl, et al. 1995; Turcotte and Desrochers 2003). Problems associated with forest fragmentation include overall habitat loss, increase in high-contrast edge habitat and edge effects, isolation effects, and increased vulnerability to predators (Finch 1991; Turcotte and Desrochers 2003). Moreover, brown-headed cowbirds benefit from forest fragmentation, particularly where livestock graze within about five miles (Rotenberry, et al. 1995), and cowbirds may have a negative impact on many Neotropical migratory birds, at least in the eastern United States (Tewksbury, et al. 1998). However, when sufficient downed woody material, residual understory trees, and wind-firm live trees and snags are available, adequate habitat values can be maintained after timber harvest (Vanderwel, et al. 2007).

Information Sources

The effects on Neotropical migrants are discussed by using analyses presented in the sections on *Old Growth, Snags and Downed Wood, Aquatics*. Riparian habitats were assessed primarily by way of the Riparian Landtype Polygon coverage in the Flathead GIS library (*Project File*

Exhibit Rr-3). The flammulated owl has a separate section under *Sensitive Wildlife Species*. Data on population trends, habitat relationships, and effects from past management activities for Neotropical migratory birds breeding in western Montana plus other observations and monitoring for riparian habitat wildlife species are in *Project File Exhibit Rr-4*.

Analysis Area

The evaluation of direct, indirect, and cumulative effects on Neotropical migratory birds and on riparian habitats was done for the same spatial and temporal extent as that for old growth associated species and their habitats, the Taylor Hellroaring Wildlife Analysis Area (Figure 3-9, in *Introduction*). All habitat attributes are distributed across this area, with some natural clumping of features like drier forests and large wetlands. It is also representative of wildland fire, natural tree mortality, timber harvest, prescribed fire, fuel reduction, firewood cutting, and recreation across the landscape. At approximately 45.6 square miles (about 29,000 acres), it is large enough to include the spring, summer, and fall range of numerous individuals of these migratory bird species as well as the home range of numerous wildlife species using riparian habitats. It is sufficiently large to evaluate the ability of the habitat to support populations of wildlife and plant species using riparian habitats, but small enough to not obscure effects of the alternatives. No known or suspected population sinks for these species occur in or near the area. For this project, the analysis of effects on Neotropical migrants and other species that use riparian habitat spans as far as 25 years, sufficient time for any effects to stabilize. An assessment at multiple scales was also conducted to address population diversity concerns (*Project File Exhibit Rg-1*).

Affected Environment

Population Status

The Flathead National Forest participated in the Region 1 Landbird Monitoring Program that includes: 1) standard point-count survey routes; 2) Monitoring of Avian Productivity and Survivorship (MAPS); and 3) single species habitat use and distribution surveys. The Avian Science Center at the University of Montana conducted habitat and distribution surveys for several individual species. The USFS Northern Region Songbird Monitoring Program (Hutto and Young 2002) provided data on population trends, habitat relationships, and effects from past management activities for birds breeding in western Montana. See Project File Exhibit Rn-1 for their results in and near the Taylor Hellroaring Wildlife Analysis Area.

The Institute for Bird Populations conducted MAPS surveys from 1992 to 2008. One hundred forty bird species were observed on the FNF during these surveys, representing a diversity of habitats. MAPS data showed that 10-year trends in productivity were generally stable, with 20 of 25 species showing no declines in productivity, two species showing increased productivity, and three species showing declines (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2012, Project File Exhibit Rg-8).

Several of the 24 migratory bird species of concern that are known or suspected to breed on the Flathead National Forest have been reported in or close to the Taylor Hellroaring Wildlife Analysis Area (Project File Project File Exhibits Rn-1 and Rn-2; Table 3-91). The other species use habitats that either does not occur in the analysis area or that would not be affected by the project (Project File Exhibits Rn-1 and Rn-2).

Table 3-91. Migratory Birds of Concern Known or Suspected to Occur in the Taylor Hellroaring Wildlife Analysis Area (Project File Exhibits Rg-4, Rn-1, and Rn-2).

Species *	Status and Habitat Association **	Reported in Analysis Area	Relative Abundance in Flathead Basin and Neighboring Areas
Cassin's Vireo	B	Yes	Common; numerous observations just outside the analysis area
Cordilleran Flycatcher	b; Rip	No	Occasional (potential habitat present but species unlikely in Analysis Area)
Flammulated Owl (SOC, Sens, MIS)	B; Sens; OG, DW, Grass	No (25 miles W and SW)	Occasional
Hammond's Flycatcher	B; OG	No (3 miles SW)	Common
Lazuli Bunting	B	No (4 miles NE)	Common (potential habitat present but species unlikely in Analysis Area)
Olive-sided Flycatcher	B; Rip, Grass	Yes	Uncommon
Red-eyed Vireo	b	No (10 miles SE)	Common
Red-naped Sapsucker	B; DW, Rip	No (2 miles S)	Common
Rufous Hummingbird (PSOC)	B; Grass	Yes	Common
Tennessee Warbler (PSOC)	b; Rip, Grass	No (4 miles SE)	Rare (potential habitat present but unlikely in Analysis Area)
Turkey Vulture	b; Grass	Yes	Uncommon
Vaux's Swift	B; OG, DW, Grass	No (5 miles NE)	Common
Veery (SOC)	b; Rip	No (6 miles SW)	Uncommon (potential habitat present but species unlikely in Analysis Area)
Williamson's Sapsucker	B; DW	No (6 miles SW)	Uncommon
Willow Flycatcher	B; Rip	No (9 miles SW)	Uncommon

* Species not in this table because there is no suitable habitat in the project area or because the species or its habitat would not be impacted by the project: Black Swift, Black-chinned Hummingbird, Bobolink, Brewer's Sparrow, Clay-colored Sparrow, Grasshopper Sparrow, Merlin, Peregrine Falcon, and Swainson's Hawk.

** Status and Habitat Association: B = Direct evidence of breeding; b = Indirect evidence of breeding; t = No evidence of breeding; Sens = Flathead National Forest Sensitive Species; OG = Old growth Associated Species; DW = Snag/Downed Wood Associated Species; Rip = Riparian Associated Species; Grass = Grassland Associated Species.

Of the 73 species of the migratory birds known or suspected to breed on the FNF, 49 have a Montana ranking of S5 ("Common, widespread, and abundant--although it may be rare in parts of its range...") or they did not warrant a ranking at all (MNHP 2014). Approximately 95 percent of the 73 species have a comparable global ranking of G5. Based on FNF management direction that applies to the habitats used by the 24 species that have some level of conservation concern, there appears to be little risk of population loss due to FNF actions. For more information, see *Project File Exhibits Rg-1, Rn-1, and Rn-2*.

Habitat

Overall, the Taylor Hellroaring Wildlife Analysis Area provides a considerable diversity of forested habitats, including old growth, snag and downed wood habitats, and a variety of riparian areas. The existing conditions of habitats important for migratory birds are described in the section of this chapter on *Old Growth, Snags, and Downed Wood Wildlife Habitat*. Additional information is provided for the flammulated owl in a separate part of the section on *Sensitive Wildlife Species*. Physical conditions of the streams, wet meadows, ponds, seeps, and springs are further described in the *Aquatics* portion of this chapter. For more information about wildlife habitat conditions across the Flathead National Forest relevant to Neotropical

migrants, see the Final Environmental Impact Statement for the Forest Plan's Amendment 21 (USDA 1999a) and Project File Exhibit Rg-1.

Riparian wildlife habitats in the analysis area appear to be functioning well, with numerous and well-distributed ponds, seeps, and streams providing a diversity of habitats (Table 3-94), *Project File Exhibit Rr-3*, Flathead National Forest 1995). Most of the birds listed as “riparian associated species” in Table 3-92 above use the dense shrubs and deciduous trees found in these habitats. The largest marshy area is along Hellroaring Creek and a tributary to Whitefish Lake northeast of Swift Creek.

Table 3-92. Riparian Habitats across the Taylor Hellroaring Wildlife Analysis Area (*Project File Exhibit Rr-3*).

Riparian Landtypes	Acres	% of Area
NL1E (Nearly level, poorly drained fine substrate, wetland in sedge/willow community)	37	0.1%
NL2A (Nearly level; gravel substrate; in subalpine-fir/spruce forest community along perennial stream)	72	0.3%
SL2A, SL3A, SL5A (Slightly sloping; undifferentiated, gravel, or boulder substrate; in subalpine-fir/spruce communities typically along perennial streams)	126	0.4%
MS3A, MS3B, MS4A, MS5A (Moderately steep; undifferentiated, boulder, or bedrock substrate; in subalpine-fir/spruce or grand fir/western red cedar communities typically along perennial streams) *	180	0.6%
VS4A, VS4G (Very steep; bedrock substrate; in subalpine-fir/spruce community along streams or snow avalanche chutes) *	25	0.1%
WL5A, WS5A (springs, seeps, wet depressions, and seasonal near-surface groundwater in subalpine-fir forest communities) *	221	0.7%
Total Across Analysis Area	661	2.3%

* These types are often not included in the Forest-wide GIS coverage but are typically discovered during field surveys and harvest unit layout. These acreages represent minimum amounts.

Over 80 percent of the Taylor Hellroaring Wildlife Analysis Area is within one-quarter mile of a stream, pond, or other riparian feature, which is a zone generally regarded as “key use” habitat for white-tailed deer (*Project File Exhibit Rr-1*). Forested connectivity cover is most persistent along riparian zones (*Project File Exhibits Rg-7 and Rr-3*).

Wildlife species reported to be using riparian habitats in the analysis area include river otter, moose, white-tailed deer, elk, black bear, coyote, bobcat, mountain lion, beaver, red-tailed chipmunk, bushy-tailed woodrat, meadow vole, deer mouse, western jumping mouse, yellow-pine chipmunk, hoary bat, little brown myotis, long-eared myotis, silver-haired bat, bald eagle, common loon, boreal owl, caspian tern, common gartersnake, western terrestrial gartersnake, long-toed salamander, western (boreal) toad, Pacific treefrog, and Columbia spotted frog (*Project File Exhibit Rr-4*).

Environmental Consequences

Additional information about the direct and indirect effects of the proposed activities on riparian habitats and on habitats important for migratory birds are described in the sections of this chapter on *Old Growth, Snags, and Downed Wood Wildlife Habitat* and *Aquatics*. Additional information is provided for the flammulated owl in a separate part of the section on *Sensitive Wildlife Species*.

Direct and Indirect Effects of Alternative 1 (No Action)

No actions, such as timber harvest, fuel reduction, burning, or road or trail construction, are proposed with this alternative. Overall, this alternative would leave riparian habitats and other areas important for Neotropical migratory birds across the analysis area to continue with relatively natural processes. Trees and snags would provide potential habitat for many species, and subsequently for secondary cavity nesters, including some Neotropical migrants. The probability of wildland fire would increase. However, the proposed BMP improvements on roads and culvert replacements would not occur, and fine sediments could continue to enter the creeks and wetlands at present levels. For more information about the effects of no action on wildlife that use riparian areas and snag and downed wood habitats, see the *Aquatics* and *Old Growth, Snags, and Downed Wood Wildlife Habitat* sections of this chapter. From *Aquatics*:

Direct and Indirect Effects of Alternatives 2 and 3

No harvest or ignition of prescribed fire would occur in Riparian Management Zones (RMZs) and all applicable BMPs will be implemented in harvest units and haul roads. In several instances in Alternatives 2 and 3, mapped vegetation management units would lie close to mapped riparian landtypes (*Project File Exhibit Rr-3*). Approximately 366 acres of vegetation management would occur within 0.1 mile of riparian habitats (Units 5, 6, 11, 12, 13, 14, 29, 38, 41, 50, 108, and B1). There would be no effects on the riparian features themselves, but nearby cover values would be affected and wildlife use of these areas could be temporarily altered. Forested riparian connectivity would not be severed or narrowed to 300 feet or less by any vegetation treatment (*Project File Exhibit Rg-7*) and connectivity between riparian and upland habitats would be maintained. Temporary and permanent road construction in Alternatives 2 and 3 could indirectly affect wildlife use of riparian habitats (Table 3-93). *Project File Exhibits Rg-3 and Rr-3* includes unit-and road-specific information. For more information, see the *Aquatics* section of this chapter.

Table 3-93. Alternatives 2 and 3 Road Construction and Mapped Riparian Habitats (Project File Exhibit Rr-3).

Road	Type of Road Construction (and miles within 0.1 mile of riparian habitats)	Comment
E3	Permanent road on existing template (0.13 miles)	Southern terminus would be about 50 feet from Trail Creek and would abut associated SL2A riparian landtype
N2	Permanent road on new template (0.13 miles)	Southern terminus would be 39 feet from Bear Creek
N4	Permanent road on new template (0.13 miles)	Northern terminus would be 150 feet from Trail Creek and about 70 feet from associated SL2A riparian landtype

SL2A = Slightly sloping, with coarse sand to cobble substrate, in subalpine-fir/spruce forest community.

In Alternatives 2 and 3, activities between May and August may have direct effects on nesting Neotropical migrants, as well as on other wildlife species that use riparian habitats. Noise from the various activities proposed during the breeding season may impact juvenile dispersal, cause premature displacement of young, or cause young to be prematurely abandoned. Some temporary displacement of Neotropical migrants and other wildlife species is likely to occur. Nest parasitism by cowbirds may increase in fuel reduction areas (Bull, et al. 1995) and adjacent to regenerated stands. There is a slight chance that some nests could be destroyed by springtime burning of hand piles in five precommercial thinning units (101, 102, 103, 104, and 105). The chance of these effects are reduced somewhat because most project activities would not occur from April 1st to June 30th, although acceptable activities during this period include prescribed burning, sale preparation, planting, and noxious weed spraying. Road treatments (including BMPs), slash burning, and pile burning may occur during the spring if along open or seasonal roads. In all season, timber harvest, prescribed burning including helicopter ignition, road construction, trail construction, culvert replacement, BMP roadwork, the parking area upgrade, and parking pullouts, and other actions could cause temporary disturbance to these species, with possible temporary displacement from the immediate area.

All trails would be constructed to minimize erosion and avoid natural water courses and sensitive riparian areas and plants to the greatest extent possible. However, as mapped, trail construction has potential for short-term negative and long-term positive effects on riparian habitat and its use by wildlife, particularly in Alternative 2. Nearly 1,500 feet of new trail construction in Alternative 2 would bisect eight separate riparian areas. Dropping or rerouting trails in Alternative 3 reduces this to two areas, totaling approximately 330 feet. Alternative 2 trail construction would cross perennial streams eight times while Alternative 3 trails would cross perennial streams twice. Trail construction, such as bridges or turnpikes, would have minor and localized direct effects on riparian habitats. The greater impact would be long-term disturbance or displacement of wildlife from important habitats through use of these new trails, primarily by hikers, bikers, and horseback riders.

BMP road improvements, dust abatement, culvert replacements, tree and shrub planting, and seeding would occur to similar extents in both action alternatives. Feeding and nesting sites for songbirds and other riparian-associated wildlife would be enhanced. Other aspects of the project would not have measurable effects on Neotropical migratory birds and other wildlife species using riparian habitats.

Cumulative Effects

Most of the cumulative effects relevant to migratory birds and riparian habitats (Project File Exhibits Rn-3 and Rr-2) are described in the sections of this chapter on *Old Growth Habitat*, *Snags and Downed Wood Habitat* and *Aquatics*. These include loss and alteration of habitat due to timber harvest; past fires; clearing vegetation for roads, utility lines, residential development, and agriculture; and access for firewood cutting and furbearer trapping. Saab and Rich (1997) list threats, species, and relevant habitats of concern for Neotropical migrants on the scale of the Columbia River Basin.

Road and trail construction and maintenance on all ownerships have converted or altered riparian habitats to varying levels and are expected to do so in the future. For example, some road construction has filled in, moved, or created riparian habitat. Most of the roads constructed and maintained on state and industrial timber lands meet BMPs and roadwork continues to improve surface drainage, stabilize slopes, and reduce erosion and stream sedimentation. Trail maintenance has primarily involved repair of drainage features and

clearing live and down vegetation. This road and trail maintenance often has short-term negative impacts on riparian wildlife, with long-term positive effects of improved water quality.

Several recreation activities such as fishing, camping, hunting, hiking, horseback riding, motorized trail use, and bicycling may impact riparian habitats or disturb or displace wildlife in riparian habitats. Recreational use in and near Whitefish Lake has altered shoreline habitats and continues to disturb wildlife. Driving on roads can cause some collision-related injuries or mortalities to wildlife, particularly in the denser-cover areas associated with riparian habitats.

Other cumulative effects on wildlife using riparian habitats are varied. Stream and lake habitats have been indirectly affected by a variety of efforts. Although avoidance maps are in effect, fire suppression activities may have affected wetlands or streams through chemical retardant or fire lines. On all ownerships, trapping of beavers and destruction of beaver dams has reduced the size of wetlands and other flooded areas. Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on riparian-associated wildlife and Neotropical migratory birds, while increasing tree growth and diversity of plant species used for cover, forage, and nest sites. Human settlement occurs on most of the private lands, and subdivision development continues to increase, which can cause considerable impacts on riparian habitat or indirect effects on wildlife from dogs left at large. Livestock and ungulate grazing on non-USFS lands has likely altered plant composition in some riparian areas and may have contributed some level of bank trampling or erosion. See the *Aquatics* sections of this chapter for cumulative effects of road and trail construction and maintenance. A variety of research and monitoring efforts are likely to continue to occur with little or no effect on species that use these habitats. See *Project File Exhibits Q-8, Rd-12, Rr-2, and Rs-9* for more information about cumulative effects relevant to Neotropical migratory birds and riparian habitats.

Regulatory Framework and Consistency

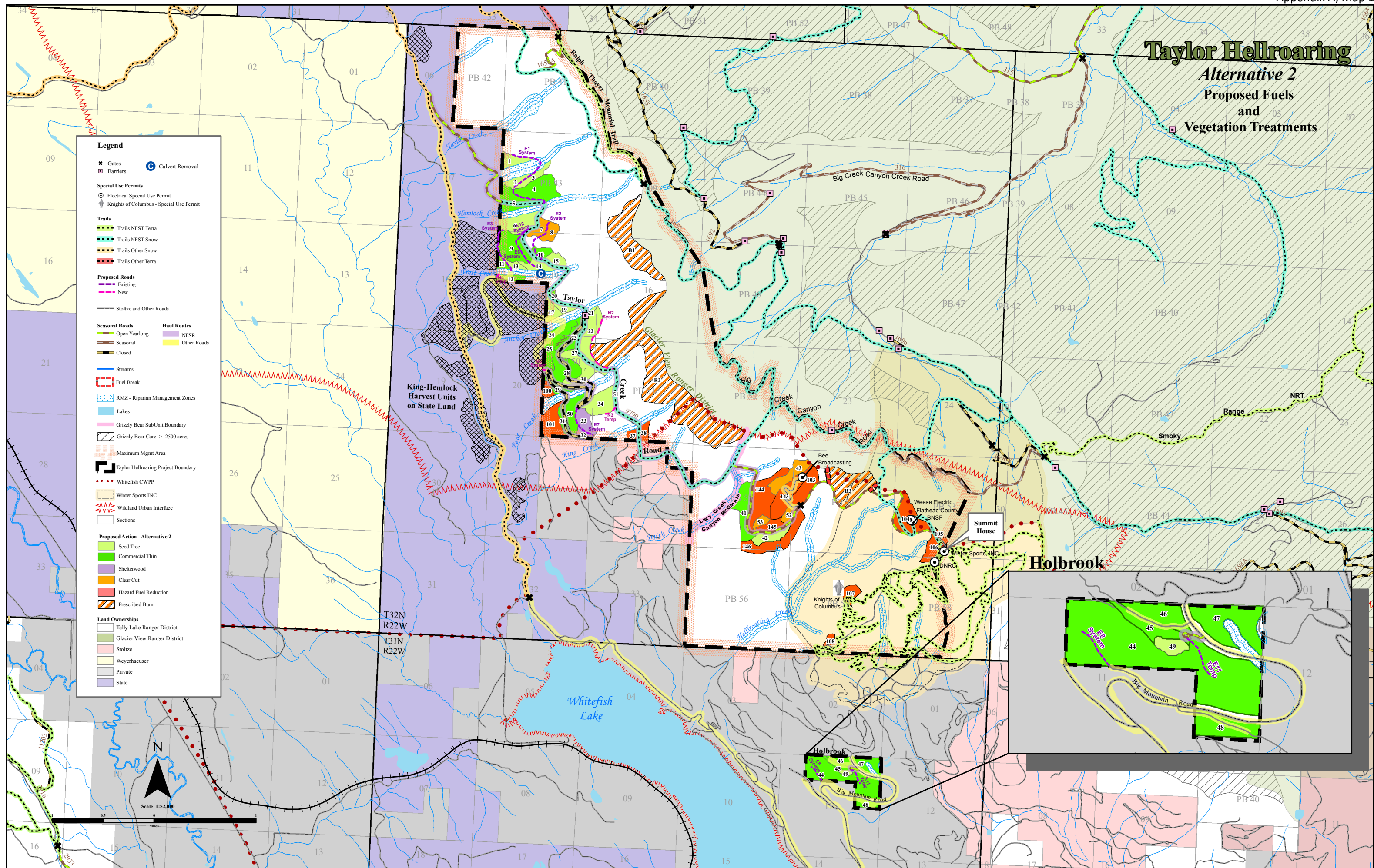
All alternatives are consistent with NFMA biodiversity requirements for wildlife (Project File Exhibit Rg-1), as described in the *Old Growth, Snags, and Downed Wood Wildlife Habitat* section of this chapter. For information about and consistency with INFISH requirements, the Forest Plan, and other regulatory requirements specific to aquatic systems, see the *Aquatics* section of this chapter and Project File section G.

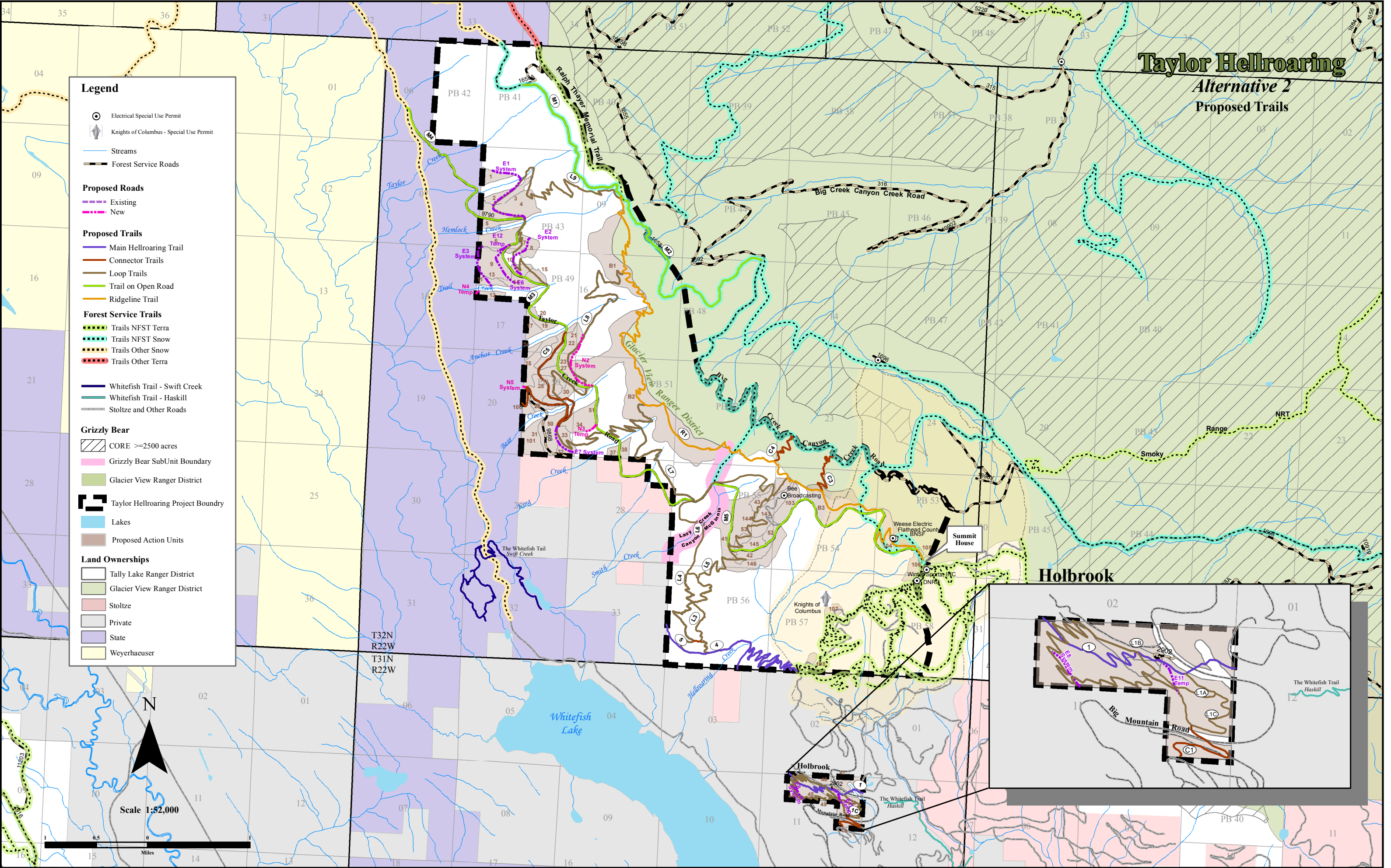
The Forest Service's Landbird Conservation Strategic Plan (2000), Executive Order 13186 (2001), the Partners in Flight Habitat Conservation Plans for birds, and the Partners in Flight North American Landbird Conservation Plan (Rich, et al. 2004) all reference goals and objectives for integrating bird conservation into forest management and planning. In 2008, a Memorandum of Understanding (MOU) was signed between the USDA Forest Service and the USDI Fish and Wildlife Service to promote the conservation of migratory birds. The intent was to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the Fish and Wildlife Service as well as other federal, state, tribal, and local governments. On the National Forests, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for land management activities. See *Project File Exhibit Rn-2* for more information.

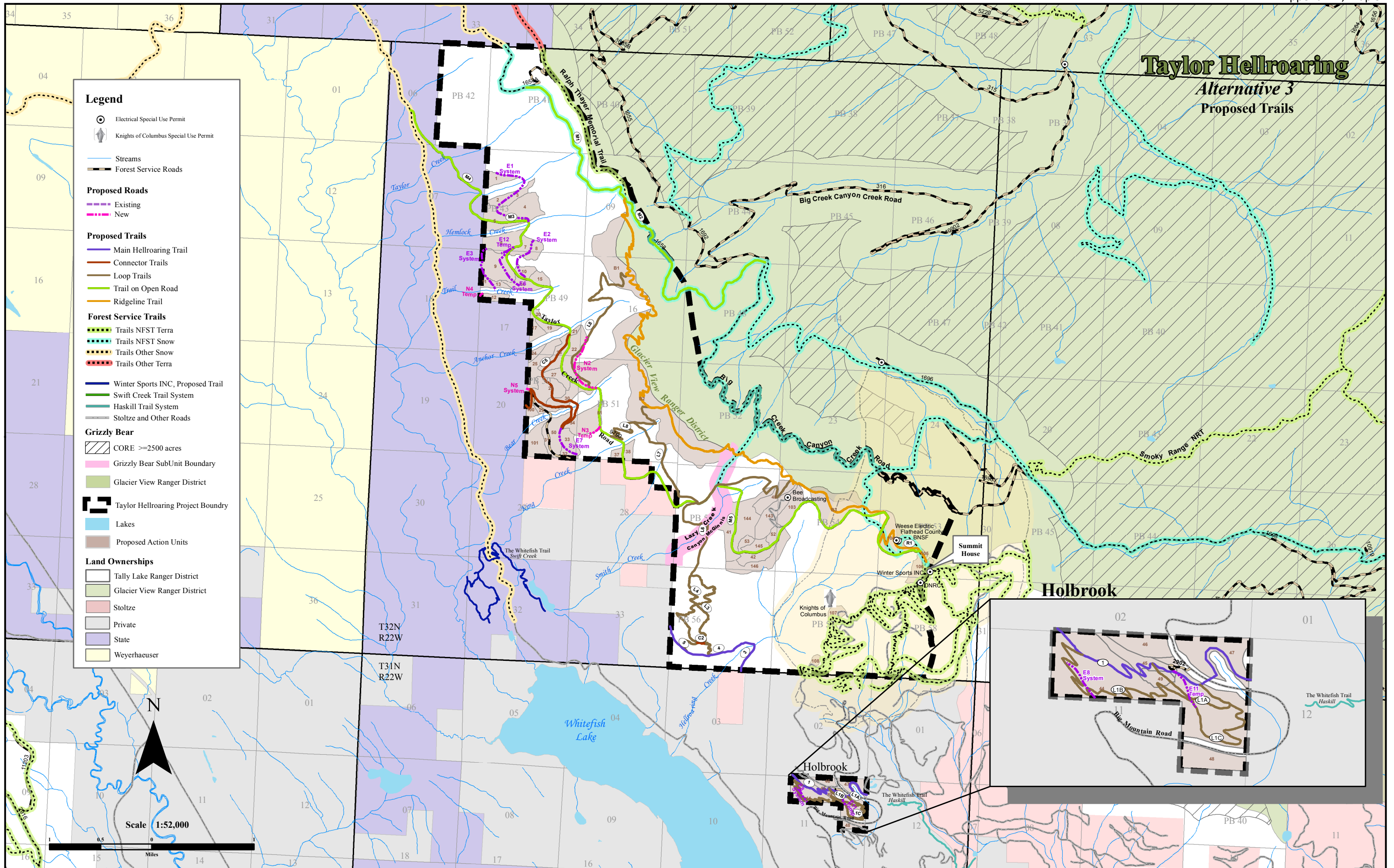
Under the Migratory Bird Treaty Act, it is unlawful to take, kill, or possess migratory birds, including their nests and eggs. A list of Neotropical migrants protected by the Migratory Bird Treaty Act is provided in 50 CFR 10.13. Some migratory birds are covered by state hunting

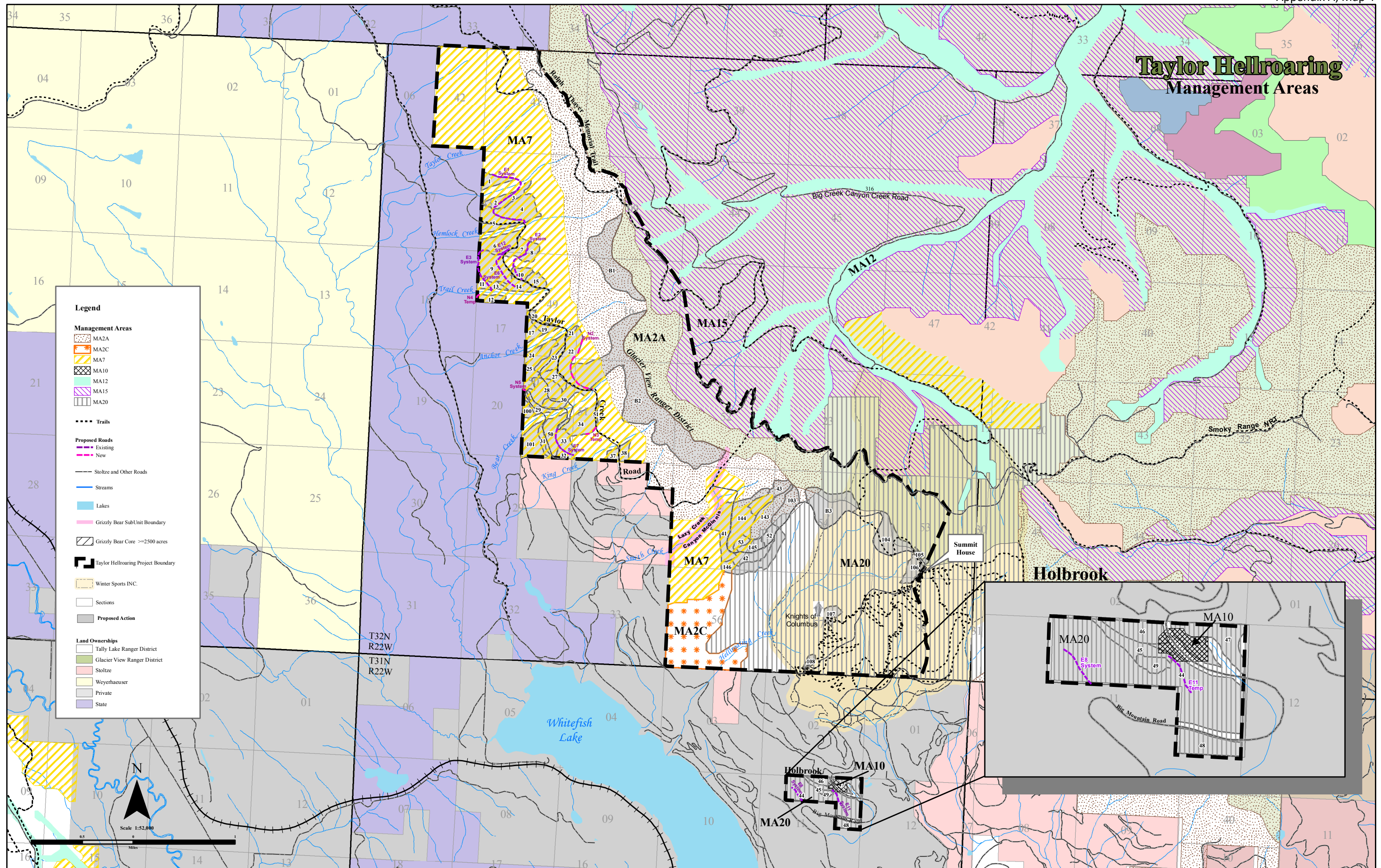
regulations; others are protected by non-game status by the Montana Department of Fish, Wildlife, and Parks. The flammulated owl and the peregrine falcon are Forest Service Region One sensitive species, and are discussed in this document and in other sections of the Project Record (*Project File Exhibit Rs-2, Rs-3, Rs-7, and Rs-20*). No impacts on the flammulated owl would be expected (*Project File Exhibit Rs-2*).

Upon review of the information regarding Neotropical migratory birds here and in the project record (Project File Exhibits Rn-2 and Rn-3), no substantial loss of migratory bird habitat is expected from the implementation of any of the action alternatives and a diversity of habitat conditions would be provided at multiple scales. The project would not adversely impact migratory landbird species or their associated habitats. Potential impacts to migratory species would be minimized through the adherence of Forest Plan Standards and Guidelines for snags/down woody debris, riparian reserve buffers, and limited ground disturbance. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. The intent of the Migratory Bird Treaty Act, the 2001 Executive Order, and the 2008 MOU to conserve and protect Neotropical migrants would be met under all alternatives. All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability.











Trail Class Matrix

Trail Classes are general categories reflecting trail development scale, arranged along a continuum. The Trail Class identified for a National Forest System (NFS) trail prescribes its development scale, representing its intended design and management standards.¹ Local deviations from any Trail Class descriptor may be established based on trail-specific conditions, topography, or other factors, provided that the deviations do not undermine the general intent of the applicable Trail Class.

Identify the appropriate Trail Class for each National Forest System trail or trail segment based on the management intent in the applicable land management plan, travel management direction, trail-specific decisions, and other related direction. Apply the Trail Class that most closely matches the management intent for the trail or trail segment, which may or may not reflect the current condition of the trail.

Trail Attributes	Trail Class 1 Minimally Developed	Trail Class 2 Moderately Developed	Trail Class 3 Developed	Trail Class 4 Highly Developed	Trail Class 5 Fully Developed
Tread & Traffic Flow	• Tread intermittent and often indistinct • May require route finding • Single lane with no allowances constructed for passing • Predominantly native materials	• Tread continuous and discernible, but narrow and rough • Single lane with minor allowances constructed for passing • Typically native materials	• Tread continuous and obvious • Single lane, with allowances constructed for passing where required by traffic volumes in areas with no reasonable passing opportunities available • Native or imported materials	• Tread wide and relatively smooth with few irregularities • Single lane, with allowances constructed for passing where required by traffic volumes in areas with no reasonable passing opportunities available • Double lane where traffic volumes are high and passing is frequent • Native or imported materials • May be hardened	• Tread wide, firm, stable, and generally uniform • Single lane, with frequent turnouts where traffic volumes are low to moderate • Double lane where traffic volumes are moderate to high • Commonly hardened with asphalt or other imported material
Obstacles	• Obstacles common, naturally occurring, often substantial and intended to provide increased challenge • Narrow passages; brush, steep grades, rocks and logs present	• Obstacles may be common, substantial, and intended to provide increased challenge • Blockages cleared to define route and protect resources • Vegetation may encroach into trailway	• Obstacles may be common, but not substantial or intended to provide challenge • Vegetation cleared outside of trailway	• Obstacles infrequent and insubstantial • Vegetation cleared outside of trailway	• Obstacles not present • Grades typically < 8%

Trail Attributes	Trail Class 1 Minimally Developed	Trail Class 2 Moderately Developed	Trail Class 3 Developed	Trail Class 4 Highly Developed	Trail Class 5 Fully Developed
Constructed Features & Trail Elements	- Structures minimal to non-existent - Drainage typically accomplished without structures - Natural fords - Typically no bridges	- Structures of limited size, scale, and quantity; typically constructed of native materials - Structures adequate to protect trail infrastructure and resources - Natural fords - Bridges as needed for resource protection and appropriate access	- Structures may be common and substantial; constructed of imported or native materials - Natural or constructed fords - Bridges as needed for resource protection and appropriate access	- Structures frequent and substantial; typically constructed of imported materials - Constructed or natural fords - Bridges as needed for resource protection and user convenience - Trailside amenities may be present	- Structures frequent or continuous; typically constructed of imported materials - May include bridges, boardwalks, curbs, handrails, trailside amenities, and similar features
Signs²	- Route identification signing limited to junctions - Route markers present when trail location is not evident - Regulatory and resource protection signing infrequent - Destination signing, unless required, generally not present - Information and interpretive signing generally not present	- Route identification signing limited to junctions - Route markers present when trail location is not evident - Regulatory and resource protection signing infrequent - Destination signing typically infrequent outside of wilderness; generally not present in wilderness - Information and interpretive signing not common	- Route identification signing at junctions and as needed for user reassurance - Route markers as needed for user reassurance - Regulatory and resource protection signing may be common - Destination signing likely outside of wilderness; generally not present in wilderness - Information and interpretive signs may be present outside of wilderness	- Route identification signing at junctions and as needed for user reassurance - Route markers as needed for user reassurance - Regulatory and resource protection signing common - Destination signing common outside of wilderness; generally not present in wilderness - Information and interpretive signs may be common outside of wilderness - Accessibility information likely displayed at trailhead	- Route identification signing at junctions and for user reassurance - Route markers as needed for user reassurance - Regulatory and resource protection signing common - Destination signing common - Information and interpretive signs common - Accessibility information likely displayed at trailhead
Typical Recreation Environments & Experience³	- Natural, unmodified - ROS: Typically Primitive to Roaded Natural - WROS: Typically Primitive to Semi-Primitive	- Natural, essentially unmodified - ROS: Typically Primitive to Roaded Natural Typically - WROS: Typically Primitive to Semi-Primitive	- Natural, primarily unmodified - ROS: Typically Primitive to Roaded Natural - WROS: Typically Semi-Primitive to Transition	- May be modified - ROS: Typically Semi-Primitive to Rural Roaded Natural to Rural setting - WROS: Typically Portal or Transition	- May be highly modified - Commonly associated with visitor centers or high-use recreation sites - ROS: Typically Roaded Natural to Urban - Generally not present in Wilderness

¹ For National Quality Standards for Trails, Potential Appropriateness of Trail Classes for Managed Uses, Design Parameters, and other related guidance, refer to FSM 2353, FSH 2309.18, and other applicable agency references.

² For standards and guidelines for the use of signs and posters along trails, refer to the Sign and Poster Guidelines for the Forest Service (EM-7100-15).

³ The Trail Class Matrix shows the combinations of Trail Class and Recreation Opportunity Spectrum (ROS) or Wilderness Recreation Opportunity Spectrum (WROS) settings that commonly occur, although trails in all Trail Classes may and do occur in all settings. For guidance on the application of the ROS and WROS, refer to FSM 2310 and 2353 and FSH 2309.18.

Literature Cited

Aquatics

- Bosch J.M and Hewlett J.D. 1982. A Review of Catchment Experiments to Determine the Effects of Vegetation Changes on Water Yield and Evapotranspiration. *Journal of Hydrology*, 55: 3-23.
- Callahan, P.C. 1996. Water yield recovery in the Northern Rockies. Thesis. University of Montana. Missoula, MT.
- Cissel, Richard, et al. (2013). Center Horse and Morrell/Trail GRAIP Roads Assessment, Clearwater River Watershed, Lolo National Forest, Montana Preliminary Report (pp. 54). Boise, ID: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Elliot, W.J. 2013. Erosion Processes and Prediction with WEPP Technology in Forests in the Northwestern U.S. *American Society of Agricultural and Biological Engineers* ISSN 2151-0032. Vol. 56(2): 563-579
- Foltz, R. B., Yanosek, K.A., Brown, T.M. 2008. Sediment concentration and turbidity changes during culvert removals. *Journal of Environmental Management*, 87, 329-340.
- Grant, Gordon E.; Lewis, Sarah L.; Swanson, Frederick J.; Cissel, John H.; McDonnell, Jeffrey J. 2008. Effects of forest practices on peak flows and consequent channel response: a state-of-science report for western Oregon and Washington. Gen. Tech. Rep. PNW-GTR-760. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 76 p.
- Kahklen, K., and Moll, J. 1999. Measuring Effects of Roads on groundwater: Five Case Studies. San Dimas Technology and Development Center, San Dimas, California.
- Kendall, C.N. 2015. Hydrologic Effects of Forest Removal and Potential Impacts on Stream Channels. Flathead National Forest. Kalispell, MT. Unpublished.
- Klein, R. (2003). Erosion and Turbidity Monitoring Report Sanctuary Forest Stream Crossing Excavations in the Upper Mattole River Basin, 2002-2003. *Inc. PO Box, 166*.
- Losensky, John, B. 1994. Historical Vegetation Types of the Columbia River Basin. Unpublished manuscript.
- MacDonald, Lee H., and J.D. Stednick. 2003. Forests and Water: A State-of-the-Art Review for Colorado. Colorado State University, Fort Collins, CO.
- Madej, M.A. (2001). Erosion and Sediment Delivery Following Removal of Forest Roads. *Earth Surface Processes and Landforms*, 26: 175-190.
- MDNRC 2016. Montana Forestry Best Management practices Monitoring-2016 Forestry BMP Field Review Results. Missoula, MT. Available URL:
<http://dnrc.mt.gov/divisions/forestry/docs/assistance/2016-bmp-field-reviews-full-report.pdf>

- MDNRC 2009. Beaver/Swift/Skyles Timber Sale Project. Environmental Assessment. Kalispell, MT.
Available URL: http://leg.mt.gov/content/Publications/MEPA/2009/dnr0606_2009001.pdf
- Montana Department of Natural Resources and Conservation (MDNRC) 2006. Montana Guide to the Streamside Management Zone Law and Rules. Missoula, MT. Available URL: <http://dnrc.mt.gov/divisions/forestry/docs/assistance/practices/smz.pdf>
- MDEQ. 2016. Final Water Quality Integrated Report. Water Quality Planning Bureau, Water Quality Standards Section. Helena, MT: Montana Dept. of Environmental Quality.
- MDEQ. 2014. Department Circular DEQ-12A: Montana Base Numeric Nutrient Standards. Planning Prevention and Assistance Division, Water Quality Planning Bureau, Water Quality Standards Section. Helena, MT: Montana Dept. of Environmental Quality.
- MDEQ. 2012. Department Circular DEQ-7: Montana Numeric Water Quality Standards. Planning Prevention and Assistance Division, Water Quality Planning Bureau, Water Quality Standards Section. Helena, MT: Montana Dept. of Environmental Quality.
- R. J. Naiman, T. J. Beechie, L. E. Benda, D. R. Berg, P. A. Bison, L. H. MacDonald, . . . E. A. Steel (1992), Fundamental elements of ecologically healthy watersheds in the Pacific Northwest coastal ecoregion, in R. J. Naiman (Ed.), *Watershed management: Balancing sustainability with environmental change* (pp. 127-188), New York, NY: Springer-Verlag.
- Stednick, John D. 1996. Monitoring the effects of timber harvest on annual water yield. *Journal of Hydrology*. 176:79-95
- Shapiro, N.R. 2010. Assessing Efforts to Reduce Sediment Impacts in Cottonwood Creek, Blackfoot Basin, Montana. Thesis. University of Montana. Missoula, MT.
- Sugden, Brian D., and Scott W. Woods, 2007. Sediment Production From Forest Roads in Western Montana. *Journal of the American Water Resources Association (JAWRA)* 43(1):193-206. DOI: 10.1111 / j.1752-1688.2007.
- Troendle, C.A., L.H. MacDonald, C.H. Luce, I.J. Larsen. 2009. Cumulative Watershed Effects of Fuel Management in the Western United States. USDA Forest Service RMRS-GTR-231.
- USDA Forest Service. 2016. Effectiveness of Best Management Practices that Have Application to Forest Roads: A Literature Synthesis. Edwards, P.J.; Wood, F.; Quinlivan, R.L. Gen. Tech. Rep. NRS-163. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.
- USDA Forest Service/ Northern Region, USDI Fish and Wildlife Service/ Montana Field Office, Lolo National Forest, Bitterroot National Forest, Flathead National Forest, Beaverhead-Deerlodge National Forest, Kootenai National Forest and Helena National Forest. 2013. Conservation Strategy for Bull Trout on USFS lands in Western Montana. Missoula, Montana. 585 pages plus appendices.

U.S. Department of Agriculture (USDA), Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands. FS-990a. Washington, DC: USDA Forest Service. Available URL: https://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

USDA, Forest Service. 2011. Watershed Condition Classification Technical Guide. FS-978. Washington, DC: USDA Forest Service. Available URL: https://www.fs.fed.us/biology/resources/pubs/watershed/maps/watershed_classification_guide2011FS978.pdf

Economics

IMPLAN. 2014. IMpacts for PLANning (IMPLAN). IMPLAN, Inc. Version 3. Copyright 2015. Additional information available at www.implan.com.

Kusel, J. and L. P. Fortmann. 1991. What is community well-being? In J. Kusel and L. Fortman (eds.). Well-being in forest-dependent communities (Volume I). Pp.1-45/ Forest and Rangeland Resources Assessment Program and California Department of Forestry and Fire Protection, Berkley, California.

Morgan et al. 2014 (BBER): *“Employment Impacts of Timber Harvesting and Processing in the United States”*, Poster, University of Montana Bureau of Business and Economic Research, Morgan et al. 2016.

Morgan et al. 2016: *“Montana Economic Report, Forest Products-Challenges and Changes for Montana’s Forest Products Industry”*, page 28, University of Montana Bureau of Business and Economic Research, Morgan et al. 2016.

Sorenson, C.B., McIver, C.P., Keegan, C.E., Morgan, T.A. Capacity and Capability of Mills in the Flathead National Forest Timber-Processing Area. Submitted to USDA Forest Service Region One, Aug 2012. Available online: http://www.bber.umn.edu/pubs/forest/capacity/Flathead_NF_capacity_final.pdf.

Sorenson, C.B., Keegan, C.E., Morgan, T.A., McIver, C.P., Niccolucci, M.J. 2016. Employment and Wage Impacts of Timber Harvesting and Processing in the United States. *J. For.* 114(4):474–482.

USDA, 2016. Federal Outdoor Recreation Trends: Effects on Economic Impacts. White, Eric M., J.M. Bowker, Ashley E. Askew, Linda L. Langner, J. Ross Arnold, and Donald B.K. English. GTR, PNW-945. 56 pp.

Fire, Fuels and Air Quality

Habeck, J.R. and R.W. Mutch. 1973. Fire dependant forests in the Northern Rocky Mountains. *Journal of Quarterly Research*. Vol. 3, No. 3, (Page 408).

General

Flathead National Forest. 1992. Land and Resource Management Plan Annual Monitoring Report for Fiscal Year 1991.

Pfister, R., B. Kolalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. USDA Forest Service Gen. Tech. Report INT-34.

USDA 1987. FSH 7709.56 - Road Preconstruction Handbook; Chapter 4-Design. Washington Office. Service-wide.

USDA Forest Service 1983. Flathead Country Land System Inventory. Flathead National Forest.

USDA Forest Service. 1986. Flathead National Forest Land & Resource Management Plan. Region 1, Flathead NF. Kalispell, MT. pp.II-55, Q1-9

USDA Forest Service 1992. Land and Resource Management Plan Annual Monitoring Report for 1991.

USDA Forest Service. 1995a. Landscape Aesthetics: A Handbook for Scenery Management. Agriculture Handbook #701. Washington, D.C.

USDA Forest Service. 1999a. Flathead National Forest Plan Amendment 21, Final Environmental Impact Statement: Management Direction Related to Old Growth Forests. Flathead National Forest, Kalispell, MT. (Pages 48-59 and 84-96; Appendix A page 27. Also, see project record U-1.)

USDA Forest Service. 2001a. Flathead National Forest Noxious and Invasive Weed Control Decision Notice. 44 pp.

USDA Forest Service. 2001b. Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment. 122 pp. plus appendices.

Heritage Resources

Flint, P. B. (1982). *The Northern Rocky Mountain Region: Environment and Culture History*. Master's Thesis, Department of Anthropology, University of Montana, Missoula.

Kornfeld, M., Frison, G.C., Larson, M.L. (2010). *Prehistoric Hunter-Gatherers of the High Plains and Rockies*. 3rd ed. Left Coast Press, Walnut Creek, WA.

MacDonald, D.H. (2012). *Montana Before History*. 1st ed. Mountain Press Publishing Company, Missoula, MT.

Underwood, J. (1981). Cultural Site Record for 24FH50. On file at the Montana State Historic Preservation Office, Cultural Records.

Whitefish Chamber of Commerce (2017). This is Whitefish Montana: History. Electronic Resource, <http://www.whitefishchamber.org/history>, accessed September 27, 2017.

Invasive and Sensitive Plant Species

- Brown, James K.; Smith, Jane Kapler, eds. 2000. Wildland Fire in Ecosystems: Effects of Fire on Flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 257 p. Pgs. 9-34. Accessed at: http://www.fs.fed.us/rm/pubs/rmrs_gtr042_2.html
- Christen, Douglas and Glenn Matlack. 2006. The role of roadsides in plant invasions: a demographic approach. *Conservation Biology* Vol. 20, No. 2. pp. 385-391.
- Endress, Bryan A. and Catherine Parks. 2004. Element Stewardship Abstract for *Potentilla recta* – sulphur cinquefoil. The Nature Conservancy. 9 pp. Accessed at: <http://www.invasive.org/gist/esadocs/documnts/poterec.pdf>
- Evans, J. 1982. Element Stewardship Abstract for *Artemisia absinthium* – Common wormwood. Updated by Nancy Eckardt in 1987. The Nature Conservancy. 8 pp. Available at: <http://www.invasive.org/gist/esadocs/documnts/arteabs.pdf>
- Executive Order 13112 – Invasive Species. 1999. 4 pp. Accessed at: <http://ceq.hss.doe.gov/nepa/reg/eos/eo13112.html>
- Hebel, Cassie L., Jane E. Smith, and Kermit Cromack Jr. 2009. Invasive plant species and soil microbial response to wildfire burn severity in the Cascade Range of Oregon. *Applied Soil Ecology* 42:150-159.
- Hitchcock, C. Leo and Arthur Cronquist. 1973. *Flora of the Pacific Northwest*. University of Washington Press, Seattle and London. Page 220.
- Jacobs, Jim and Sharlene Sing. 2007. Ecology and Management of Houndstongue (*Cynoglossum officinale* L.). United States Department of Agriculture; Natural Resources Conservation Service. Invasive Species Technical Note No. MT-8. 7 pp.
- Jacobs, Jim and Jessie Wiese. 2007. Ecology and Management of Invasive Hawkweeds [*Hieracium* spp]. United States Department of Agriculture; Natural Resources Conservation Service. Invasive Species Technical Note No. MT-16. 10 pp.
- Jones, Alexis and Elizabeth Crone. 2009. The Effect of Disturbance History on Hawkweed Invasion (Montana). *Ecological Restoration*. Vol. 27, No. 2, pp. 139-141.
- King County Noxious Weed Control Program. 2006. Best Management Practices: Tansy Ragwort – *Senecio jacobaea* Asteraceae. Accessed at: <http://dnr.metrokc.gov/weeds>
- Krueger, Jane and Roger Sheley. 2002. St. Johnswort (*Hypericum perforatum*). Montana State University Extension. 4 pp. Accessed at: <http://www.ipm.montana.edu/CropWeeds/Extension/weed%20species%20not%20every%20file%20is%20here-/St%2520Johnswort.pdf>
- Krueger, Jane and Roger Sheley. 2003. Oxeye Daisy (*Chrysanthemum leucanthemum*). Montana State University Extension. 3 pp. Accessed at:

- <http://www.ipm.montana.edu/cropweeds/Extension/weed%20species%20not%20every%20file%20is%20here-/oxeye%2520daisy.pdf>
- Kuropat, Betty. 2009. Tally Lake Ranger District Silviculturist. Personal communication.
- LeCain, Ron and Roger Sheley. 2006. Common Tansy (*Tanacetum vulgare*). Montana State University Extension. 4 pp. Accessed at: <http://msuextension.org/publications/AgandNaturalResources/MT199911AG.pdf>
- Lyons, K.E. 1998. Species Management Element Stewardship Abstract for Reed canarygrass. The Nature Conservancy. 14p.
- Mauer, T., M.J. Russo, and M. Evans. 2001. Element Stewardship Abstract for *Centaurea maculosa*, spotted knapweed. The Nature Conservancy. 8 p. Accessed at: <http://tncweeds.ucdavis.edu/esadocs.html>
- Menalled, Fabian, Jane Mangold and Ed Davis. 2008. Cheatgrass: Identification, Biology and Integrated Management. Montana State University Extension. 4 pp. Accessed at: <http://ipm.montana.edu/cropweeds/montguides/Cheatgrass.pdf>
- Montana Department of Agriculture. 2015. Montana Noxious Weed List. Website accessed October 30, 2015. <http://agr.mt.gov/agr/Programs/Weeds/PDF/2015WeedList.pdf>
- Montana Plant Life. 2012. Accessed 11/05/2012. Common Burdock – *Arctium minus*. Website: http://montana.plant-life.org/species/arctium_minus.htm
- Natural Resource Information System. 2013. Forest Service database of Threatened, Endangered, Sensitive Plants and Invasive Species. Accessed April 2013.
- Nuzzo, Victoria. 1997. Element Stewardship Abstract for *Cirsium arvense*. The Nature Conservancy. 32 pp. Available at: <http://tncinvasives.ucdavis.edu/esadocs/documnts/cirsarv.pdf>
- Parkinson, Hilary, Jane Mangold, Jim Jacobs. 2010. Biology, Ecology and Management of Hoary Alyssum (*Berteroa incana* L.). Montana State University Extension. 15 pp. Accessed at: <http://store.msuextension.org/publications/AgandNaturalResources/EB0194.pdf>
- Parks, C., S. Radosevich, B. Endress, B. Naylor, D. Anzinger, L. Rew, B. Maxwell, K. Dwire. 2005. Natural and land-use history of the Northwest mountain ecoregions (USA) in relation to patterns of plant invasions. Perspectives in Plant Ecology, Evolution and Systematics. Vol. 7, pages 137–158.
- Pimental, David, Rodolfo Zuniga and Doug Morrison. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. Ecological Economics. 52: 273-288.
- Silveri, Ann, Peter W. Dunwiddie and Helen J. Michaels. 2001. Logging and edaphic factors in the invasion of an Asian woody vine in a mesic North American forest. Biological Invasions Vol.3. pp. 379-389.

- Taylor, Kimberley, Jane Mangold and Lisa J. Rew. 2011. Weed Seed Dispersal by Vehicles. MontGuide MT201105AG. Montana State University Extension: Agriculture and Natural Resources (Weeds). 4 pages.
- Thomas A. G. and H. M. Dale. 1975. The role of seed reproduction in the dynamics of established populations of *Hieraceum floribundum* and a comparison with that of vegetative reproduction. Canadian Journal of Botany. 53: 3022-3031.
- Trombulak, S. C. and C. A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology Vol. 14 No. 1. pp.18-30.
- USDA Animal and Plant Health Inspection Service. 2001. Future Trends in Agricultural Trade. Miscellaneous publication 1579. Accessed at: http://www.aphis.usda.gov/publications/aphis_general/content/printable_version/brotradi.pdf
- USDA Forest Service. 1995. Forest Service Manual Series 2000 National Forest Resource Management Amendment No. 2000-95-5, FSM 2081.03. Noxious Weeds Management.
- USDA Forest Service 1997. Tansy Ragwort Control Project Record of Decision. 18 pp.
- USDA Forest Service. 2001a. Flathead National Forest Noxious and Invasive Weed Control Decision Notice. 44 pp.
- USDA Forest Service. 2001b. Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment. 122 pp. plus appendices.
- USDA Forest Service. 2001c. USDA Forest Service Guide to Noxious Weed Prevention Practices. Version 1.0 25 pp. Accessed at: http://www.fs.fed.us/rangelands/ftp/invasives/documents/GuidetoNoxWeedPrevPractices_07052001.doc
- USDA Forest Service. 2003. Weed Risk Assessment. The Nature Conservancy and Forest Service. On file at the Supervisor's Office, Flathead National Forest.
- USDA Forest Service. 2005a. Forest Service Manual 2600 - Wildlife, Fish and Sensitive Plant Habitat Management. Chapter 2670 - Threatened, Endangered and Sensitive Plants and Animals. 22 pages.
- USDA Forest Service. 2005b. Guidelines for Road Maintenance Levels. Technology & Development Program. 7700-Transportation Management; 0577 1205-SDTDC. 54 pages.
- USDA Forest Service. 2008. Forest Service Manual Series 2000 National Forest Resource Management Amendment No. 2000-2008-1, FSM 2070. Vegetation Ecology.
- USDA Forest Service. 2011. Forest Service Manual 2900 – Invasive Species Management. 2900 Zero Code. 28 pages.

USDA National Invasive Species Information Center. 2011. National Agriculture Library. Musk thistle (*Carduus nutans*). Accessed online 07/20/2011 at:
<http://www.invasivespeciesinfo.gov/plants/muskthistle.shtml>

USDI Fish and Wildlife Service. 2007. Recovery Plan for *Silene spaldingii* (Spalding's Catchfly). U.S. Fish and Wildlife Service, Portland, Oregon. Xiii + 187 pages. Accessible via:
<http://www.fws.gov/endangered/species/recovery-plans.html>

USDI Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List *Pinus albicaulis* as Endangered or Threatened with Critical Habitat. 50 CFR Part 17. Federal Register. Vol. 76, No. 138:42631-42654. July 19, 2011.

USDI Fish and Wildlife Service. 2013. Water howellia (*Howellia aquatilis*) 5-Year Review : Summary and Evaluation. Montana Ecological Services Field Office, Helena, MT. Accessed at
http://ecos.fws.gov/docs/five_year_review/doc4271.pdf

UW Stevens Point. 2009. Freckmann Herbarium. *Ranunculus acris*. Accessed 07/22/2009. Website:
<http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=RANACR>

Van Driesche, R., Suzanne Lyon, Bernd Blossey, Mark Hoddle, and Richard Reardon. 2002. Biological Control of Invasive Plants in the Eastern United States, USDA Forest Service Publication FHTET-2002-04, 413 p. Bull Thistle (Spear Thistle). Accessed at:
<http://www.invasive.org/eastern/biocontrol/>

Von der Lippe, Moritz and Ingo Kowarik. 2007. Long-distance dispersal of plants by vehicles as a driver of plant invasions. *Conservation Biology* Vol. 21, No. 4. pp. 986-996.

Whitson, Tom D., Larry C. Burrill, Steven A. Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee, and Robert Parker. Whitson, Tom D. (ed.) 2000. *Weeds of the West*. 9th ed. Laramie: University of Wyoming. Page 525.

Wisconsin Department of Natural Resources. 2012. Invasive Species: Canada thistle. Accessed 11/05/2012. Website: <http://dnr.wi.gov/topic/Invasives/fact/CanadaThistle.html>.

Zouhar, Kris. 2009. *Isatis tinctoria*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2011, July 20].

Zouhar, Kristin; Smith, Jane Kapler; Sutherland, Steve; Brooks, Matthew L. 2008. Wildland fire in ecosystems: fire and nonnative invasive plants. General Technical Report RMRS-GTR-42-vol. 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 355pp.

Recreation

American Recreation Coalition, 2016. Outdoor Recreation Outlook 2017. Washington, D.C.. Prepared by Travel and Tourism Research Association, 2016 Marketing Outlook Forum. 10 pp.

- Grau, Kara, 2015. "2014 Economic Contribution of Nonresident Travel Spending in Montana Travel Regions and Counties". Institute for Tourism and Recreation Research Publications. Paper 315. 35 pp.
- Grau, Kara, 2017. "2016 Economic Contribution of Nonresident Travel Spending in Montana Travel Regions and Counties". Institute for Tourism and Recreation Research Publications. 360. 31 pp.
- MT FWP (2015). Draft Environmental Assessment for the South Whitefish Range Conservation Project. October 26, 2015.
- Nickerson, Norma P., 2014. "Whitefish Legacy Trail Visitor Study" *Institute for Tourism and Recreation Research Publications*. Paper 246.
- Nickerson, Norma P., "Economics Impacts: How and Why of Counting Dollars" Institute for Tourism and Recreation Research. Presented to National Bicycle Tourism Conference. 11/6/2015. San Diego, CA.
- Nickerson, Norma P. and Grau, Kara, "Focus on Activities - Montana Visitors' Key Niche Activities" (2017). Institute for Tourism and Recreation Research Publications. 357. 44 pp.
- USDA, 2002. Forest Service National Visitor Use Monitoring Process: research Method Documentation; English, Kocis, Zarnoch, and Arnold; Southern Research Station; May 2002 (<http://www.fs.fed.us/recreation/programs/nvum/>).
- USDA, 2005. National Visitor Use Monitoring Report, Flathead National Forest. Data Collected FY2005. 51 pp.
- USDA, 2010a. National Visitor Use Monitoring Report, Flathead National Forest. Data Collected FY2010. 52 pp.
- USDA, 2010b. *Connecting People with America's Great Outdoors: A Framework for Sustainable Recreation*. Recreation, Heritage and Volunteer Resources. 9 pp.
- USDA, 2015. National Visitor Use Monitoring Report, Flathead National Forest. Data Collected FY2015. 51 pp.

Scenic Quality

- Ribe, R. G. (2002). Is scenic beauty a proxy for acceptable management? The influence of environmental attributes on landscape perceptions. . *Environment and Behavior*, 34(6): 757-780.
- Ryan, R. L. (2005). *Social science to improve fuels management: a synthesis of research on aesthetics and fuel management*. St. Paul, MN: USDA Forest Service, North Central Research Station.
- USDA-Forest Service. 1985. Flathead National Forest Land and Resource Management Plan. Pacific Northwest Region.

- United States. Flathead National Forest. (2017). *Draft Flathead National Forest Plan*. Kalispell, MT: U.S.D.A.
- United States. Forest Service. (1973). *Agriculture Handbook 434. National forest landscape management: vol. 1*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1974). *Agriculture Handbook 462. National forest landscape management: vol. 2*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1980). *Agriculture Handbook 559. National forest landscape management: vol. 2, chp. 5, Timber*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1995). *Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook Number 701*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (2003). Chapter 2380-Landscape Management. *FSM 2300-Recreation, Wilderness, and Related Resource Management*, WO Amendment 2300-2003-1.
- United States. Forest Service. (2006). Appendix J. Recommended SMS Refinements. In U. S. Service, *Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook Number 701*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1973). *Agriculture Handbook 434. National forest landscape management: vol. 1*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1974). *Agriculture Handbook 462. National forest landscape management: vol. 2*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1976). *Agriculture Handbook 483. National forest landscape management: vol. 2, chp. 4, Roads, Handbook 483*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1985). *Agriculture Handbook 608. National forest landscape management: vol. 2 chp. 6, Fire*. Washington D.C.: U.S.D.A.
- United States. Forest Service. (1995). *Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook Number 701*. Washington D.C.: U.S.D.A.

Soils

- Amaranthus, M. P. (1991). Factors affecting ectomycorrhizae and forest regeneration following disturbance in the Pacific Northwest. *Proceedings-Management and Productivity of Western-Montane Forest Soils*. Eds. AE Harvey and LF Neunschwander, 205-208.
- Borchers, J. G., & Perry, D. A. (1990). Effects of prescribed fire on soil organisms. In J. D. Walstad, S. R. Radosevich, & D. V. Sandberg (Eds.), *Natural and prescribed fire in Pacific Northwest forests* (pp. 143-157). Corvallis, OR: Oregon State University Press.

- Brown, J. K., Reinhardt, E. D., & Kramer, K. A. (2003). *Coarse woody debris: Managing benefits and fire hazard in the recovering forest*. Retrieved from Fort Collins, CO:
- Busse, M. D. (1994). Downed bole-wood decomposition in lodgepole pine forests of central Oregon. *Soil Science Society of America Journal*, 58(1), 221-227.
- Cavagnaro, T. R. (2016). Soil moisture legacy effects: Impacts on soil nutrients, plants and mycorrhizal responsiveness. *Soil Biology and Biochemistry*, 95, 173-179.
- Certini, G. (2005). Effects of fire on properties of forest soils: a review. *Oecologia*, 143(1), 1-10.
- DeBano, L. F., Neary, D. G., & Ffolliott, P. F. (1998). *Fire effects on ecosystems*: John Wiley & Sons.
- Garland, J. J. (1983). *Designated skid trails minimize soil compaction*. Retrieved from Corvallis, OR:
- Garrison, M. T., & Moore, J. A. (1998). *Nutrient management: a summary and review*. Retrieved from
- Goldman, S. J., Jackson, K., & Bursztynsky, T. A. (1986). *Erosion and sediment control handbook*: McGraw-Hill.
- Gonsior, M. J. (1983). *Forest soil compaction: Where next? A literature review and assessment*. Retrieved from Bozeman, MT:
- Graham, R. T., Harvey, A. E., Jurgensen, M. F., Jain, T. B., Tonn, J. R., & Page-Dumroese, D. S. (1994). *Managing coarse woody debris in forests of the Rocky Mountains* (477). Retrieved from Ogden, UT:
- Han, H.-S., Page-Dumroese, D. S., Han, S.-K., & Tirocke, J. M. (2006). Effects of Slash, Machine Passes, and Soil Moisture on Penetration Resistance in a Cut-to-length Harvesting. *International Journal of Forest Engineering*, 17(2), 11-24.
- Han, S.-K. (2006). *Impacts on soils from cut-to-length and whole tree harvesting*. University of Idaho,
- Harrod, R., Ohlson, P., Flatten, L., Peterson, D., & Ottmar, R. (2009). A user's guide to thinning with mastication equipment. In: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Region, Okanogan-Wenatchee National Forest.
- Hartford, R. A., & Frandsen, W. H. (1992). When it's hot, it's hot... or maybe it's not! (Surface flaming may not portend extensive soil heating). *International Journal of Wildland Fire*, 2(3), 139-144.
- Harvey, A. E., Geist, J. M., McDonald, G. L., Jurgensen, M. F., Cochran, P. H., Zabowski, D., & Meurisse, R. T. (1994). *Biotic and abiotic processes in eastside ecosystems: the effects of management on soil properties, processes, and productivity*. Retrieved from Portland, OR:
- Hatchett, B., Hogan, M., & Grismer, M. (2006). Mechanical mastication thins Lake Tahoe forest with few adverse impacts. *California Agriculture*, 60(2), 77-82.

- Jurgensen, M. F., Harvey, A. E., & Larsen, M. J. (1981). *Effects of prescribed fire on soil nitrogen levels in a cutover Douglas-fir/western larch forest*. Retrieved from Ogden, UT:
- Jurgensen, M. F., Harvey, A. E., & Larson, M. J. (1977). *Effects of timber harvesting on soil biology*. Retrieved from Ogden, UT:
- Lentile, L. B., Morgan, P., Hudak, A. T., Bobbitt, M. J., Lewis, S. A., Smith, A., & Robichaud, P. (2007). Post-fire burn severity and vegetation response following eight large wildfires across the western United States. *Fire Ecology Special Issue*, 3(1), 18.
- Lloyd, R. A., Lohse, K. A., & Ferré, T. P. A. (2013). Influence of road reclamation techniques on forest ecosystem recovery. *Frontiers in Ecology and the Environment*, 11(2), 75-81.
- Lull, H. W. (1959). *Soil compaction on forest and range lands*: U.S. Dept. of Agriculture, Forest Service.
- Martinson, A. H., & Basko, W. J. (1983). *Flathead country land system inventory*. Kalispell, MT: U.S. Dept. of Agriculture, Forest Service, Flathead National Forest.
- Martinson, A. H., & Basko, W. J. (1988). *Soil survey of Flathead National Forest area, Montana*: U.S. Dept. of Agriculture, Forest Service and Natural Resources Conservation Service.
- McIver, J. D., & Starr, L. (2000). *Environmental effects of postfire logging: literature review and annotated bibliography*. Retrieved from Portland, OR:
- McNabb, D. H., Startsev, A. D., & Nguyen, H. (2001). Soil wetness and traffic level effects on bulk density and air-filled porosity of compacted boreal forest soils. *Soil Science Society of America Journal*, 65(4), 1238-1247.
- Page-Dumroese, D. S. (1993). *Susceptibility of volcanic ash-influenced soil in northern Idaho to mechanical compaction*. Retrieved from Ogden, UT:
- Page-Dumroese, D. S., Abbott, A. M., & Rice, T. M. (2009). *Forest soil disturbance monitoring protocol: Volume I rapid assessment*. Washington, D.C.: U.S. Dept. of Agriculture, Forest Service.
- Page-Dumroese, D. S., Busse, M. D., Overby, S. T., Gardner, B. D., & Tirocke, J. M. (2015). Impacts of Forest Harvest on Active Carbon and Microbial Properties of a Volcanic Ash Cap Soil in Northern Idaho. *Open Journal of Soil Science*, 5(01), 11.
- Page-Dumroese, D. S., Harvey, A. E., Jurgensen, M. F., & Graham, R. T. (1991). *Organic matter function in the western-montane forest soil system*. Paper presented at the Management and Productivity of Western-Montane Forest Soils, Boise, ID.
- Parsons, A., Robichaud, P. R., Lewis, S. A., Napper, C., & Clark, J. T. (2010). *Field guide for mapping post-fire soil burn severity*: US Department of Agriculture, Forest Service, Rocky Mountain Research Station Fort Collins.

- Perry, D. A., Borchers, J. G., Borchers, S. L., & Amaranthus, M. P. (1990). Species migrations and ecosystem stability during climate change: the belowground connection. *Conservation Biology*, 4(3), 266-274.
- Powers, R. F., Andrew Scott, D., Sanchez, F. G., Voldseth, R. A., Page-Dumroese, D. S., Eliooff, J. D., & Stone, D. M. (2005). The North American long-term soil productivity experiment: findings from the first decade of research. *Forest Ecology and Management*, 220(1), 31-50.
- Prescott, C. E., & Laiho, R. (2002). *The nutritional significance of coarse woody debris in three Rocky Mountain coniferous forests*. Paper presented at the Symposium on Ecology and Management of Dead Wood in Western Forests, Reno, NV.
- Schmidt, S. K., Costello, E. K., Nemergut, D. R., Cleveland, C. C., Reed, S. C., Weintraub, M. N., . . . Martin, A. M. (2007). Biogeochemical consequences of rapid microbial turnover and seasonal succession in soil. *Ecology*, 88(6), 1379-1385.
- Seymour, G. B., & Tecle, A. (2004). Impact of slash pile size and burning on ponderosa pine forest soil physical characteristics. *Journal of the Arizona-Nevada Academy of Science*, 37(2), 74-82.
- Startsev, A. D., & McNabb, D. H. (2001). Skidder traffic effects on water retention, pore-size distribution, and van Genuchten parameters of boreal forest soils. *Soil Science Society of America Journal*, 65(1), 224-231.
- Williamson, J. R., & Neilsen, W. A. (2000). The influence of forest site on rate and extent of soil compaction and profile disturbance of skid trails during ground-based harvesting. *Canadian Journal of Forest Research*, 30(8), 1196-1205.

Vegetation

- Amman, G.D., McGregor, M.D., Cahill, D.B., Klein W.H. 1977. Guidelines for Reducing Losses of Lodgepole Pine to the Mountain Pine Beetle in Unmanaged Stands in the Rocky Mountains. General Technical Report. INT-36. Ogden, UT: U.S. Department of Agriculture, Forest Service. Intermountain Forest and Range Experiment Station. 19 pages.
- Brown, S. and J. Barber. 2012. The Region 1 Existing Vegetation Mapping Program (VMap) Flathead National Forest Overview; Version 12. USDA Forest Service, Northern Region, CMIA Numbered Report 12-34
- Depro, B.M., B.C. Murray, R.J. Alig, and A. Shanks. 2008. Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands. *Forest Ecology and Management* 255 (2008) 1122–1134.
- Finkral, A.J. and A.M. Evans. 2008. Effects of a thinning treatment on carbon stocks in a northern Arizona ponderosa pine forest. *Forest Ecology and Management* 255: 2743-2750.
- Funk, J., S. Saunders, T. Sanford, T. Easley, and A. Markham. 2014. Rocky Mountain forests at risk: Confronting climate-driven impacts from insects, wildfires, heat, and drought. Report from the Union of Concerned Scientists and the Rocky Mountain Climate Organization. Cambridge, MA: Union of Concerned Scientists.

- Kashian, D.M., W.H. Romme, D.B. Tinker, M.G. Turner, and M.G. Ryan. 2006. Carbon storage on landscapes with stand-replacing fires. *BioScience* 56: 598-606.
- Keane, Robert E.; Tomback, D.F.; Aubry, C.A.; Bower, A.D.; Campbell, E.M.; Cripps, C.L.; Jenkins, M.B.; Mahalovich, M.F.; Manning, M.; McKinney, S.T.; Murray, M.P.; Perkins, D.L.; Reinhart, D.P.; Ryan, C.; Schoettle, A.W.; Smith, C.M. 2012. A range-wide restoration strategy for whitebark pine (*Pinus albicaulis*). Gen. Tech. Rep. RMRS-GTR-279. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 108 p.
- McKinley, D.C., M.G. Ryan, R.A. Birdsey, C.P. Giardina, M.E. Harmon, L.S. Heath, R.A. Houghton, R.B. Jackson, J.F. Morrison, B.C. Murray, D.E. Pataki, and K.E. Skog. 2011. A synthesis of current knowledge on forests and carbon storage in the United States. In press. *Ecological Applications*.
- Milburn, A, B. Bollenbacher, M. Manning and R. Bush. 2015. Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. USDA Forest Service, Northern Region. Report 15-4 v1.0.
- Mitchell, S.R., M.E. Harmon, and K.E.B. O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. *Ecological Applications* 19: 643-655.
- North, M., M. Hurteau, and J. Innes. 2009. Fire suppression and fuels treatment effects on mixed-conifer carbon stocks and emissions. *Ecological Applications*, 19(6), 2009, pp. 1385–1396.
- Powell, David C. 1999. Suggested Stocking Levels for Forest Stands In Northeastern Oregon and Southeastern Washington: An Implementation Guide for The Umatilla National Forest. USDA Forest Service, Pacific Northwest Region. Report F14-SO-TP-03-99.
- Reinhardt, E. and L. Holsinger. 2010. Effects of fuel treatments on carbon-disturbance relationships in forests of the northern Rocky Mountains. *Forest Ecol. Manage.* (2010), doi:10.1016/j.foreco.2010.01.015.
- Ryan, M.G., D.M. Kashian, E.A.H. Smithwick, W.H. Romme, M.G. Turner, and D.B. Tinker. 2008. Joint Fire Science Program Project Number: 03-1-1-06. Final Report on Carbon cycling at the landscape scale: the effect of changes in climate and fire frequency on age distribution, stand structure, and net ecosystem production. Unpublished report for BLM Agreement/Task Order Number: 1422RAH03-0041 available online at: http://www.firescience.gov/projects/03-1-1-06/project/03-1-1-06_03-1-1-06_final_report.pdf
- Ryan M.G., M.E. Harmon, R.A. Birdsey, C.P. Giardina, L.S. Heath, R.A. Houghton, R.B. Jackson, D.C. McKinley, 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. 17 p.
- Schmidt, W.C., Shearer, R.C. and Roe, A.L., 1976. Ecology and silviculture of western larch forests. U.S. Dep. Agric., Tech. Bull., 1520:96 pp.

- Schmidt WC, Shearer RC. 1990. *Larix occidentalis* Nutt., western larch. In: Burns RM, Honkala BH, tech. coords. *Silvics of North America*. Volume 1, Conifers. Agric. Handbook. 654. Washington DC: USDA Forest Service: 160–172.
- Scott, G., Mahalovich, M. F., Rinehart, S. and J. Krueger. 2013. *Reforestation – Revegetation Primer for the Northern Region. Incorporating Climate Change Impacts into Reforestation and Revegetation Prescriptions*. USDA Forest Service. Northern Region. Missoula, MT.
- Smith, C. M., B. Wilson, S. Rasheed, R. C. Walker, T. Carolin and B. Sheppard. 2008. Whitebark pine and white pine blister rust in the Rocky Mountains of Canada and northern Montana. *Canadian Journal of Forest Research* 38: 982-995.
- US EPA 2013. Chapter 7. Land Use, Land-Use Change, and Forestry, in *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2011*. The entire report is available online at: <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>
- USDA Forest Service. 1986. *Flathead National Forest Land & Resource Management Plan*. Region 1, Flathead NF. Kalispell, MT.
- USDA Forest Service. 1998. *Northern Region Overview Detailed Report and Summary*. Northern Region. Missoula, MT.

Wildlife

- Anderson, Steve, et al. 2009. *Guide to effects analysis of helicopter use in grizzly bear habitat*. Montana/Northern Idaho Level I Terrestrial Biologists Team Final version September 17, 2009 (pp. 19): U.S. Department of Agriculture, Forest Service; and U.S. Department of the Interior, Fish and Wildlife Service.
- Aubry, K. B., Raley, C. M., Buskirk, S. W., Zielinski, W. J., Schwartz, M. K., Golightly, R. T., Purcell, K. L., Weir, R. D. and Yaeger, J. S. (2013), *Meta-analyses of habitat selection by fishers at resting sites in the pacific coastal region*. *The Journal of Wildlife Management*, 77: 965–974.
- Aubry, K. B., K. S. McKelvey, J. P. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *Journal of Wildlife Management*. 71(7):2147-2158.
- Aubry, K., K. McKelvey, and J. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *The Journal of Wildlife Management* 71(7):2147-2158.
- Bartuszevige & Kennedy 2009 Bartuszevige, A.M., P.L. Kennedy. 2009. *Synthesis of knowledge on the effects of fir and thinning treatments on understory vegetation in US dry forests*. Oregon State University: Agricultural Experiment Station. 133 pp.

- Bate, L.J., Wisdom, M.J., Garton, E.O., Clabough, S.C., 2008. SnagPRO: snag and large tree sampling and analysis methods for wildlife. USDA Forest Service General Technical Report PNW-GTR. Portland, OR
- Bate, Lisa J., and Michael J. Wisdom. 2004. Snag Resources in Relation to Rods and Other Indices of Human Access on the Flathead National Forest. 28pp.
- Beebe, S.B. 1974. Relationship Between Insectivorous Hole-nesting Birds and Forest Management. Yale University School of Forestry and Environmental Studies. Pp. 1, 19-22, 27-31.
- Boulanger & Stenhouse 2014 Boulanger, J. and G.B. Stenhouse. 2014. The impacts of roads on the demography of grizzly bears in Alberta. PLOS one. 9(12).
- Boulanger et al 2013 Boulanger, J., M. Cattet, S.E. Nielson, G. Stenhouse, J. Cranston. 2013. Use of multi-state models to explore relationships between changes in body condition, habitat and survival of grizzly bears *Ursus arctos horribilis*. Wildlife Biology. 19(3):274-288.
- Boyd, James, et al. 2017. Species Status Assessment Report for the Northern Rocky Mountains Fisher, Version 2.0. U.S. Fish & Wildlife Service's Northern Rocky Mountains fisher core team. U.S. Fish and Wildlife Service Mountain-Prairie Region, Denver, CO. 83pp.
- Braid, Manzer, & Nielsen 2016 Braid, A. C.R., D. Manzer, S.E. Neilson. 2016. Wildlife habitat enhancement of grizzly bears: Survival rates of planted fruiting shrubs in forest harvests. Forest Ecology and Management. 369: 144-154
- Bull, E. L., C. G. Parks, and T. R. Torgersen. 1997. Trees and logs important to wildlife in the Interior Columbia River Basin. USDA Forest Service Pacific Northwest Research Station, General Technical Report PNW-GTR-391. 55 pp.
- Bull, E. L., T. R. Torgerson, A. K. Blumton, C. M. McKenzie, and D. S. Wyland. 1995. Treatment of an old-growth stand and its effects on birds, ants, and large woody debris: a case study. USDA Forest Service, Pacific Northwest Research Station General Technical Report PNW-GTR-353. Portland, OR. 12 pp.
- Carey, C. 1993. Hypothesis Concerning the Causes of the Disappearance of Boreal Toads from the Mountains of Colorado. Conservation Biology. 7(2): 355-362.
- Carey, A. B. 1996. Interactions of northwest forest canopies and arboreal mammals. Northwest Science. 70: 72-78.
- Chen, J., and J. F. Franklin, and T.A. Spies. 1992. Vegetation Responses to Edge Environments in Old-growth Douglas-fir Forests. Ecological Applications, 2(4):387-396.
- Christensen, A. G., L. J. Lyon, and J. W. Unsworth. 1993. Elk management in the Northern Region: considerations in forest plan updates or revisions. USDA Forest Service General Technical Report INT-303. 10 pp.

- Cilimburg, A. 2006. Northern Region Land bird Monitoring Program: 2005 Flammulated Owl Surveys Final Report. Avian Science Center. Missoula, MT.
- Claar, J. J., et al. 1999. Carnivores. Pp. 7.1-7.63. In: Effects of recreation on Rocky Mountain wildlife: A review for Montana. Coordinated by Joslin, G. and H. Youmans. Committee on Effects of Recreation on Wildlife, Montana Chapter of the Wildlife Society. 307 pp.
- Coltrane, J., J. Gude, B. Inman, N. Lance, K. Laudon, A. Messer, A. Nelson, T. Parks, M. Ross, T. Smucker, J. Steuber, and J. Vore. 2015. Montana Gray Wolf Conservation and Management 2015 Annual Report. Montana Fish, Wildlife & Parks. Helena, Montana. 74pp.
- Costello, C.M., and L.L. Roberts. 2016. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2015. Montana Fish, Wildlife & Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished Data.
- Dixon, R. D., and V. A. Saab. 2000. Black-backed woodpecker (*Picoides arcticus*). No. 509. In: Birds of North America. A. Poole, and F. Gill, editors. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, DC.
- Dobkin, D. S. et al. 1995. Springtime movements, roost use, and foraging activity of Townsends' big-eared bat (*Plecotus townsendii*) in central Oregon. Great Basin Naturalist. 55(4):315-321.
- Dudley, J. G. 2005. Home range size and foraging habitat of Black-backed Woodpeckers. Master's thesis. Boise State University. Boise, ID.
- Finch, D. 1991. Population ecology, habitat requirements, and conservation of neotropical migratory birds. USDA Forest Service, Rocky Mountain Forest And Range Experimental Station General Technical Report RM-205. Fort Collins, CO.
- Fisher, J. T. and L. Wilkinson. 2005. The response of mammals to forest fire and timber harvest in the North American boreal forest. Mammal Review 35:51–81.
- Fortin et al 2016. Fortin, J.K., K.D. Rode, G.V. Hilderbrand, J. Wilder, S. Farley, C. Jorgensen, B.G. Marot. 2016. Impacts of human recreation on brown bears (*Ursus arctos*): A review and new management tool. PLOS one. 11(1).
- Garroway et al. 2011. Using a genetic network to parameterize a landscape resistance surface for fishers, *Martes pennanti*. Molecular Ecology (2011) 20, 3978–3988.
- Gibeau et al 2002. Gibeau, M. L., A.P. Clevenger, S. Herrero, J. Wierzchowski. 2002. Biological Conservation. 103: 227-236
- Green, P. J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Nauman. 2011. Old-growth Forest Types in the Northern Region. USDA Forest Service, Northern Region, Missoula, MT. Correction of R1SES 4/92.

- Hayes, J.P. and Loeb, S.C., 2007. The influences of forest management on bats in North America. Bats in forests: conservation and management (MJ Lacki, JP Hayes, and A. Kurta, eds.). Johns Hopkins University Press, Baltimore, Maryland, pp.207-235.
- Hayward, G. D. and J. Verner. 1994. Flammulated, boreal, and great gray owls in the United States: A technical conservation assessment. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-253. Fort Collins, CO. 214 pp.
- Heinemeyer, K. S. and Jones, J. L. 1994. Fisher biology and management in the western United States: A literature review and adaptive management strategy. USDA Forest Service Northern Region, Missoula, MT. 108pp.
- Hejl, Sallie J., and Mary McFadden. 2000. Maintaining fire-associated bird species across forest landscapes in the Northern Rockies. USDA Forest Service. Rocky Mountain Research Station, Forest Sciences Laboratory. INT-99543-RJVA. 21pp.
- Hejl, Sally J., Richard L. Hutto, Charles R. Preston, and Deborah M. Finch. 1995. Effects of silvicultural treatments in the Rocky Mountains, In: Ecology and Management of Neotropical Migratory Birds: a Synthesis and Review of Critical Issues. Edited by T. E. Martin and D. M. Finch. Oxford University Press, NY.
- Herrero & Fleck 1990 Herrero, S., S. Fleck. 1990. Injury to people inflicted by black, grizzly or polar bears: recent trends and new insights. Bears: Their Biology and Management, Vol. 8, A selection of papers from the eighth international conference on bear research and management, Victoria, British Columbia, Canada, February 1989 (1990), pp. 25-32.
- Herrero & Higgins 1999 Herrero, A., A. Higgins. 1999. Human Injuries Inflicted by Bears in British Columbia: 1960-97. Ursus. Vol. 11, A Selection of Papers from the Eleventh International Conference on Bear Research and Management, Graz, Austria, September 1997, and Gatlinburg, Tennessee, April 1998 (1999), pp. 209-218
- Herrero & Higgins 2003 Herrero, S., A. Higgins. 2003. Human injuries inflicted by bears in Alberta: 1960-98. Ursus. 14(1):44-54.
- Hillis, J. M., M. J. Thompson, J. E. Canfield, L. J. Lyon, C. L. Marcum, P. M. Dolan, and W. McCleerey. 1991. Defining elk security: the Hillis paradigm. Pages 38-54 in A. G. Christensen, L. J. Lyon and T. N. Lonner, comps. Proc. Elk Vulnerability Symposium, Montana State University, Bozeman.
- Hillis, J. Michael, Amy Jacobs, and Vita Wright. 2003. USDA Forest Service Region 1 Canada lynx assessment. Missoula, MT. 20 pp.
- Hitchcox, Susan M. 1996. Abundance and nesting success of cavity-nesting birds in unlogged and salvaged-logged burned forests in northwestern Montana. M.S. thesis. Univ. of Montana. Missoula, MT. 89 pp.
- Hodges, K.E. 2000. Ecology of snowshoe hares in southern boreal and montane forests. Chapter 7 in L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, et al., tech. eds. Ecology and Conservation of Lynx in

- the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Published by University Press of Colorado, Boulder. Pages 166-168.
- Howie, R.R., and Ritcey, R. 1987. Distribution, Habitat Selection, and Densities of Flammulated Owls in British Columbia. In: Biology and Conservation of northern forest owls: proceedings of the symposium; 1987 February 3-7; Winnipeg, Manitoba. General Technical Report. RM-142. U.S. Department of Agriculture, Forest Service: 249-254.
- Hutto, R. L. 2008. The ecological importance of severe wildfires: some like it hot. *Ecological Applications* 18:1827-1834.
- Hutto, R. L. 1995a. Composition of bird communities following stand-replacement fires in northern Rocky Mountain (USA) conifer forests. *Cons. Biol.* 9(5):1041-1058.
- Hutto, R. L. 1995b. Distribution and habitat relationships. USDA-FS Northern Region songbird monitoring program, Second Report. University of Montana, Missoula, MT.
- Inman, R. M., K. H. Inman, A. J. McCue, M. L. Packila, G. C. White, and B. C. Aber. 2007. Wolverine space use in Greater Yellowstone. In: Wildlife Conservation Society, Greater Yellowstone Wolverine Program, Cumulative Report, May 2007.
- 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, S.S. Sartorius. 2012. Spatial ecology of wolverines at the southern periphery of distribution. *Journal of Wildlife Management* 76:778-792.
- Jones, J. L. 1991. Habitat use of fisher in Northcentral Idaho. Master's Thesis, University of Idaho, Moscow, ID. 146 pp.
- Joslin, G. and Youmans, H.B., 1999. Effects of recreation on Rocky Mountain wildlife: a review for Montana. Montana Chapter of the Wildlife Society.
- Kasworm, W. F., and T. L. Manley. 1990. Road and trail influences on grizzly bears and black bears in northwest Montana. *Int. Conf. Bear Res. and Manage.* 8:79-84.
- Keane RE , Tomback DF , Aubry CA , et al. 2012. A range-wide restoration strategy for whitebark pine (*Pinus albicaulis*). Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-279.
- Kendall, K. C., J. B. Stetz, D. A. Roon, L. P. Waits, J. B. Boulanger, and D. Paetkau. 2008. Grizzly bear density in Glacier National Park, Montana. *Journal of Wildlife Management* 72(8):1693-1705.
- Kendall, K. C., J. B. Stetz, J. Boulanger, A. C. Macleod, D. Paetkau, and G. C. White. 2009. Demography and genetic structure of a recovering brown bear population. *Journal of Wildlife Management* 73(1):3-17.

- Koehler, G. M. and K. B. Aubry. 1994. Lynx, In: The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States. USDA Forest Service, General Technical Report. RM-254. Fort Collins, CO. 184 p.
- Kunkel, Kyran and Daniel H Pletscher. 2001. Winter hunting patterns of wolves in and near Glacier National Park, Montana. *Journal of Wildlife Management* 65:520-530.
- Lesica, P. 1996. Using fire history models to estimate proportions of old growth forest in northwestern Montana, USA. *Biological Conservation* 77: 33–39.
- Lyon, L.J., 1983. Road density models describing habitat effectiveness for elk. *Journal of Forestry*, 81(9), pp.592-613.
- Lyon, L. J., et al. 1985. Coordinating elk and timber management. Final Report of the Montana Cooperative Elk-logging Study. (pp. 56). Bozeman, MT: Montana Department of Fish, Wildlife and Parks.
- Mace, R. D., & Manley, T. L. (1993). South Fork Flathead River Grizzly Bear Project: Progress Report for 1992. Helena, MT: Montana Department of Fish, Wildlife, and Parks.
- Mace, R. and L. Roberts. 2012. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2011. Montana Department of Fish, Wildlife & Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.
- Mace, R., & Roberts, L. (2013). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2012. Montana Fish Wildlife and Parks 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.
- Mace, R. D. and J. S. Waller. 1997. Final report: Grizzly bear ecology in the Swan Mountains, Montana. Montana Department of Fish, Wildlife and Parks. 191 pp.
- Mace, R. D., and J. S. Waller. 1997. Denning ecology of grizzly bears in the Swan Mountains, Montana. In: Final report, grizzly bear ecology in the Swan Mountains, Montana. Pp.36-41.
- Mace, R. D., D. W. Carney, T. Chilton-Radandt, S. A. Courville, M. A. Haroldson, R. B. Harris, J. Jonkel, B. McLellan, M. Madel, T. L. Manley, C. C. Schwartz, C. Servheen, G. Stenhouse, J. S. Waller, E. Wenum. 2011. Grizzly bear population vital rates and trend in the Northern Continental Divide Ecosystem, Montana. *Journal of Wildlife Management*. 9999. Pp. 1-10.
- Mace, R. D. and L. Roberts. 2011. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2009-2010. Montana Fish, Wildlife and Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.
- Mace, R. D. and L. Roberts. 2014. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2009-2010. Montana Fish, Wildlife and Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.

- Mace et al 2012 Mace, R.D., D.W. Carney, T. Chilton-Radandt, S.A. Courville, M.A. Haroldson, R.B. Harris, J. Jonkel, B. McClelland, M. Madel, T.L. Manley, C.C. Shwartz, C. Servheen, G. Stenhouse, J.S. Waller, E. Wenum. 2012. Grizzly bear population vital rates and trend in the Northern Continental Divide Ecosystem, Montana. *Journal of Wildlife Management*. 76:119-128.
- Martin, P. 1983. Factors Influencing Globe Huckleberry Fruit Production in Northwestern. In: *Bears: Their Biology and Management*, Vol. 5, A Selection of Papers from the Fifth International Conference on Bear Research and Management, Madison, Wisconsin, USA, February 1980 (1983), pp. 159-165.
- McCallum, D. A., P. Morgan, J. Verner, G. D. Hayward. 1994. Conservation assessment for the Flammulated Owl in the United States. In: *Forest Owl Conservation Assessment: Flammulated, Boreal, and Great Gray Owls in the United States* (G. D. Hayward, ed.). USDA Forest Service General Technical Report RM-253.
- McLellan 2015 McLellan, B.N. 2015. Some mechanisms underlying variation in vital rates of grizzly bears on a multiple use landscape. *Journal of Wildlife Management*. 79(5): 749-765.
- McLellan, B.N. and D.M. Shackleton. 1989. Grizzly bears and resource extraction industries: habitat displacement in response to seismic exploration, timber harvesting and road maintenance. *Journal of Applied Ecology* 26:371-380.
- McClelland, B. R. and J. A. Schmidt. 1995. Old-growth western larch forests: management implications for cavity nesting birds. In *Proceedings of the symposium on ecology and management of Larix forests: A look ahead*. Whitefish, Montana, October 5-9, 1992. USDA Forest Service, Intermountain Research Station, Ogden, Utah. Gen. Tech. Report INT 319. Page 376.
- McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000. History and distribution of lynx in the contiguous United States. Pages 207-264. Chapter 8. In Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires (Tech Eds). *Ecology and conservation of lynx in the United States*. Univ. Press of Colorado. Boulder. 480pp.
- McLellan, B. N. and D. M. Shackleton. 1989. Grizzly bears and resource extraction industries: habitat displacement in response to seismic exploration, timber harvesting and road maintenance. *Journal of Applied Ecology* 26: 371-380.
- McLellan, B. N., and D. M. Shackleton. 1989. Immediate reactions of grizzly bears to human activities. *Wildlife Society Bulletin* 17:269-274.
- Montana Department of Fish, Wildlife and Parks. 2004. Montana Statewide Elk Management Plan. <http://fwp.mt.gov/fishandwildlife/management/>
- Montana Partners in Flight. April 2000. Bird Conservation Plan - Montana. Version 1.1.
- Muths, E., 2003. Home range and movements of boreal toads in undisturbed habitat. *Copeia*, 2003(1), pp.160-165.

- Nielson, S. E., M. S. Boyce, G. B. Stenhouse. 2004. Grizzly bears and forestry I. Selection of clearcuts by grizzly bears in west-central Alberta, Canada. *Forest Ecology and Management* 199:51-65.
- Northrup et al 2012. Northrup, J.M., J. Pitt, T.B. Muhly, G.B. Stenhouse, M. Musiani, M.S. Boyce. 2012. Vehicle traffic shapes grizzly bear behavior on a multiple-use landscape. *Journal of Applied Ecology*. 49: 1159-1167.
- Olson, L.E., Squires, J.R., DeCesare, N.J., Kolbe, J.A., 2011. Den use and activity patterns in female Canada lynx (*Lynx canadensis*) in the Northern Rocky Mountains. *Northwest Sci.* 85, 455–462.
- Olson, L.E., J.D. Sauder, N.M. Albrecht, R.S. Vinkey, S.A. Cushman, M.K. Swartz. 2014. Modeling the effects of dispersal and patch size on predicted fisher (*Pekania [Martes] pennanti*) distribution in the U.S. Rocky Mountains. *Biol. Cons.* 169 (2014) 89-98.
- Otvos, I.S. 1979. The Effects of Insectivorous Bird Activities in Forest Ecosystems: An Evaluation. In Dickson et. al. *The Role of Insectivorous Birds in Forest Ecosystems*. New York, Academic Press. Pages 341-374.
- Pilliod, David S., et al. 2003. Fire and amphibians in North America. *Forest Ecology and Management*, 178(1), 163-181.
- Powell, R. A. and W. J. Zielinski. 1994. Fisher. In: *The Scientific Basis for Conserving Forest Carnivores: American Martin, Fisher, Lynx, and Wolverine in the Western United States*. USDA Forest Service, General Technical Report RM-254. Fort Collins, CO.
- Raley, C. M., Lofroth, E. C., Truex, R. L., Yaeger, J. S., Higley, J. M., 2012. Habitat ecology of fishers in western North America: a new synthesis. In: Aubry, K. B., Zielinski, W. J., Raphael, M. G., Proulx, G., Buskirk, S. W. (Eds.), *Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis*. Cornell University Press, Ithaca, NY. Pp. 231–254.
- Reel, S, L. Schassberger, W. Ruediger. 1989. Caring for our natural community: Region 1 - Threatened, Endangered and Sensitive Species Program. U. S. D. A., Forest Serv., Missoula, MT. 334 pp.
- Rich, T. D., et. al. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. http://www.partnersinflight.org/cont_plan/ (VERSION: March 2005).
- Rochelle, James A. 2008. Biological Basis for Forest Practices Rules for Retaining Coarse Woody Debris in Managed Forests of the Pacific Northwest. National Council for Air and Stream Improvement. Technical Bulletin 954. 46 pages.
- Roever et al 2010. Roever, C., M.S. Boyce, G.B. Stenhouse. 2010. Grizzly bear movements relative to roads: application of step selection functions. *Ecography*. 33:6. 1113-1122.
- Rose, Cathy L.; Marcot, Bruce G.; Mellen, T. Kim; Ohmann, Janet L.; Waddell, Karen L.; Lindley, Deborah L.; Schreiber, Barry. 2001. *Decaying Wood in Pacific Northwest Forests: Concepts*

- and Tools for Habitat Management. In: Johnson, D. H.; O'Neil, T. A., editors. Wildlife-habitat relationships in Oregon and Washington. Corvallis, OR: Oregon State University Press; 580-623.
- Rotenberry, J. T., R. J. Cooper, J. M. Wunderle, and K. G. Smith. 1995. When and how are populations limited? The Roles of Insect Outbreaks, Fire, and Other Natural Perturbations. In: Ecology and Management of Neotropical Migratory Birds: a Synthesis and Review of Critical Issues. (pp. 55-84). Edited by T. E. Martin and D. M. Finch. Oxford University Press, NY.
- Ruby, M.D. 2014. Evaluation of grizzly bear (*Ursus arctos*) movement and habitat use in relationship to human development in the Swan-Clearwater Valleys, Montana. University of Montana. Thesis. 82 pp
- Ruggerio, L. F., B. Keith, S. W. Buskirk, W. Steven, L. J. Lyon, and W. J. Zielinski. 1994. The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States. General Technical Report RM-254. Fort Collins, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 184 pp.
- Ruggiero, L. F., K. S. McKelvey, K. B. Aubry, J. P. Copeland, D. H. Pletscher, and M. G. Hornocker. 2007. Wolverine conservation and management. *Journal of Wildlife Management* 71:2145–2146.
- Russell, Robin E., Victoria A. Saab, and Jonathan G. Dudley. "Habitat-Suitability Models for Cavity-Nesting Birds in a Postfire Landscape." *The Journal of Wildlife Management* 71.8 (2007): 2600-2611.
- Saab, Victoria A., et al. 2014. Ecological consequences of mountain pine beetle outbreaks for wildlife in western North American forests. *Forest Science*, 60(3), 539-559.
- Saab, Victoria, Jonathan Dudley, and William Thompson. 2004. Factors influencing occupancy of nest cavities in recently burned forests. *Condor* 106:20-36.
- Saab, V. A., and T. D. Rich. 1997. Large-scale conservation assessment for neotropical migratory land birds in the interior Columbia River basin. USDA Forest Service General Technical Report PNW-GTR-399, Portland, Oregon, USA.
- Samson, F. B. 2006. Habitat estimates for maintaining viable populations of the northern goshawk, black-backed woodpecker, flammulated owl, pileated woodpecker, American martin, and fisher. Unpublished report on file, Northern Region, Missoula, Montana, USA [Project File Exhibit Rs-20].
- Sauder, J.D. and Rachlow, J.L., 2014. Both forest composition and configuration influence landscape-scale habitat selection by fishers (*Pekania pennanti*) in mixed coniferous forests of the Northern Rocky Mountains. *Forest Ecology and Management*, 314, pp.75-84.
- Schmetterling, David A., & Michael K. Young. (2008). Summer movements of boreal toads (*Bufo boreas boreas*) in two western Montana basins. *Journal of herpetology*, 42(1), 111-123.

- Schmor, Mathew Robert. 1999. An exploration into bear deterrents, as related to mountain biking, and the design of an ultrasonic bear warning device. Thesis. University of Calgary.
- Schwartz, C. C., S.L. Cain, S. Podruzny, S. Cherry, and L. Frattaroli. 2010. Contrasting Activity Patterns of Sympatric and Allopatric Black and Grizzly Bears. *Journal of Wildlife Management* 74(8):1628-1638.
- Schwartz, M. K., N. J. DeCesare, B. S. Jimenez, J. P. Copeland, W. E. Melquist. 2013. Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. *Forest Ecology Management*. 305:103–111.
- Servheen, C.S., T.L. Manley, D. Mucklow Starling, A. Jacobs, J. Waller. 2017. Board of Review Recommendations: Recommendations related to mountain bike safety in bear habitat based on the fatality of Mr. Brad Treat on June 29, 2016. Report. 5 pp.
- Sime, C., 1999. Domestic dogs in wildlife habitats. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. G. Joslin and H. Youmans,(coordinators). Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society. Pages, pp.8-11.
- Spring, D.A., J.O.S. Kennedy, D.B. Lindenmayer, M.A. McCarthy, and R.M. Nally. 2008. Optimal Management of a Flammable Multi-stand Forest for Timber Production and Maintenance of Nesting Sites for Wildlife. *Forest Ecology and Management*, 255(11):3857–3865, 2008.
- Squires, J. R. and L. F. Ruggiero. 2007. Winter Prey Selection of Canada Lynx in Northwestern Montana. *Journal of Wildlife Management* 71(2):310–315.
- Squires, J. R., N. J. Decesare, J. A. Kolbe, and L. F. Ruggiero. 2008. Hierarchical den selection of Canada lynx in western Montana. *Journal of Wildlife Management* 72:1497-1506.
- Squires, J. R., N. J. Decesare, J. A. Kolbe, and L. F. Ruggiero. 2010. Seasonal resource selection of Canada lynx in managed forests of the northern Rocky Mountains. *Journal of Wildlife Management* 74(8):1648-1660.
- Squires, J. R., N. J. DeCesare, L. E. Olson, J. A. Kolbe, M. Hebblewhite, 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.
- Teisberg, J.E., M.J. Madel, R.D. Mace, C.W. Servheen, C.T. Robbins. 2015. Diet Composition and Body Condition of Northern Continental Divide Grizzly Bears: Final Report. March 2015.
- Tewksbury, J. K., S. J. Hejl, and T. E. Martin. 1998. Breeding Productivity Does Not Decline With Increasing Fragmentation in a Western Landscape. *Ecology*, 79(8): 2890-2903.
- Theil, R.P. 1985. Relationship between road densities and wolf habitat suitability in Wisconsin. *American Midland Naturalist*. 113(2): 404-407

- Turcotte, Yves, and Andre Desrochers. 2003. Landscape-dependent response to predation risk by forest birds. *Oikos* 100(3):614.
- Tuttle, M. D., and D. A. R. Taylor. 1994. Bats and mines. Bat Conservation International, Inc., Austin, TX. Resource Publication No. 3. 41 pp.
- Thomas, J. W., and D. E. Toweill, eds. 1982. Elk of North America - Ecology and Management. Wildl. Manage. Inst. Stackpole Books, Harrisburg, PA. (Pages 415-442).
- Torgersen, T. F., R. R. Mason, and R. W. Campbell. 1990. Predation by Birds and Ants on Two Forest Insect Pests in the Pacific Northwest. *Studies in Avian Biology*, 13:14-19.
- Torgersen, T. R. 1996. Birds, bats & bugs: essential elements of forest health. Wild Fish and Forests. Summer 1996. (Pages 8-10).
- Torgersen, T. R., and E. L. Bull. 1995. Down Logs as Habitat for Forest-dwelling ants -- The Primary Prey of Pileated Woodpeckers in Northeastern Oregon. *Northwest Science*, 69:. 294-303.
- USDA Forest Service. 1986. Flathead National Forest Land and Resource Management Plan. Flathead National Forest, Kalispell, MT.
- USDA Forest Service. 1994. Flathead LRMP Amendment #19 Biological Assessment. Flathead National Forest, Kalispell, MT. 35 pp.
- USDA Forest Service. 1999a. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Forest Service, Rocky Mountain Research Station. Fort Collins, CO. 474 pp.
- USDA Forest Service. 2013. Letter from USFS Region 1 to US Fish and Wildlife Service addressing new lynx science. September 13, 2013.
- USDA Forest Service. 2017a. Flathead National Forest Evaluation and Compliance with National Forest Management Act Requirements to Provide for Viability and Diversity of Animal Communities (pp. 208).
- USDI Fish and Wildlife Service. 1987. Northern Rocky Mountain Wolf Recovery Plan. USFWS, Denver, CO. 119 pp.
- USDI Fish and Wildlife Service. 1993. Grizzly Bear Recovery Plan. USFWS, Denver, CO. 181 pp.
- USDI Fish and Wildlife Service. 2008a. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx (*Lynx canadensis*); Proposed Rule. Federal Register Vol. 73, No. 40, February 28, 2008, p. 10867.
- USDI Fish and Wildlife Service. 2009a. Biological Opinion on the Effects of the Spotted Bear River Project on Canada Lynx, Flathead National Forest. USDI FWS, Ecological Services, Helena, MT. 59601. 69 pp.

- USDI Fish and Wildlife Service. 2013a. Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rules. Federal Register 78: 7864-7890. <http://federalregister.gov/a/2013-01478>
- USDI Fish and Wildlife Service. 2014. Federal Register/Vol. 79/No. 156/Wednesday, August 13, 2014/Proposed Rules. 50 CFR Part 17 - Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rule. *Federal Register*, 79(156), 47522-47545.
- USDI Fish and Wildlife Service. 2014b. Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rules- Withdrawal. Federal Register 79: 47522-47545. <http://www.gpo.gov/fdsys/pkg/FR-2014-08-13/pdf/2014-18743.pdf>.
- U.S. Forest Service. 2017. Biological Assessment for Canada lynx designated critical habitat, Northern Rockies lynx management direction. U.S.D.A. Forest Service, Northern Region, Missoula, Montana. 60pp.
- Vanderwel et al. 2006. M.C. Vanderwel, J.P. Caspersen, M.E. Woods Snag dynamics in partially harvested and unmanaged northern hardwood forests. *Can. J. For. Res.*, 36 (2006), pp. 2769-2779
- Waller, J.S. 1992. Grizzly bear use of habitats modified by timber management. Thesis. Montana State University. 74 pp.
- Weilgus, R.B., P.R. Vernier, T. Schivatcheva. 2002. Grizzly bear use of open, closed and restricted forestry roads. *Canadian Journal of Forestry Resources*. 32:1597-1606.
- Weir, R.D., and F.B. Corbould. 2010. Factors affecting landscape occupancy by fishers in north-central British Columbia. *Journal of Wildlife Management* 74:405–410.
- Witmer, G. W., S. K. Martin, and R. D. Sayler. 1998. Forest carnivore conservation and management in the interior Columbia basin: issues and environmental correlates. General Technical Report PNW-420. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 51 pp. (Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).
- Wright, Vita. 1996. Multi-scale Analysis of Flammulated Owl Habitat Use: Owl Distribution, Habitat Management, and Conservation. M.S. Thesis, University of Montana. 91 pages.
- Wright, Vita, Sallie J. Hejl, and Richard L. Hutto. 1997. Conservation implications of a multi-scale study of Flammulated Owl (*Otus flammeolus*) habitat use in the Northern Rocky Mountains, USA. In: Duncan, James R., et al., eds. 1997. *Biology and conservation of owls of the*

- Northern Hemisphere: Second international symposium; 1997 February 5-9; Winnipeg, MB. Gen. Tech. Rep. NC-190. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Central Research Station: 506-516.
- Youmans, C. C. 1991. Analysis of long-term trends in elk vulnerability on the Bitterroot National Forest in relation to selected predictor variables. In Proceedings of the symposium on elk vulnerability. Edited by Christensen, A. G., L. J. Lyon, and T.N. Lonner. Montana State Univ., Bozeman, MT. (Pages 159-167).
- Zager, P., C. Jonkel, J. Habeck. 1983. Logging and wildfire influence on grizzly bear habitat in Northwestern Montana in Bears: Their Biology and Management. Volume 5. Selection of papers from the fifth international conference on bear research and management, Madison, Wisconsin, USA. Pp. 124-132.